

**TOPICAL PLAN
FOR JINR RESEARCH
AND INTERNATIONAL COOPERATION
2016**

Dubna 2015

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Prepared by
 N.A. Boklagova
 L.K. Ivanova

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 Dubna 2015

All the themes in the Plan are listed by fields of research. Each theme is coded according to the JINR system of classification and contains the following information:

- the first number * - the field of research
- the second number ** - the conventional number
of Laboratory or other Division of JINR
- the third number - the theme's ordinal number
- the fourth and
- the fifth numbers - the years of the activity's beginning
and completion

* 01 -	Theoretical Physics	** 0 -	All-Institute Topics
02 -	Elementary Particle Physics and Relativistic Nuclear Physics	1 -	Veksler and Baldin Laboratory of High Energy Physics (VBLHEP)
03 -	Nuclear Physics	2 -	Dzhelepov Laboratory of Nuclear Problems (DLNP)
04 -	Condensed Matter Physics and Radiobiological Research	3 -	Bogoliubov Laboratory of Theoretical Physics (BLTP)
05 -	Networking, Computing, Computational Physics	4 -	Frank Laboratory of Neutron Physics (FLNP)
06 -	Educational Programme	5 -	Flerov Laboratory of Nuclear Reactions (FLNR)
		6 -	Laboratory of Information Technologies (LIT)
		8 -	Science Organization Department (SOD)
		9 -	Laboratory of Radiation Biology (LRB)

Theoretical Physics (01)

01-3-1113-2014/2018

Priority:

1

Status:

In-progress

Theory of Fundamental Interactions

Leaders:

D.I. Kazakov
O.V. Teryaev
A.B. Arbuzov

Participating Countries and International Organizations:

Armenia, Azerbaijan, Belarus, Bulgaria, Canada, CERN, China, Czech Republic, Finland, France, Georgia, Germany, Hungary, ICTP, Italy, Japan, Kazakhstan, Mexico, Mongolia, New Zealand, Norway, Poland, Republic of Korea, Russia, Serbia, Slovakia, Spain, Sweden, Switzerland, USA, Ukraine, United Kingdom, Uzbekistan, Vietnam.

Scientific Programme

The main aim of the research within the theme is the construction of theoretical models and their application to the description of properties of elementary particles and their interactions. This research includes the following directions of activity. The development of quantum field theory formalism in gauge and supersymmetric theories. Construction and investigation of the models of particle physics beyond the Standard Model. Theoretical support of experiments at the Large Hadron Collider on the search of new physics and the study of the properties of the Higgs boson. Calculation of radiative corrections to the processes of particle creation within the Standard Model and its extensions. Investigation of neutrino properties and neutrino oscillations. Investigation of the hadron properties within quantum chromodynamics and phenomenological quark models. Study of the hadron spin structure with the help of generalized and transverse momentum dependent parton distributions. Study of heavy quark properties and exotic hadrons. Lattice simulations for obtaining nonperturbative results in gauge theories. Investigation of dense hadronic matter and theoretical support of the program NICA. Theoretical support of a wide range of current and future experiments at JINR, IHEP, CERN, GSI, DESY and other physics centers.

Expected main results in 2016:

- Calculation of the amplitudes in maximally supersymmetric theories in extra dimensions.
Analysis of possible SUSY search strategies at the LHC in the framework of the MSSM and NMSSM.
Interpretation of experimental data on supersymmetry searches coming from the ATLAS and CMS collaborations.
Theoretical analysis of the effects due to radiative corrections in Drell-Yan processes taking into account new experimental conditions being relevant after increasing LHC luminosity and beam energy.
Investigation of the Q^2 evolution of the average multiplicities with the double-logarithm resummation taken into account.
Consideration of the Q^2 evolution of the structure function F_2 , its derivations and heavy quark parts at small x in the first three orders of perturbation theory.
Studies of the dark matter problem and searches for different dark matter particle candidates both in the Standard Model and beyond it, in particular within supersymmetric theories.
Investigation of the low-energy behavior of the hadronic vacuum polarization function within the dispersive approach to QCD.
Calculation of different four-loop contributions to beta-functions and anomalous dimensions in the Standard Model and its supersymmetric and non-supersymmetric extensions.
- Derivation of the complete analytical expression for the missing contribution of the three-loop radiative correction to the pion transition form factor.

Investigation of the evolution of spin structure functions and their truncated moments at low Q^2 in the NLO approximation and with account for models of coupling in the infrared region and higher twists.

Investigations of transverse-momentum dependent parton distributions for Drell-Yan processes and direct photon production within the NICA project. Construction of global fits for Sivers functions with account for evolution effects, constraints from g_2 structure functions and sum rules.

Lattice calculations of the form factors related to the quark spin and orbital angular momenta and their comparison with the constraints implied by the equivalence principle.

Development of the general theory of wave packets. Construction of a model of a covariant asymmetric wave packet and detailed study of its properties. Derivation of general formulae for an effective 4-momentum of neutrino in ultra-relativistic and non-relativistic cases.

Investigation of the correlation functions of the color charged field fluctuations in the confinement regime within the domain model of the QCD vacuum. Study of the spectral properties of the color charged quasi-particles and thermodynamics of the heterophase state of hadronic matter under conditions of the relativistic heavy ion collision.

- Description of tau lepton decays with taking into account radial excited states of vector and axial vector mesons within the extended Nambu-Jona-Lasinio model.

Derivation of the full set of evolution equations for the transverse-momentum dependent parton distribution functions basing on the results of geometrical and group properties of the Wilson loop space.

Investigation of the role of non-Gaussian probability distributions in the description of the nonperturbative input in the phenomenology of the polarized semi-inclusive processes studied at the JLab, RHIC and future Electron-Ion Collider (EIC).

Complete analysis of nonleptonic decays of the whole family of bottom and charm baryons into an ordinary baryon and a meson. Calculation of decay widths and parameters of various asymmetries.

Studies of spectra and semileptonic decays of baryons containing heavy flavors. Evaluation of form factors of the decay Lambda-b into Lambda-c in the framework of the covariant quark model. Development of the theoretical formalism for these decays by using helicity methods including lepton mass effects.

- Participation in the tmfT Collaboration (finite temperature with twisted mass fermions) aimed at description of the quark-gluon thermodynamics including strange and charmed quarks, consideration of new observables indicating the crossover.

Investigation of topological aspects of the quark-gluon plasma (monopoles, dyons, vortices etc.) and estimation of the contribution of these degrees of freedom to trace anomaly, energy density etc.

Evaluation of transport coefficients in the u-d-s-c-gluon plasma (jet quenching, heavy quark diffusion, dilepton rates etc.).

Model calculations of the generation of vorticity in heavy-ion collisions and its effect on P-odd correlations of quarks and mesons in the NICA project.

Investigation of the role of color degrees of freedom at the early stage of heavy-ion interactions within the model of Parton Hadron String Dynamics (PHSD), estimation of the intensity of chromoelectric and chromomagnetic fields created in collisions of relativistic heavy ions. Study of the influence of color forces on the dynamics of parton interactions.

Study of the impact of strong electromagnetic fields (occurring during relativistic heavy-ion collisions) on the character of background gluon fields and the formation of a heterophase mixed hadron system within the domain model of the QCD vacuum. Investigation of observable manifestations of azimuthal anisotropy of the gluon fields in the collision region.

Study of the thermodynamic properties of non-uniform quark ensembles (quark droplets) on the basis of the models with four-fermion interaction. The Keldysh model (featuring an infinite correlation length) will receive special attention.

Further development of effective models for the QCD phase diagram to exhibit further observables (mesonic correlation functions, condensates and dual condensates) ready for comparison with lattice QCD data.

Extension of the PNJL and PQM models to include baryonic degrees of freedom to describe the region of non-vanishing net-baryon density.

Study of hybrid EoS (equations of state) based on ab-initio nuclear EoS and non-local PNJL models in a wide range of densities, temperatures and isospin asymmetry, for applications in the simulation of heavy-ion collisions, of supernova collapse and in compact star phenomenology.

List of activities:

Activity or experiment	Leaders
Laboratory or other	Main researchers
Division of JINR	
1. Standard Model and its extension	D.I. Kazakov A.B. Arbuzov
BLTP	A.V. Bednyakov, A.V. Gladyshev, A.V. Kotikov, G.A. Kozlov, V.K. Mitrjushkin, V.A. Naumov, V.N. Pervushin, A.D. Popov, S.I. Vinitsky, + 5 students
LIT	V.P. Gerdt
VBLHEP	V.G. Krivokhizhin
DLNP	D.Yu. Bardin, V.A. Bednyakov, L.B. Kalinovskaya
2. QCD parton distributions for modern and future colliders	A.V. Efremov O.V. Teryaev D.V. Shirkov
BLTP	M. Deka, S.V. Goloskokov, S.V. Mikhailov, A.V. Nesterenko, A.V. Radyushkin, O.V. Selyugin, A.V. Sidorov, + 3 students
VBLHEP	Yu.I. Ivanshin, I.A. Savin
DLNP	L.L. Nemenov, L.G. Tkatchev, A.S. Khrykin
3. Physics of heavy and exotic hadrons	A.E. Dorokhov M.A. Ivanov
BLTP	I.V. Anikin, G. Ganbold, S.B. Gerasimov, S.M. Eliseev, N.I. Kochelev, V.I. Korobov, V.A. Meshcheryakov, S.N. Nedelko, M.K. Volkov, Yu.S. Surovtsev, S.A. Zhaugasheva, + 5 students
VBLHEP	Yu.A. Panebratsev, M.V. Tokarev, V.A. Nikitin, Yu.I. Ivanshin, I.A. Savin, M.G. Sapozhnikov
DLNP	V.A. Bednyakov, N.B. Skachkov

4. Hadron Matter under extreme conditions

**E.-M. Ilgenfritz
S.N. Nedelko
D. Blaschke**

BLTP

D.E. Alvarez-Castillo, M. Deka, A.E. Dorokhov,
A.V. Friesen, M. Hasegawa, A.S. Khvorostukhin,
N.I. Kochelev, A. Parvan, B.D. Rumiantsev,
O.V. Teryaev, V.D. Toneev, A.M. Trunin, V.E. Voronin,
+ 3 students

LIT

Yu.L. Kalinovsky, Zh.Zh. Musulmanbekov, V. Voronyuk

VBLHEP

V.D. Kekelidze, A.G. Litvinenko, M.V. Tokarev,
O.V. Rogachevsky

DLNP

G.I. Lykasov

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	RAU Foundation ANSL
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	INP BSU JIPNR-Sosny NASB NC PHEP BSU
	Gomel	BelSUT GSU GSTU
Bulgaria	Sofia	INRNE BAS SU
Canada	Montreal	McGill UdeM
	Toronto	U of T
CERN	Geneva	CERN
China	Wuhan	WIPM CAS
Czech Republic	Prague	CTU CU IP ASCR
	Řež	NPI ASCR
Finland	Helsinki	UH
France	Lyon	UCBL
	Metz	UPV-M
	Montpellier	UM2
	Saclay	SPhN CEA DAPNIA IRFU
Georgia	Tbilisi	RMI TSU
Germany	Berlin	FU Berlin

		HUB
Aachen		RWTH
Bielefeld		Univ.
Bochum		RUB
Bonn		UniBonn
Dortmund		TU Dortmund
Erlangen		FAU
Hamburg		DESY
Heidelberg		Univ.
Jena		Univ.
Jülich		FZJ
Kaiserslautern		TU
Karlsruhe		KIT
Regensburg		UR
Rostock		Univ.
Mainz		JGU
Munich		LMU
Tübingen		Univ.
Wuppertal		UW
Zeuthen		DESY
Hungary	Budapest	ELTE
		Wigner RCP
ICTP	Trieste	ICTP
Italy	Bari	INFN
	Naples	INFN
	Padua	UniPd
	Pavia	INFN
	Pisa	INFN
	Trieste	SISSA/ISAS
	Turin	UniTo
Japan	Tokyo	UT
	Kyoto	Kyoto Univ.
	Nagoya	Meiji Univ.
		Nagoya Univ.
	Tsukuba	KEK
Kazakhstan	Almaty	APHI
		INP
	Astana	BA INP
Mexico	Cuernavaca	UNAM
Mongolia	Ulaanbaatar	IPT MAS
		NUM
New Zealand	Hamilton	Univ.
Norway	Trondheim	NTNU
Poland	Krakow	NINP PAS
	Kielce	JKU

	Lodz	UL
	Lublin	UMCS
	Otwock-Swierk	NCBJ
Republic of Korea	Seoul	SNU
Russia	Moscow	IMM RAS
		ITEP
		LPI RAS
		MSU
		MI RAS
		SCC RAS
		SINP MSU
	Moscow, Troitsk	INR RAS
	Belgorod	BelSU
	Chernogolovka	LITP RAS
	Gatchina	PNPI
	Irkutsk	ISU
		ISDCT SB RAS
	Ivanovo	ISU
	Kazan	KFU
	Novosibirsk	IM SB RAS
		BINP SB RAS
	Perm	PSNRU
	Protvino	IHEP
	Rostov-on-Don	SFedU
	St. Petersburg	SPbSU
		SPbSPU
	Samara	SSU
		SSAU
	Saratov	SSU
	Sarov	VNIIEF
	Tomsk	TSU
		IHCE SB RAS
	Tver	TvSU
	Yoshkar-Ola	VSUT
Serbia	Belgrade	Univ.
Slovakia	Bratislava	CU
		IP SAS
	Košice	IEP SAS
Spain	Santiago de Compostela	USC
	Valencia	UV
Switzerland	Bern	Uni Bern
	Villigen	PSI
Sweden	Lund	LU
United Kingdom	London	QM
		Imperial College

Ukraine	Canterbury Kiev Dnepropetrovsk Kharkov Lutsk L'viv Sumy New York, NY	Univ. BITP NASU DNU KFTI VNU IAPMM NASU IFNU SumSU RU CUNY
USA	College Park, MD Lemont, IL Minneapolis, MN Norman, OK Newport News, VA Philadelphia, PA University Park, PA Tashkent	UMD ANL U of M OU JLab Penn Penn State IAP NUU NUU
Uzbekistan		IOP VAST
Vietnam	Hanoi	

01-3-1114-2014/2018

Priority:

1

Status:

In-progress

Theory of Nuclear Structure and Nuclear Reactions

Leaders:

V.V. Voronov
A.I. Vdovin
N.V. Antonenko

Participating Countries and International Organizations:

Armenia, Austria, Belarus, Belgium, Brazil, Bulgaria, Canada, China, Czech Republic, Egypt, France, Germany, Greece, Hungary, Italy, Japan, Kazakhstan, Moldova, Norway, Poland, Republic of Korea, Romania, Russia, Serbia, Slovakia, South Africa, Spain, Sweden, Switzerland, Taiwan, Ukraine, USA, Uzbekistan.

Scientific Programme

The main goals are to predict and analyze properties of atomic nuclei beyond the stability valley and investigate structure peculiarities of superheavy and exotic nuclei; to study dynamics of nuclear collisions at low and intermediate energies accompanied by production of stable as well as radioactive nuclides; to investigate fundamental properties of various few-body systems and develop rigorous and effective mathematical methods of calculations of their properties; to explore the dynamics of particle-nucleus and nucleus-nucleus collisions at relativistic energies and nuclear matter properties and its phase transitions at extreme values of temperature and density.

Expected main results in 2016:

- Calculation of the delayed multi-neutron emission probabilities in the nuclei near the closed $N=28, 50, 82, 126, 184$ shells.

Investigation, within the Skyrme-RPA approach, of the interplay between E0 and E2 giant resonances in deformed nuclei.

Analysis of the low-lying parts of excitation spectra in odd-neutron transfermium nuclei within QPM.

Elucidation of the origin of high-energy monopole states in ^{132}Sn .

Calculation of inelastic neutrino-nucleus scattering cross section at finite temperature within a self-consistent approach based on Skyrme forces.

- Investigation of the dependence of probabilities of E2 transitions within the same rotational band on the signature in the odd deformed nuclei.

Development of the method for constructing the Interacting Boson-Fermion Model Hamiltonian in well deformed axially symmetric odd nuclei allowing consider at on of pairing interaction in the intrinsic frame and preserving the rotational invariance of the Hamiltonian.

Investigation of the fission mass, charge, and energy distributions of superheavy nuclei with $Z=102-118$.

Investigation of the cluster feature of rotational bands in ^{44}Ti and ^{48}Cr .

Analysis of the coherence and dissipative effects in reactions with radioactive beams.

- Development of the effective-range theory for two-dimensional scattering by a long-range central potential.

Development of the gauge invariant strong-field approximation in laser-atom interaction.

Investigation of the quantum dynamics of two-dimensional atoms in external electromagnetic fields.

Study of the metastable states of composite systems tunneling through repulsive barriers.

Investigation of the synthesis of chemical elements in the ultra-magnetized astrophysical plasma with realistic field geometry.

Study of the effect of resonances on block diagonalization of J-self-adjoint Hamiltonians.

- Study of the 2-body current effects on the deuteron magnetic moment within the Bethe-Salpeter approach.
Description of the transverse momentum distributions of hadrons and partons in the proton-proton and heavy ion collisions at high energies applying the exact relativistic Tsallis statistics.
- Analysis of the manifestation of the chromo effects in ultra-relativistic heavy-ion collisions within the PHSD model.
- Calculation of the pion-nucleus elastic and inelastic scattering cross sections at intermediate energies with different optical potentials.

List of activities:

Activity or experiment	Leaders
Laboratory or other Division of JINR	Main researchers
1. Nuclear properties at the border of stability	V.V. Voronov A.A. Dzhioev J. Kvasil
BLTP	N.N. Arseniev, E.B. Balbutsev, A.I. Vdovin, V.A. Kuz'min, L.A. Malov, S. Mishev, V.O. Nesterenko, A.P. Severyukhin, H. Ganey, R. Dvornicki, V.M. Shilov, A.V. Sushkov, E.O. Sushenok, + 3 students
LIT	N.Yu. Shirikova, I.V. Molodtsova
FLNP	A.M. Sukhovoi
DLNP	V.B. Brudanin, V.G. Kalinnikov
2. Low-energy dynamics and nuclear system properties	S.N. Ershov N.V. Antonenko R.V. Jolos
BLTP	G.G. Adamian, A.V. Andreev, A.N. Bezbakh, I.A. Egorova, S.I. Fedotov, V.G. Kartavenko, Sh. Kalandarov, A.K. Nasirov, R.G. Nazmitdinov, H. Paska, T.M. Shneidman, A.S. Zubov, + 1 students
FLNR	L.V. Grigorenko, Yu.E. Penionzhkevich
3. Quantum few-body systems	A.K. Motovilov A.S. Melezhik
BLTP	S.S. Kamalov, O.P. Klimenko, E.A. Kolganova, A.A. Korobitsyn, O.A. Koval, E.A. Koval, A.V. Malykh, V.S. Melezhik, V.N. Kondratyev, V.V. Pupyshev, E.A. Soloviev, S.I. Vinitsky, P. Jaluvkova, + 4 students
DLNP	O.I. Kartavtsev
4. Processes with nuclei at relativistic energies and extreme states of matter	V.V. Burov M. Gaidarov
BLTP	A. Bekzhanov, S.G. Bondarenko, A.V. Frisen, L.P. Kaptari, A. Khvorostukhin, V.K. Lukyanov, A.S. Parvan, N. Sagimbaeva, A.I. Titov, V.D. Toneev, + 1 students
LIT	E.B. Zemlianaya, K.V. Lukyanov
VBLHEP	A.I. Malakhov, N.M. Piskunov, Yu.A. Panebratsev, E.P. Rogochaya

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	RAU
Austria	Innsbruck	Univ.
Belarus	Minsk	IP NASB
Belgium	Brussels	VUB
	Louvain-la-Neuve	UCL
Brazil	Florianopolis, SC	UFSC
	Sao Paulo, SP	UEP
	Sao Jose dos Campos, SP	ITA
	Niteroi, RJ	UFF
Bulgaria	Sofia	INRNE BAS
Canada	Hamilton	McMaster
	Saskatoon	U of S
China	Beijing	ITP CAS CIAE PKU
Czech Republic	Prague	CU
	Řež	NPI ASCR
Egypt	Cairo	EAEA
	Giza	CU
France	Bordeaux	UB
	Caen	GANIL
	Orsay	CSNSM IPN Orsay
Germany	Bonn	UniBonn
	Cologne	Univ.
	Darmstadt	GSI IKP TU Darmstadt
	Dresden	HZDR
	Erlangen	FAU
	Frankfurt/Main	Univ.
	Hamburg	Univ.
	Giessen	JLU
	Leipzig	UoC
	Mainz	JGU
	Regensburg	UR
	Rostock	Univ.
	Siegen	Univ.
Greece	Thessaloniki	AUTH
	Athens	INP NCSR “Demokritos”
Hungary	Budapest	Wigner RCP

	Debrecen	Atomki
Italy	Bologna	Centro, ENEA
	Catania	INFN LNS
	Naples	INFN
	Messina	UniMe
	Perugia	INFN
	Trento	ECT*
	Turin	UniTo
Japan	Kobe	Kobe Univ.
	Morioka	Iwate Univ.
	Osaka	RCNP
		Osaka Univ.
Kazakhstan	Almaty	INP
		KazNU
Moldova	Chișinău	IAP ASM
Norway	Bergen	UiB
	Oslo	UiO
Poland	Krakow	NINP PAS
	Lublin	UMCS
	Otwock-Swierk	NCBJ
	Warsaw	UW
		WUT
Republic of Korea	Seoul	SNU
	Daejeon	IBS
Romania	Bucharest	IFIN-HH
		UB
Russia	Moscow	ITEP
		NNRU “MEPhI”
		MSU
		NRC KI
		SINP MSU
	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Irkutsk	ISU
	Obninsk	IPPE
	Omsk	OmSU
	Saratov	SSU
	St. Petersburg	SPbSU
	Vladivostok	FEFU
Serbia	Belgrade	IPB
Slovakia	Bratislava	CU
		IP SAS
South Africa	Pretoria	Unisa
	Stellenbosch	SU
	Cape Town	iThemba LABS

Spain	Palma	UIB
Sweden	Lund	LU
	Göteborg	Chalmers
Switzerland	Bern	Uni Bern
Taiwan	Taipei	NTU
Ukraine	Kiev	KINR NASU BITP NASU
USA	Lemont, IL	ANL
	Los Alamos, NM	LANL
	Notre Dame, IN	ND
	University Park, PA	Penn State
Uzbekistan	Tashkent	IAP NUU INP AS RUz Assoc.“P.-S.” PTI

01-3-1115-2014/2018

Priority:

1

Status:

In-progress

Theory of Condensed Matter

Leaders:

V.A. Osipov
A.M. Povolotskii

Participating Countries and International Organizations:

Armenia, Australia, Belarus, Belgium, Brazil, Bulgaria, Canada, Czech Republic, France, Germany, Hungary, India, Ireland, Italy, Moldova, Mongolia, Poland, Romania, Russia, Serbia, Slovakia, Slovenia, Spain, Switzerland, Taiwan, Ukraine, USA, Uzbekistan, Vietnam.

Scientific Programme

Effects of strong electron correlations in high-temperature superconductors, colossal magneto-resistance compounds (manganites), heavy-fermion systems, low-dimensional quantum magnets with strong spin-orbit interaction, topological insulators, etc. will be investigated based on a variety of underlying many-band electronic models including the extended Hubbard model, Anderson model, super-exchange spin-orbital models of transition of metal oxides with strong relativistic spin-orbital coupling. The electronic band structure, spectral properties of charge carrier quasiparticles, magnetic and charge collective excitations, metal-insulator and magnetic phase transitions, Cu- and Fe-based high-T_c superconductivity, charge and spin-orbital ordering will be studied. The obtained results will be used to support neutron scattering experiments performed at FLNP, JINR.

Investigations in the field of nanostructures and nanoscaled phenomena will be addressed to a study of physical characteristics of nanomaterials promising for various applications in modern nanotechnologies. The electronic, thermal and transport properties of carbon nanostructures will be investigated. It is planned to study the problem of quantum transport in molecular devices. Spin dynamics of magnetic nanoclusters will be investigated. The analysis of resonance tunneling phenomena in the layered superconductors and superconducting nanostructures in the external fields will be performed. Numerical modeling of resonance, radiative and chaotic properties of intrinsic Josephson junctions in high temperature superconductors is planned to be carried out.

Models in condensed matter physics will be studied by using methods of equilibrium and non-equilibrium statistical mechanics with the aim of revealing general properties of many-particle systems based on the ideas of self-similarity and universality. Mathematical mechanisms, underlying the kinetic and stationary behavior of model systems, as well as possible links between different models, will be investigated. The study of two-dimensional lattice models by the transfer matrix method will be focused on confirming the predictions of the logarithmic conformal field theory. The theory of integrable systems will be developed in the aspect of finding new integrable boundary conditions for two-dimensional spin systems and the solution of the corresponding Yang-Baxter equations. The universal behavior of correlation functions in non-equilibrium systems will be studied as well. The research in the structure theory and the theory of representations of quantum groups and matrix algebras will be directed to further applications in the theory of integrable models in quantum mechanics and statistical physics. Applications of the elliptic hypergeometric integrals, defining the most general solutions of the Yang-Baxter equation and most complicated known exactly computable path integrals in four-dimensional quantum field theory, to two-dimensional spin systems will be studied.

Expected main results in 2016:

- Investigations of magnetic phase transitions in anisotropic antiferromagnets within the compass-Heisenberg and Kitaev-Heisenberg models.

Study of the lattice Kondo-Heisenberg model in the strong coupling limit to describe the pseudogap phase of the underdoped cuprates.

Investigation of the electro and thermal conductivity of graphene and graphene nanoribbons with different types of defects .

Estimation of the intensity of electromagnetic radiation from coupled system of Josephson junctions in parametric resonance region.

Study of small-angle neutron scattering from fractal structures which show both mass and surface fractal regions.

Analytic and numerical investigation of nonequilibrium Bose gases of cold atoms.

- Application of the coordinate Bethe ansatz to higher spin stochastic vertex models. Investigation of the statistics of large deviations in conformally invariant stochastic models.

Generalization of the theorem about loop covering in the rotor-router model for the case of loops with holes. Investigation of spiral structure of a random walk in the rotor-router model.

Derivation of new formulas for zonal spherical functions on symmetric spaces of negative curvature of the class A II.

Study of scattering of instantons in Yang-Mills theory with the help of the adiabatic approach.

Derivation of finite-dimensional solutions of the Yang-Baxter equation by reduction of the general integral R-operator with rank 1 symmetry algebra. Investigation of two-dimensional integrable spin systems with the mixed discrete and continuous spin variables.

List of activities:

Activity or experiment	Leaders
Laboratory or other	Main researchers
Division of JINR	
1. Complex materials and nanostructures	V.A. Osipov N.M. Plakida
BLTP	E.M. Anitas, A.Yu. Cherny, A.V. Chizhov, V. Ilkovich, O.G. Isaeva, V.L. Katkov, E.A. Kochetov, D.V. Kolesnikov, S.E. Krasavin, D.A. Lobanov, M. Maiti, A.N. Novikov, V.N. Plechko, I.R. Rahmonov, J. Schmelzer, Yu.M. Shukrinov, M.A. Smondyrev, J. Smotlacha, A.A. Vladimirov, V.Yu. Yushankhai
FLNP	V.L. Aksenov, A.M. Balagurov, A.I. Kuklin
LIT	E.B. Zemlianaya, I. Sarhadov, S.I. Serdyukova, L.A. Syurakshina
2. Contemporary problems of statistical physics	A.M. Povolotsky V.B. Priezzhev
BLTP	J. Brankov, N.Zh. Bunzarova, V.M. Dubovik, V.I. Inozemtsev, A.L. Kuzemsky, T.A. Ivanova, V. Papoyan, A.E. Patrik, P.N. Pyatov, V.P. Spiridonov, O. Turek, V.I. Yukalov, P.E. Zhidkov
LIT	E.P. Yukalova

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	Foundation ANSL YSU
Australia	Melbourne Sydney	IIAP NAS RA Univ.
Belarus	Minsk	BSTU

		IP NASB
		ICE MES RB
		JIMB NASB
		JIPNR-Sosny
		NASB
Belgium	Louvain-la-Neuve	UCL
Brazil	Brasilia, DF	UnB
	Sao Paulo, SP	USP
	Natal, RN	IIP UFRN
Bulgaria	Sofia	IMech BAS
		ISSP BAS
		SU
		INRNE BAS
Canada	Montreal	Concordia
	Quebec	UL
	Kingston	Queen's
	London	Western
Czech Republic	Řež	NPI ASCR
France	Paris	UPMC
	Marseille	UPC
	Nice	UN
	Valenciennes	UVHC
Germany	Bonn	UniBonn
	Bremen	Univ.
	Braunschweig	TU
	Dortmund	TU Dortmund
	Darmstadt	GSI
	Dresden	IFW
		MPI PkS
		TU Dresden
	Duisburg	UDE
	Leipzig	UoC
	Magdeburg	OVGU
	Rostock	Univ.
	Stuttgart	MPI-FKF
	Wuppertal	UW
Hungary	Budapest	Wigner RCP
India	Mumbai	TIFR
Ireland	Dublin	DIAS
Italy	Catania	UniCT
	Salerno	UNISA
Poland	Krakow	JU
	Warsaw	IPC PAS
		WUT
	Katowice	US

	Poznan	AMU
Romania	Bucharest	IMP PAS
	Cluj-Napoca	IFIN-HH
	Timișoara	UTC-N
Russia	Moscow	UVT
	Moscow, Troitsk	MIREA
	Belgorod	NNRU “MEPhI”
	Gatchina	MSU
	Kazan	PFUR
	Protvino	SINP MSU
	Saratov	MI RAS
	St. Petersburg	NRC KI
	Voronezh	HPPI RAS
Moldova	Chișinău	INR RAS
Mongolia	Ulaanbaatar	BelSU
Serbia	Belgrade	PNPI
Slovakia	Bratislava	KFU
	Košice	IHEP
Slovenia	Ljubljana	SSU
Spain	Madrid	ETU
Switzerland	Villigen	IPTI RAS
	Zurich	SPbSU
Taiwan	Taipei	VSU
Ukraine	Kharkov	IAP ASM
	Kiev	NUM
	L'viv	INS “VINČA”
USA	Louisville, KY	CU
	New York, NY	IEP SAS
	Rochester, NY	TUKE
	Tallahassee, FL	UL
Uzbekistan	Tashkent	ICMM-CSIC
Vietnam	Hanoi	PSI
		ETH
		IP AS
		KFTI
		IMP NASU
		NUK
		ICMP NASU
		UofL
		CUNY
		UR
		FSU
		Assoc.“P.-S.” PTI
		IMS VAST

01-3-1116-2014/2018

Priority:

1

Status:

In-progress

Modern Mathematical Physics: Strings and Gravity, Supersymmetry, Integrability

Leaders:	A.P. Isaev
Deputy:	A.S. Sorin
Scientific leader:	S.O. Krivonos

Participating Countries and International Organizations:

Australia, Austria, Armenia, Belarus, Brazil, Bulgaria, Canada, CERN, Czech Republic, France, Germany, Greece, Hungary, ICTP, India, Italy, Japan, Norway, Poland, Romania, Russia, Serbia, Spain, Turkey, Ukraine, United Kingdom, USA.

Scientific Programme

The main purpose of research in modern mathematical physics is the development of mathematical methods for solving the most important problems of modern theoretical physics: clarifying the nature of fundamental interactions and their symmetries, construction and study of effective field models arising in the theory of strings and other extended objects, uncovering the geometric description of quantum symmetries and their spontaneous breaking in the framework of search for a unified theory of all fundamental interactions, including quantum gravity. Mathematical physics in recent years has been characterized by increasing interest in identifying and effective used of integrability in various areas, and in applying powerful mathematical methods of quantum groups and non-commutative geometry to quantum theories of fundamental interactions as well as to classical models.

The main goals and tasks of the research within the theme include: development of new mathematical methods for description of a variety of integrable models and their exact classical and quantum solutions; analysis of a wide range of problems in the theory of superstrings and superbranes, including study of nonperturbative regimes in supersymmetric gauge theories; development of a microscopic description of black holes and constructing cosmological models of the early Universe. The decisive factor to solve the above problems is a crucial use of the mathematical methods of the theory of integrable systems, quantum groups and noncommutative geometry.

Expected main results in 2016:

- Construction of the field theory models realizing the partial breaking of the global supersymmetries in D=3 and D=4 with the hypermultiplet and vector supermultiplets as the Goldstone superfields;

We will study basic equations and relationships between relativistic static spherically symmetric stars (SSSS) and other static spherically symmetric objects (SSSO) of different scales - planets, white dwarfs, normal star of solar types, dark spheroids, galaxies and galaxy coupling in the model of minimal dilatonic gravity (MDG) locally equivalent to f(R) gravity theories leading to an alternative description of dark matter and dark energy. We will describe singular manifolds in the phase space of SSSO. We will study new effects of the bifurcation of the phase portrait of the systems under the change of the mass of the dilatonic field. We will develop new effective computation schemes for the listed problems using the parallel programming;

We will develop a new approach based on the symmetrical form of the Hoin differential equation. The approach is based on the generalization of the Klien symmetrical form for the Fuksian equations for any number (N> 3) of regular singular points;

Construction of the universal Bethe vectors for the quantum integrable models associated with supersymmetric extension of the Yangian double. Calculation of the formfactors of the local operators in the supersymmetric quantum integrable models;

For a five-dimensional supergravity model we aim to build new analytic black holes in Lifshitz-like backgrounds, which are able to describe holographically the quark-gluon plasma at strong coupling. We will also construct a Vaidya-Lifshitz solution that represents a thin shell falling at the speed of light and allows one to describe a black hole formation. Using the obtained solutions we will compute and investigate nonlocal operators (entanglement entropy, Wilson loops, etc.) characterizing various stages of the quark-gluon plasma. The impact of the background anisotropy on the QGP thermalization will be studied;

We will construct pseudotoric structures on hyperplane sections of toric varieties. We will study the exotic lagrangian tori arising in this construction;

Special geometry for Bohr - Sommerfeld cycles will be constructed. We will prove that the universal moduli space of special Bohr - Sommerfeld cycles carries a natural universal Kahler structure;

Special Bohr - Sommerfeld geometry can be exploited in the theory of sigma models. We will associate to any embedded Riemann surface a complicated graph in the loop space of the target space.

- Analysis of loop structure of Bagger-Lambert-Gustavsson and Aharony-Bergman-Jafferis-Maldacena models by using the superfield background field method and manifestly covariant superfield proper-time method, and study the aspects of the AdS(4)/CFT(3) correspondence;

Design and analysis of new models of supersymmetric mechanics, including cases of deformed and quasi-complex supersymmetries, and their application to the description of the motion of spin particles in different background non-Abelian gauge fields and in the theory of the quantum Hall effect;

Further elaboration of the formalism of auxiliary fields in the duality invariant supersymmetric theories and construction of duality-invariant actions for the Born-Infeld theory with partial supersymmetry breaking;

Construction of new twistor formulations of spinning (super)particles and (super)strings and study of their application in higher spin fields theory;

Study of various black-hole configurations and localized particle-like soliton solutions in the higher dimensional (super)gravity and (super)Yang-Mills theories by numerical analysis;

Analysis of the ultraviolet properties of $N=(1,0)$ and $N=(1,1)$ super Yang-Mills theories in dimension 6 in terms of the harmonic off-shell $N=(1,0)$ and on-shell $N=(1,1)$ superfields. Solving of the defining constraints of 6D $N=(1,1)$ super Yang-Mills theory in terms of harmonic $N=(1,0)$ superfields;

Construction of the superfield description of the new type supermultiplets of supersymmetric quantum mechanics, the so called “long multiplets”, for $N=2$ and $N=4$ supersymmetries in one dimension, equally as for their $SU(2|1)$ deformations. Construction of new explicit realizations of the conformal supergroup $D(2, 1; \alpha)$ in the models of $N=4$ superconformal mechanics.

- Investigation of the Minkowski space-time stability in the framework of the modified gravitation theories with higher derivatives by making use of a new, specially developed, universal method based on the theory of dynamical systems;

Searches for new physics and creation of new theoretical models for interpretations of observational data for the Galactic Center;

Creation of advanced theoretical models for exo-planetary systems with gravitational microlensing and polarization observations;

Development of the heat kernel expansion for manifolds with non-smooth boundaries will be proposed. For domains with boundaries possessing cusps the multiple reflection technique will be extended in order to derive systematically the higher order heat kernel coefficients;

Investigation of electronic excitations in graphene will be conducted in the framework of the quantum theory of the Dirac field defined on the 2-dimensional graphene sheet and interaction with the electromagnetic field occupying the whole 3-dimensional space. Study of the surface plasmon excitations in this system;

Realistic inflation scenarios consistent with observational data from Plank-2015 will be developed in conformal gravity models with several scalar fields and symmetry violating R^2 -term;

It is planned to examine the possibility of constructing the regimes of accelerated expansion in the models of gravity non-minimally coupled to a scalar field with one-loop quantum corrections;

The vacuum friction force between macroscopic bodies will be calculated in the framework of the quantum-statistical theory of the linear response by making use of different versions of the electromagnetic energy-momentum tensor in a medium;

It is expected to accomplish the construction of the uniform asymptotic expansions for hypergeometric function products arising, for instance, in the vacuum energy calculation for quantized fields in the background of the media with variable spherically symmetric refractive index.

List of activities:

Activity or experiment	Leaders
Laboratory or other	Main researchers
Division of JINR	
1. Quantum groups and integrable systems	A.P. Isaev
BLTP	S.A. Belev, A.A. Golubtsova, S.O. Krivonos, N.Yu. Kozyrev, R.M. Mir-Kasimov, S.Z. Pakulyak, G.S. Pogosyan, N.A. Tyurin, + 4 students
2. Supersymmetry	E.A. Ivanov
BLTP	S.A. Fedoruk, M. Pientek, S.S. Sidorov, Ya.M. Shnir, A.O. Sutulin, + 2 students
3. Quantum gravity, cosmology and strings	A.T. Filippov V.V. Nesterenko A.S. Sorin
BLTP	B.M. Barbashov, E.A. Davydov, D.V. Fursaev, A.B. Pestov, I.G. Pirozhenko, A.D. Popov, E.A. Tagirov, P.V. Tretyakov, + 3 students
LIT	I.L. Bogoliubsky, A.M. Chervyakov
VBLHEP	E.E. Donets
UC	S.Z. Pakuliak

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU
Australia	Sydney	Univ.
Austria	Vienna	TU Vienna
Belarus	Minsk	IP NASB
Brazil	Sao Paulo, SP	USP
Bulgaria	Sofia	INRNE BAS
		SU
Canada	Montreal	McGill
		UdeM
CERN	Edmonton	U of A
Czech Republic	Geneva	CERN
	Prague	CTU
	Řež	CU
		NPI ASCR

France	Annecy-le-Vieux	LAPP
	Dijon	LAPTh
	Lyon	UB
	Marseille	ENS Lyon
	Nantes	CPT
	Paris	SUBATECH
	Palaiseau	ENS
	Valenciennes	LPTHE
Germany	Berlin	Polytech
	Bielefeld	UVHC
	Bonn	FU Berlin
	Dortmund	HUB
	Hannover	Univ.
	Jena	UniBonn
	Leipzig	TU Dortmund
	Munich	LUH
	Potsdam	Univ.
Greece	Athens	UoC
Hungary	Budapest	MPI-P
India	Calcutta	AEI
Italy	Bari	UoA
	Frascati	Wigner RCP
	Naples	BNC
	Padua	INFN
	Pavia	INFN
	Pisa	INFN
	Salerno	INFN LNF
	Trieste	UNISA
	Turin	SISSA/ISAS
ICTP	Trieste	INFN
Japan	Fukuoka	ICTP
	Kyoto	Kyushu Univ.
		KSU
		RIMS
		YITP
Norway	Tsukuba	KEK
Poland	Trondheim	NTNU
	Warsaw	NCAC PAS
	Krakow	UW
	Lodz	JU
	Wroclaw	NINP PAS
		UL
		UW

Romania	Bucharest	IFIN-HH
Russia	Moscow	ITEP
		LPI RAS
		MSU
		MI RAS
		NRU HSE
		VNIIMS
	Moscow, Troitsk	INR RAS
	Chernogolovka	LITP RAS
	Protvino	IHEP
	St. Petersburg	PDMI RAS
		SPbSU
	Tomsk	TPU
Serbia	Belgrade	IPB
		Univ.
Spain	Bilbao	UPV/EHU
	Barcelona	IEEC-CSIC
	Valencia	IFIC
Turkey	Istanbul	BU
	Izmir	IZTECH
USA	New York, NY	CUNY
		RU
		SUNY
	Baltimore, MD	JHU
	Cincinnati, OH	UC
	Clemson, SC	Clemson
	College Park, MD	UMD
	Coral Gables, FL	UM
	Minneapolis, MN	U of M
	Norman, OK	OU
	Philadelphia, PA	Penn
	Piscataway, NJ	Rutgers
	Rochester, NY	UR
Ukraine	Kiev	BITP NASU
	Kharkov	KFTI
United Kingdom	London	Imperial College
	Cambridge	Univ.
	Durham	Univ.
	Liverpool	Univ.
	Southampton	Univ.
	York	Univ.

Dubna International Advanced School of Theoretical Physics (DIAS-TH)

Leaders: V.V. Voronov
Scientific leader: A.S. Sorin
 A.T. Filippov

Participating Countries and International Organizations:

Austria, Brazil, Bulgaria, Canada, CERN, Czech Republic, France, Germany, Greece, Hungary, India, Israel, Italy, Japan, Mexico, Poland, Romania, Russia, Serbia, South Africa, Turkey, Ukraine, United Kingdom, USA, Vietnam.

The Bogoliubov Laboratory of Theoretical Physics (BLTP) has a good record of organizing international workshops and schools in Dubna. DIAS-TH organizes and supervises all educational programs for students, postgraduates, and young scientists at BLTP. It should function continuously and the standard short schools (about 3-4 a year) should be organized coherently. Other educational programs in Dubna such as the JINR University Center may also correlate with DIAS-TH (common programs on modern theoretical physics, workshops for students and young scientists, etc.).

The main goals of DIAS:

- Training courses for students, graduates, and young scientists in the JINR Member States and other countries (according to special agreements and grants).
- Looking for and supporting gifted young theorists in the JINR Member States; creating databases of students and young researchers.
- Organization of schools of different levels in Dubna and coordination with similar schools in Russia, Germany, and other European countries.
- Support of the JINR experimental programs by organizing lecture courses and review lectures on new trends in modern physics.
- Cooperation with the JINR University Center in training students and postgraduates as well as in organizing schools for students.
- Coordination of the research - training programs with workshops and conferences at JINR.
- Publication of lectures and discussions in different forms, in particular, with the use of modern electronic equipment, etc.
- Supporting the WEB page of DIAS-TH which should become the organizing center of the programs related to DIAS-TH.

The main topics of the DIAS activity should be centered around the most important directions of research at BLTP: Theory of Fundamental Interactions; Nuclear Theory; Theory of Condensed Matter; Modern Mathematical Physics.

Expected main results in 2016:

- Organization of three international schools and a research workshop at BLTP.
- Organization of “educational workshops”, one-day lectures/discussions and regular seminars for students and post-graduates.
- Computer processing of video records of lectures, support of digital archive of video records.
- Support of Web-site of DIAS-TH.

List of activities:

Activity or experiment	Leaders
Laboratory or other	Main researchers
Division of JINR	
1. DIAS-TH	V.V. Voronov A.S. Sorin
BLTP	D. Blaschke, A.T. Filippov, A.P. Isaev, E.A. Kolganova, V.V. Nesterenko, V.A. Osipov, I.G. Pirozhenko, O.V. Teryaev, P.V. Tretyakov, A.A. Starobinsky, A.A. Vladimirov, V.I. Zhuravlev, + 4 students
LIT	V.V. Korenkov
UC	S.Z. Pakuliak
FLNP	V.L. Aksenov
VBLHEP	I.A. Savin, Yu.A. Panebratsev
DLNP	V.A. Bednyakov
FLNR	Yu.Ts. Oganessian

Collaboration

Country or International Organization	City	Institute or Laboratory
Austria	Vienna	Univ. TU Vienna
Brazil	Sao Paulo, SP	USP
Bulgaria	Sofia	INRNE BAS SU
Canada	Montreal Edmonton	UdeM U of A
CERN	Geneva	CERN
Czech Republic	Prague	CTU IP ASCR
France	Řež Annecy-le-Vieux Dijon Lyon Marseille Nantes Paris	NPI ASCR LAPP UB ENS Lyon CPT SUBATECH ENS LPTHE UPMC UVHC
Germany	Valenciennes Berlin Bonn Frankfurt/Main Hamburg	HUB UniBonn Univ. DESY

	Hannover	LUH
	Jena	Univ.
	Leipzig	UoC
	Munich	MPI-P
	Potsdam	AEI
	Rostock	Univ.
	Zeuthen	DESY
Greece	Athens	UoA
Hungary	Budapest	Wigner RCP
India	Calcutta	BNC
Italy	Frascati	INFN LNF
	Padua	UniPd
	Pavia	INFN
	Pisa	INFN
	Salerno	UNISA
	Trieste	SISSA/ISAS
	Turin	INFN
Israel	Rehovot	WIS
Japan	Kyoto	KSU
		RIMS
	Tsukuba	KEK
Mexico	Leon	UG
Poland	Warsaw	UW
	Otwock-Swierk	NCBJ
	Wroclaw	UW
Romania	Bucharest	IFIN-HH
Russia	Moscow	ITEP
		LPI RAS
		MSU
		SCC RAS
		SINP MSU
		MI RAS
		VNIIMS
	Moscow, Troitsk	INR RAS
	Chernogolovka	LITP RAS
	Gatchina	PNPI
	Petrozavodsk	PetrSU
	Protvino	IHEP
	St. Petersburg	PDMI RAS
	Tomsk	TSU
Serbia	Belgrade	IPB
		Univ.
South Africa	Cape Town	UCT
Turkey	Istanbul	BU
Ukraine	Kiev	BITP NASU

	Kharkov	KFTI
United Kingdom	London	Imperial College
	Durham	Univ.
	Cambridge	Univ.
	Southampton	Univ.
	York	Univ.
USA	New York, NY	CUNY SUNY
	Baltimore, MD	JHU
	College Park, MD	UMD
	Cincinnati, OH	UC
	Coral Gables, FL	UM
	Minneapolis, MN	U of M
	Newport News, VA	JLab
	Philadelphia, PA	Penn
	Piscataway, NJ	Rutgers
	Rochester, NY	UR
	Salt Lake City, UT	U of U
Vietnam	Hanoi	IOP VAST

Elementary
Particle Physics
and
Relativistic
Nuclear Physics
(02)

02-2-1123-2015/2016

Priority:

1

Status: Approved for completion
in 2016

JINR's Participation at the BES-III Physics Research Program

Leader: A.S. Zhemchugov

Participating Countries and International Organizations:

China, Russia.

Scientific Programme

The BES-III experiment at the electron-positron collider BEPC (IHEP CAS, Beijing, China) is aimed at systematic and precise measurements in τ -charm domain. The main goals of the experiment include light hadron spectroscopy, study of charmonium spectrum and transitions, study of open charm particles like D and Ds mesons, τ -lepton physics and search for new exotic XYZ states. Data taking started in 2009. The world largest sample of J/ψ , $\psi(3686)$, $\psi(3770)$, $\psi(4040)$ is already collected. Scan in the energy range 2.0–4.6 GeV is performed for R-ratio measurement. Unique sample in the energy range 4.2–4.6 GeV is collected to search for new XYZ states.

Expected main results in 2016:

- BES-III data analysis.
- Development of offline software and analysis tools
- Development of the distributed computing system.

List of projects:

Project	Leader	Priority (period of realization)
1. BES-III	A.S. Zhemchugov	1 (2007 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
BES-III Project	A.S. Zhemchugov	Realization
DLNP	I.R. Boyko, D.V. Dedovich, Yu.A. Nefedov, G.A. Shelkov, I.I. Denisenko, E.A. Boger, O.V. Bakina, E. Tskhadadze	
BLTP	V.V. Bytev, O.V. Teryaev	
LIT	V.V. Korenkov, A.V. Uzhinsky, S.D. Belov, I.S. Pelevanyuk, O.V. Ustimenko, V.V. Trofimov	

Collaboration			
Country or International Organization	City		Institute or Laboratory
China	Beijing		IHEP CAS
Russia	Gatchina		PNPI
	Novosibirsk		BINP SB RAS
	Irkutsk		ISU

02-0-1081-2009/2016

Priority:

1

Status: Approved for completion
in 2016

ATLAS.

Upgrade of the ATLAS Detector and Physics Research at the LHC

Leader: V.A. Bednyakov
Deputies: E.V. Khramov
A.P. Cheplakov

Participating Countries and International Organizations:

Armenia, Azerbaijan, Belarus, Canada, CERN, Czech Republic, France, Germany, Georgia, Greece, Israel, Italy, Netherlands, Russia, Slovakia, Spain, USA, Uzbekistan.

Scientific Programme

Many-sided and comprehensive investigations of superhigh-energy (7–14 TeV) proton scattering at the Large Hadron Collider with the ATLAS facility (created at the previous stage of the project) will yield utterly new and unique experimental data. Their analysis will allow solution to the most profound physical problems fundamentally important for world outlook.

JINR researchers will take part in solution of some of these problems within the project. Among the most important of them are the clarification of the origin of the elementary particle mass (Higgs mechanism) and search for and investigation of supersymmetry, which will allow an insight into the nature of galactic dark matter and the character of the evolution of our Universe. Other important problems are determination of the applicability boundaries of the modern standard model of elementary particles and observation of evidence for new physical phenomena, such as additional space dimensions or previously unknown particles and interactions. In addition, JINR researchers will get new results allowing more specific knowledge as to the properties of the already known elementary particles such as the W and Z bosons, the top quark, and others.

Implementation of this project aimed at solving highly important scientific problems will result in getting unique applied data.

The “by-products” worth noting are development, debugging, and experience in operation of systems for remote monitoring of highly complicated devices and development and practical use of the distributed computation system (grid) in a long-term, full-scale experiment.

Expected main results in 2016:

- Participation in the LHC and ATLAS detector maintenance and upgrades. Participation in LHC and ATLAS restart.
- Data development and analysis of the ATLAS data. The new physical results to be obtained in investigations of some key processes of the Standard Model, exotic physics, search for SUSY and heavy quarks physics.
- Development of the ATLAS physics programme: simulation of physical processes, participation in the ATLAS working group, etc.
- Work on the modernization project of the ATLAS detector, including the toroidal magnets, hadron calorimeters and muon spectrometer.
- Detector maintenance and operation.

List of projects:

Project	Leader	Priority (period of realization)
1. ATLAS. Physics.	E.V. Khramov	1 (2010 – 2019)

2. Upgrade of the ATLAS Detector	A.P. Cheplakov	1 (2013 – 2018)
3. SANC	D.Yu. Bardin	1 (2003 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Experiment ATLAS	V.A. Bednyakov E.V. Khramov A.P. Cheplakov	Technical proposal
DLNP V.A. Bednyakov, J.A. Budagov, N.A. Rusakovich, G.A. Chelkov	A.L. Gongadze, I.R. Boyko, M.A. Demichev, Yu.A. Koultchitski, I.A. Minashvili, M.I. Gostkin, D.V. Dedovich, Yu.A. Nefedov, D.V. Kharchenko, Yu.A. Usov, S.N. Malyukov, V.V. Lyubushkin, R.R. Sadykov, M.V. Chizhov, V.V. Glagolev, P.V. Tereshka, Z.U. Usabov, Yu.P. Ivanov, S.N. Karpov, Z.M. Karpova, M.V. Lyablin, G.I. Lykasov, A.A. Sapronov, A.N. Shalyugin, M.M. Shiyakova, V.B. Vinogradov, A.C. Zhemchugov, Yu.L. Vertogradova, A.V. Ershova, N. Huseinov, L.K. Gladilin, I.V. Eletskikh, E.M. Plotnikova, Yu.I. Davydov, V.G. Elkin, S.A. Kotov, V.G. Kruchonok, I.N. Potrap, E. Tschadadze	
VBLHEP A.P. Cheplakov, V.D. Peshekhonov	N. Dzhavadov, E.A. Ladygin, F.N. Ahmadov, A.V. Ivanov, G.D. Kekelidze, V.V. Kukhtin, V.M. Lysan, B.G. Shaykhatdenov, N.G. Fadeev, L.A. Merkulov, V.V. Myalkovsky, A.A. Soloshenko, N.I. Zimin, Yu.A. Filippov	
LIT V.V. Korenkov, P.V. Zrelov	I.N. Aleksandrov, N.I. Gromova, A.V. Yakovlev, V.N. Shigaev, M.A. Mineev, D.A. Oleynik, A.S. Petrosyan	
BLTP D.I. Kazakov	A.V. Gladyshev, A.V. Bednyakov, N.I. Kochelev, A.F. Pikelner, O.B. Teryaev	
FLNP S.A. Kulikov	M.V. Bulavin, E.N. Kulagin, E.P. Shabalin	
2. SANC Project	D.Yu. Bardin	Realization
DLNP	L.V. Kalinovskaya, A.A. Sapronov, P. Christova, R.R. Sadykov, E.D. Uglov, V.A. Kolesnikov, L.A. Rumyantsev	
BLTP	A.B. Arbuzov, S.G. Bondarenko	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	Foundation ANSL
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	IP NASB NC PHEP BSU

		JIPNR-Sosny
	Gomel	NASB
Canada	Vancouver	GSTU
	Montreal	TRIUMF
CERN	Geneva	UdeM
Czech Republic	Prague	CERN
France	Clermont-Ferrand	CU
	Orsay	LPC
Germany	Munich	LAL
	Zeuthen	MPI-P
Georgia	Tbilisi	DESY
Greece	Athens	HEPI-TSU
Israel	Rehovot	UoA
Italy	Pisa	WIS
Netherlands	Amsterdam	INFN
Russia	Moscow	NIKHEF
		LPI RAS
		ITEP
		MSU
	Protvino	IHEP
Slovakia	Bratislava	CU
		IP SAS
Spain	Barcelona	IFAE
USA	Lemont, IL	ANL
Uzbekistan	Samarkand	SSU

02-2-1124-2015/2017

Priority:

1

Status:

In-progress

Search for New Physics in Experiments with the Fermilab High-Intensity Muon Beams

Leader: V.V. Glagolev
Scientific leader: J.A. Budagov

Participating Countries and International Organizations:

Belarus, Bulgaria, Georgia, Italy, Russia, Slovakia, USA, Ukraine.

Scientific Programme

The muon anomalous magnetic moment a_μ can be measured and computed to high precision. The comparison between experiment and the SM therefore provides a sensitive search for New Physics (NP). At present, both measurement and theory have sub-part-per-million (ppm) uncertainties, and the “g-2 test” is being used to constrain SM extensions. The difference between experiment and theory, $\Delta a_\mu(\text{Expt} - \text{SM}) = (255 \pm 80) \times 10^{-11}$ ($3, 2\sigma$), is a highly cited result and a possible harbinger of new TeV-scale physics. Potential explanations of the deviation include: supersymmetry, lepton substructure, dark matter loop etc., all well motivated by theory and consistent with other experimental constraints. Fermilab experiment has a plan to reduce the experimental uncertainty by a factor of 4 or more. A precise g-2 test, no matter where the final value lands, will sharply discriminate among models and will enter as one of the central observables in a global analysis of any SM extensions.

The Mu2e experiment at Fermilab is a dedicated search for the CLFV process $\mu^- N \rightarrow e^- N$, which is the coherent conversion of a muon into an electron in the vicinity of a nucleus. Once neutrinos masses are included, the process is allowed but effectively still absent since the rate is proportional to $(\Delta m_{ij}^2/M_W^2)^2$, where Δm_{ij}^2 is the mass difference squared between i-th and j-th neutrino mass eigenstates, and M_W is the mass of the W-boson. The predicted rates for the $\mu^- N \rightarrow e^- N$ and $\mu^+ \rightarrow e^+ \gamma$ CLFV processes are less than 10^{-50} each. This makes this process a very theoretically clean place to search for NP effects. In many NP models that include a description of neutrino mass, the rates for these processes are enormously enhanced so that they occur at a level to which Mu2e experiment will have sensitivity.

Expected main results in 2016:

- Simulation to define optimal crystal type and sizes for e.m. calorimeter of the Mu2e experiment.
- Tests of the different type (CsI, BaF₂) e.m. calorimeter elements on the gamma sources and electron beam.
- Tests of the extruded scintillation strips different geometry and manufacture with wave length shifter fibers readout to optimize the final version of counters. The choice of filler for the holes for the strips to increase the light collection.
- Creation of the working version of the on-line control and data visualization program for Muon g-2 experiment and its integration in the common DAQ system.
- Performing R&D for choosing optimal tracker detector element for Muon g-2 experiment.
- Participation in the radiation hardness tests of the detector elements.

List of projects:

Project	Leader	Priority (period of realization)
1. Search for new physics in experiments with the Fermilab high-intensity muon beams	V.V. Glagolev	1 (2015 – 2017)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Experiment Mu2e	V.V. Glagolev	R&D Realization
DLNP	A.M. Artikov, N.V. Atanov, O.S. Atanova, N.S. Azaryan, V.Yu. Baranov, V.Yu. Batusov, J.A. Budagov, D.Sh. Chokheli, Yu.I. Davydov, D.L. Demin, V.B. Flyagin, D.S. Guskov, Yu.N. Kharzheev, V.I. Kolomoets, S.M. Kolomoets, M.V. Lyablin, Yu.A. Koulchitski, V.M. Romanov, A.V. Sazonova, A.N. Shalyugin, A.V. Simonenko, S.N. Studenov, I.A. Suslov, A.K. Suhanova, I.V. Titkova, V.V. Tereschenko, S.V. Tereschenko, Z.U. Usubov	
BLTP	D.I. Kazakov, G.A. Kozlov, O.V. Tarasov	
LIT	V.V. Korenkov, V.V. Uzhinsky	
VBLHEP	A. Galoyan	
Experiment Muon g-2	N.V. Khomutov	R&D Realization
DLNP	V.A. Baranov, V.N. Duginov, K.I. Gritsaj, A.S. Korenchenko, N.P. Kravchuk, N.A. Kuchinsky, T.N. Mamedov, A.I. Rudenko, V.P. Volnykh	
VBLHE	S.A. Movchan	
LRB	V.A. Krylov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	NC PHEP BSU “INTEGRAL”
Bulgaria	Sofia	SU
Georgia	Tbilisi	HEPI-TSU
Italy	Pisa	UniPi
	Frascati	INFN LNF
Russia	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
Slovakia	Bratislava	IP SAS
		CU
USA	Batavia, IL	Fermilab
	Charlottesville, VA	UVa
	Lexington, KY	UK
Ukraine	Kharkov	ISMA NASU

02-2-1099-2010/2018

Priority:

1

Status:

Extended

Study of Neutrino Oscillations

Leaders:

D.V. Naumov
A.G. Olshevskiy

Participating Countries and International Organizations:

China, Czech Republic, France, Germany, Japan, Italy, Slovakia, Turkey, USA.

Scientific Programme

- Measurement of the θ_{13} neutrino mixing angle and Δm^2_{ee} squared mass difference in Daya Bay experiment.
- Measurement of the solar neutrino fluxes in Borexino experiment, search for the sterile neutrino state.
- Study of the neutrino oscillations in OPERA experiment.
- Neutrino mass hierarchy determination and measurement of CP violation phase of the neutrino mixing matrix in JUNO and NOvA experiments.
- R&D for the new photo-detectors and detector equipment for the neutrino experiments.
- Improving of the precision of direct solar neutrino flux measurements with the Borexino detector, phase-II experiment.

Expected main results in 2016:

- Application of developed algorithms and improvement of Daya Bay measurements of reactor antineutrino flux and spectrum.
- New data analysis on the search of quantum decoherence effects and light sterile neutrinos using Daya Bay and global neutrino oscillation data.
- Development of proposals for sensitivity optimization to the mass hierarchy measurements and determination of neutrino oscillation parameters.
- Software and algorithms development for event reconstruction in JUNO and NOvA experiments.
- Analysis of NOvA experiment systematic uncertainties related to the neutrino-nucleon cross sections and MSW effects.
- Construction of NOvA experiment Remote Operation Centre at JINR.
- Test bench measurement of NOvA electronics parameters at JINR and preparation of proposals for their account in simulation.
- Test of High Voltage options for JUNO PMT.
- Measurement of JUNO Photodetector characteristics and development of their acceptance test criteria.
- OPERA emulsions scanning and analysis at JINR. New results on tau-neutrino appearance.
- OPERA experiment decommissioning and preparation of the OPERA TT detectors for the use in JUNO experiment.
- Construction of JUNO veto system prototype at JINR using OPERA detectors.
- Application of the developed events coordinates reconstruction algorithms in Borexino detector.
- New measurement of solar neutrino parameters in Borexino detector.

List of projects:

Project	Leader	Priority (period of realization)
1. BOREXINO	O.Yu. Smirnov	1 (1996 – 2016)
2. Daya Bay/JUNO	D.V. Naumov	1 (2009 – 2017)
3. NOvA	A.G. Olshevskiy	1 (2015 – 2017)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
1. Experiment BOREXINO	O.Yu. Smirnov	Data taking
DLNP	K.A. Fomenko, D.V. Koralev, A.P. Sotnikov	
2. Daya Bay/JUNO Project	D.V. Naumov M.O. Gonchar	Data taking R&D
DLNP	I.V. Butorov, M.A. Dolgareva, E.A. Naumova, I.B. Nemchenok, A.G. Olshevskiy, A.V. Chukanov, D.V. Taichenachev, N.V. Anfimov, S.V. Biktemerova, Yu.A. Gornushkin, S.G. Dmitrievsky, A.V. Krasnoperov, Z.V. Krumshtein, N.A. Morozov, A.V. Rybnikov, A.B. Sadovsky, A.S. Selunin, O.Yu. Smirnov, K.A. Fomenko, D.V. Fedoseev, M.V. Zhabitsky	
3. NOvA Project	A.G. Olshevskiy O.B. Samoylov	Data taking
DLNP	N.V. Anfimov, A.E. Bolshakova, S.G. Dmitrievsky, A.G. Dolbilov, A.A. Dolmatov, Yu.A. Gornushkin, Ch. Kullenberg, D.V. Naumov, A.B. Sadovsky, I.M. Shandrov, A.S. Sheshukov, A.P. Sotnikov	
BLTP	S.M. Bilenky, K.S. Kuzmin, V.A. Matveev, V.A. Naumov, O.N. Petrova	
LIT	V.V. Korenkov, N.A. Balashov, A.V. Baranov	
4. Experiment OPERA	Yu.A. Gornushkin	Data analysis
DLNP	S.G. Dmitrievsky, Z.V. Krumshtein, A.G. Olshevskiy, S.G. Zemskova, A.V. Chukanov, A.B. Sadovsky, A.S. Sheshukov, A.A. Nozdrin	
VBLHEP	Yu.P. Petukhov	
LIT	G.A. Ososkov	
5. Development of new photodetectors and the equipment for application in registering systems of neutrino experiments	N.V. Anfimov	R&D
DLNP Z.V. Krumshtein	A.I. Antoshkin, A.G. Olshevskiy, T.V. Rezinko, A.V. Rybnikov, A.V. Selunin, V.V. Chalyshev, I.E. Chirikov-Zorin, D.V. Fedoseev	

VBLHEP
Z.Ya. Sadygov

T.Yu. Bokova, I.A. Tyapkin, B.R. Marinova

Collaboration

Country or International Organization	City	Institute or Laboratory
Germany	Hamburg	Univ.
	Aachen	RWTH
Czech Republic	Prague	CU
France	Strasbourg	CRN
Italy	Salerno	INFN
China	Beijing	IHEP CAS
Slovakia	Bratislava	CU
USA	Indianapolis, IN	IUPUI
	Batavia, IL	Fermilab
	Cambridge, MA	Harvard Univ.
Turkey	Ankara	METU
Japan	Tokyo	Toho Univ.

02-0-1108-2011/2016

Priority:

1

Status: Approved for completion
in 2016

Experiment PANDA at FAIR

Leader: G.D. Alexeev
Deputies: A.N. Skachkova
 A.S. Vodopyanov

Participating Countries and International Organizations:

Belarus, CERN, Czech Republic, Germany, Italy, Russia, Slovakia.

Scientific Programme

The study of the exotic nuclear-matter states and nucleon structure in the PANDA experiment at FAIR.

Expected main results in 2016:

- Inclusion of MC generators into the PANDA software and optimization of the event analysis.
- Calculations and coordination of the work for the production of the superconducting solenoid sub-systems.
- Preparation of the FAIR-JINR contract for the production of the PANDA muon system.
- Test of Range System Prototype at CERN PS.

List of projects:

Project	Leader	Priority (period of realization)
1. PANDA	G.D. Alexeev	1 (2011 – 2019)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. PANDA Project	G.D. Alexeev	Technical proposal
DLNP	V.M. Abazov, N. Angelov, G.A. Golovanov,	
A.N. Skachkova	Yu.A. Kozhevnikov, S.A. Kutuzov, V.L. Malyshev,	
	A.A. Piskun, D.B. Pontekorvo, A.G. Samartsev,	
	N.B. Skachkov, V.V. Tokmenin, A.Yu. Verkheev,	
	L.S. Vertogradov, Yu.L. Vertogradova, N.I. Zhuravlev	
VBLHEP	E.A. Strokovsky, M.G. Sapozhnikov, V.K. Dodokhov,	
A.S. Vodopyanov	V.I. Datskov, E.K. Koshurnikov, M.Yu. Barabanov,	
	V.A. Arefev, V.I. Astakhov, A.A. Efremov, V.I. Lobanov,	
	Yu.Yu. Lobanov, P.V. Nomokonov, I.A. Olex, Yu.N. Rogov,	
	R.A. Salmin, A.A. Feshchenko, A.S. Galoyan	
LIT	Gh. Adam, V.V. Uzhinsky	
BLTP	A.S. Sorin, O.V. Teryaev, A.V. Efremov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	NC PHEP BSU
CERN	Geneva	CERN
Czech Republic	Prague	CU
Germany	Darmstadt	GSI
Italy	Turin	UniTo
		INFN
Russia	Protvino	IHEP
	Dubna	BSINP MSU
	Omsk	OB IM SB RAS
Slovakia	Bratislava	IP SAS

02-2-1125-2015/2017

Priority:

2

Status:

In-progress

Astrophysical Studies in the Experiment TAIGA

Leader: L.G. Tkatchev
Deputy: V.M. Grebenyuk

Participating Countries and International Organizations:

Czech Republic, Germany, Japan, Italy, Mexico, Republic of Korea, Romania, Russia, Ukraine.

Scientific Programme

- The main topic of multi-messenger TAIGA array are Gamma-ray astronomy, charged cosmic ray physics and particle physics. Gamma-ray astronomy - one of the most intriguing questions in high-energy astroparticle physics is a search for galactic objects for accelerating of particles up to PeV-energies (the so-called Pevatrons); VHE spectra of known sources: where do they stop; absorption in IR and CMB; diffuse emission from galactic plane and local supercluster. Charged cosmic ray physics – the energy spectrum and mass composition measurements from 10^{14} to 10^{18} eV. Particle physics - axion/photon conversion; hidden photon/photon oscillations; Lorentz invariance violation; pp cross-section measurement; search for quark-gluon plasma phenomena.
- The TUS space experiment has been proposed to measure the energy spectrum, composition and angular distribution of the Ultra High Energy Cosmic Rays (UHECR) at $E \approx 10^{19} - 10^{20}$ eV, to study the region beyond the GZK cutoff. Existence of these particles is beyond the Standard Model of particle physics and is of great interest. The study from the orbit is much more effective in comparison with the ground-based detectors. The existing world statistics is assumed to be increased by a factor of 2–3 during 3 years of the global data taking. The TUS detector will make it possible to study UHECP neutrino Extensive Air Showers (EAS) from the space orbit.
- The aim of the NUCLEON Project is direct CR measurements in the energy range 10^{11} - 10^{15} eV and the atomic charge range up to $Z \approx 40$ in the near-Earth space to solve mainly the “knee” problem in the CR spectrum. The CR phenomena in this energy region are investigated in terrestrial experiments by measurement of EAS parameters or in balloon or space experiments. Below $\sim 10^{14}$ eV the spectrum and composition are known from direct observation with detectors placed in balloons and earth satellites. However, at higher energies the CR flux is smaller and more difficult for direct and needs observation. Precise measurement of the CR composition and anisotropy will help to test the existing theoretical concepts and will become a basis for further studies.

Expected main results in 2016:

- Design and production of IACT for TAIGA experiment.
- Participation in the MC simulation of TAIGA experiment.
- Participation in the data taking of the TUS experiment.
- Participation in the TUS data off-line analysis.
- Test of the fluorescent datactor for TYHKA array.
- Production and test of the calibration system for TUS detector on the Earth orbit.
- Participation in the data taking of the NUCLEON experiment and data analysis.

List of projects:

Project	Leader	Priority (period of realization)
TAIGA	L.G. Tkatchev	2 (2015 – 2017)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other Division of JINR Responsible person	Main researchers	
1. Experiment TAIGA	L.G. Tkatchev	Realization
DLNP	V.M. Grebenyuk, S.Yu. Porokhovoy, A.V. Tkachenko, F.F. Grinyuk, M. Slunečhka, V. Slunečhkova, N.I. Kalinin, V.F. Boreyko, A.A. Timoshenko, V.M. Romanov, M. Finger, B.M. Sabirov, Nguen Man Shat, M.V. Lavrova	
VBLHEP	N.V. Gorbunov	
LIT	S.K. Slepnev	
2. Experiment TUS	L.G. Tkatchev	Realization
DLNP	V.M. Grebenyuk, S.Yu. Porokhovoy, A.V. Tkachenko, F.F. Grinyuk, M. Slunečhka, V. Slunečhkova, M.V. Lavrova N.I. Kalinin , V.F. Boreyko, A.A. Timoshenko	
VBLHEP	N.V. Gorbunov	
3. Experiment NUCLEON	L.G. Tkatchev	Realization
DLNP	V.M. Grebenyuk, S.Yu. Porokhovoy, N.I. Kalinin, V.F. Boreyko, Nguen Man Shat, B.M. Sabirov, A.B. Sadovsky, A.V. Tkachenko, A.A. Timoshenko, M.V. Lavrova	
VBLHEP	N.V. Gorbunov	
LIT	V.N. Shigaev, S.K. Slepnev	
FLNP	A.D. Rogov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Czech Republic	Prague	CU
Germany	Zeuthen	DESY
	Munich	MPI-P
	Hamburg	Univ.
	Tübingen	Univ.
Japan	Wako	RIKEN

Mexico	Puebla	BUAP
Italy	Turin	UniTo
Republic of Korea	Seoul	EWU
Romania	Bucharest	ISS
Russia	Moscow	SINP MSU
	Irkutsk	NNRU “MEPhI”
	Korolev	ISU
	St. Petersburg	RSC “Energia”
	Moscow, Troitsk	KB “Arsenal”
Ukraine	Kiev	INR RAS
		BITP NASU

02-1-1106-2011/2016

Priority:

1

Status: Approved for completion
in 2016

Investigations of Compressed Baryonic Matter at the GSI Accelerator Complex

Leaders: V.P. Ladygin
Deputy: V.V. Ivanov
P.K. Kurilkin

Participating Countries and International Organizations:

Bulgaria, Germany, Mongolia, Romania, Russia, Slovakia, Uzbekistan, Ukraine.

Scientific Programme

Design and development of the superconducting dipole magnet, transition radiation and straw detectors for the CBM experiment at the GSI accelerator complex. Study of the multiparticle dynamics in heavy ion collisions at SIS100 and SIS300. Development of algorithms and software for the trigger, simulation and data analysis.

Expected main results in 2016:

- Preparation of the drawings of individual parts of the superconducting dipole magnet for the CBM experiment.
- Design and testing of the prototype straw detectors.
- Development of the algorithms and software for the trigger and data analysis.
- Simulation of the multiparticle dynamics in heavy ion collisions.
- Development of the mathematical methods and fast computing algorithms for the data analysis and selection of the signal events.

List of projects:

Project	Leader	Priority (period of realization)
1. CBM	V.P. Ladygin V.V. Ivanov	1 (2011 – 2020)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. CBM Project Design and manufacture of the superconducting dipole magnet, and straw detectors. Development of the algorithms and software for trigger, simulation and data analysis	V.P. Ladygin V.V. Ivanov Yu.V. Gusakov	Realization

VBLHEP	Yu.S. Anisimov, S.N. Kuznetsov, A.I. Malakhov, Yu.V. Zanevsky, V.F. Chepurnov, O.V. Fateev, V.N. Zryuev, G.A. Cheremukhina, A.K. Kurilkin, A.P. Ierusalimov, A.P. Zinchenko, D.V. Peshekhonov, P.A. Rukoyatkin, S.V. Razin, V.D. Peshekhonov, G.D. Kekelidze, V.V. Myalkovsky, I.V. Boguslavsky, V.M. Golovatyuk, V.M. Lysan, O.V. Rogachevsky, A.V. Bychkov
LIT	V.V. Ivanov, P.V. Zrelov, P.G. Akishin, E.P. Akishina, E.I. Alexandrov, I.N. Alexandrov, D.V. Belyakov, O.Yu. Derenovskaya, V.V. Ivanov (jr), P.I. Kisiel, G.E. Kozlov, A.V. Kryanev, S.A. Lebedev, G.N. Ososkov, A.M. Raportirenko, T.P. Sapozhnikova, I.A. Filozova
DLNP	V.A. Karnaughov, V.V. Kirakosyan, Yu.L. Vertogradova, S.P. Avdeev, W. Karch
BLTP	E.-M. Ilgenfritz, D. Blaschke, V.V. Burov, S.G Bondarenko, V.D. Toneev

Collaboration

Country or International Organization	City	Institute or Laboratory
Bulgaria	Sofia	INRNE BAS
Germany	Darmstadt	GSI
	Dresden	HZDR
	Frankfurt/Main	Univ.
	Heidelberg	Univ.
Mongolia	Ulaanbaatar	IPT MAS
Romania	Bucharest	IFIN-HH
Russia	Moscow	ITEP
	Moscow, Troitsk	SINP MSU
	Protvino	NNRU "MEPhI"
Slovakia	Bratislava	INR RAS
		IHEP
Ukraine	Kiev	IP SAS
Uzbekistan	Jizakh	CU
	Samarkand	BITP NASU
		JSPI
		SSU

02-1-1096-2010/2019

Priority:

1

Status:

In-progress

Study of Rare Charged Kaon Decays in Experiments at the CERN SPS

Leaders:

V.D. Kekelidze
Yu.K. Potrebenikov

Participating Countries and International Organizations:

Belarus, Belgium, Bulgaria, CERN, Czech Republic, Germany, Italy, Mexico, Romania, Russia, Slovakia, United Kingdom, USA.

Scientific Programme

Realization of the NA62 Project allows to clarify CP-violation problem, to measure precisely very rare charged kaon decay to charged pions and two neutrinos, to carry out a search for supersymmetric particles and their partners with a goal to observe a physics beyond the Standard Model. In addition, characteristics of rare kaon and hyperon decays will be improved. A high resolution straw-detectors of the NA62 magnetic spectrometer working in vacuum will be supported during experimental runs. Software for simulation, data processing and analysis will be developed.

Expected main results in 2016:

- Data taking by the NA62 set-up and data analysis will be carried out.
- Software for the simulation of magnetic spectrometer and full set-up will be developed; system for detector calibration and event reconstruction will be upgraded; common software of the experiment will be developed.
- Calibration, testing and support of the NA62 straw detectors will be carried out.

List of projects:

Project	Leader	Priority (period of realization)
1. NA62	V.D. Kekelidze Yu.K. Potrebenikov	1 (2010 – 2016)

List of activities:

Activity or experiment Laboratory or other Division of JINR Responsible person	Leaders Main researchers	Status
1. Experiment NA62	V.D. Kekelidze Yu.K. Potrebenikov	Data taking Data analysis
VBLHEP	D.T. Madigozhin, S. Gevorgyan, A.I. Zinchenko, N.A. Molokanova, L.N. Glonti, I.A. Polenkevich, S.N. Shkarovsky, M.H. Misheva, E.A. Gudzovsky, V.P. Falaleev, A.A. Belkova, V.N. Gorbunova, L.A. Slepets, S.A. Movchan, E.M. Kislov, V.V. Elsha, T.L. Enik, A.O. Kolesnikov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	NC PHEP BSU
Belgium	Louvain-la-Neuve	UCL
Bulgaria	Sofia	SU
	Blagoevgrad	SWU
	Plovdiv	PU
CERN	Geneva	CERN
Czech Republic	Prague	CU
Germany	Mainz	JGU
Italy	Florence	INFN
	Ferrara	INFN
	Frascati	INFN LNF
	Naples	INFN
	Perugia	INFN
	Padua	INFN
	Pisa	INFN
	Rome	INFN
	Turin	Univ. “Tor Vergata”
Mexico	San Luis Potosi	UASLP
Romania	Bucharest	IFIN-HH
Russia	Moscow, Troitsk	INR RAS
	Protvino	IHEP
Slovakia	Bratislava	CU
United Kingdom	Birmingham	Univ.
	Bristol	Univ.
	Glasgow	US
	Liverpool	Univ.
USA	Boston, MA	BU
	Chicago, IL	UChicago
	Fairfax, VA	GMU
	Menlo Park, CA	SLAC
	Merced, CA	UCMerced
	Upton, NY	BNL

02-0-1083-2009/2016

Priority:

1

Status: Approved for completion
in 2016

CMS. Compact Muon Solenoid at the LHC

Leader: A.V. Zarubin
Scientific leader: I.A. Golutvin

Participating Countries and International Organizations:

Armenia, Austria, Belarus, Belgium, Brazil, Bulgaria, CERN, China, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, India, Iran, Italy, Mexico, New Zealand, Pakistan, Poland, Republic of Korea, Russia, Serbia, Slovakia, Spain, Switzerland, Taiwan, Turkey, Ukraine, United Kingdom, USA, Uzbekistan.

Scientific Programme

The CMS Collaboration has constructed a general-purpose detector to be operational at the start-up of the Large Hadron Collider (LHC/CERN) to exploit its full discovery potential. Study of fundamental properties of the matter in Super High Energy proton-proton and nucleus-nucleus interactions.

The major activities of JINR are focused on the following directions:

- forward calorimetry, including endcap hadron, and preshower detector;
- forward muon stations with cathode strip chambers;
- development of Physics program to test SM and BSM.

Expected main results in 2016:

- Upgrade and technical support of the CMS detectors.
- CMS start up shifts, data taking, and data quality monitoring.
- Processing and analysis of experimental data, development and improvement of muon and jet reconstruction algorithms.
- Development of software for GRID-based distributed system for data processing and analysis. Data transmission from CERN to JINR.

List of projects:

Project	Leader	Priority (period of realization)
1. CMS	A.V. Zarubin I.A. Golutvin	1 (2010 – 2019)
2. Upgrade of the CMS Detector	A.V. Zarubin I.A. Golutvin	1 (2013 – 2018)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Forward calorimetry	A.V. Zarubin	<div style="border: 1px solid black; padding: 10px; width: fit-content; margin-left: auto; margin-right: auto;"> Upgrade Commissioning Maintenance Data taking </div>

VBLHEP

S.V. Afanasiev, P.D. Bunin, M.G. Gavrilenko, I.A. Golutvin, N.S. Golova, I.N. Gorbunov, Yu.V. Ershov, N.I. Zamyatin, V.D. Kalagin, A.Yu. Kamenev, L.G. Kobylets, A.M. Kurenkov, V.A. Smirnov, A.I. Malakhov, B.S. Yuldashev

DLNP

A. Mestvirishvili, M. Finger, M. Finger (Jn.), A. Khvedelidze, M. Slunečhka, V. Slunečhková, A. Yanata, T. Toriashvili, Z. Tsamalaidze

**2. Forward muon station
ME1/1**

V.Yu. Karjavin

Commissioning
Maintenance
Data taking

VBLHEP

S.E. Vasiliev, A.O. Golunov, I.A. Golutvin, N.V. Gorbunov, Yu.V. Ershov, N.N. Evdokimov, A.V. Zarubin, A.Yu. Kamenev, A.M. Kurenkov, A.M. Makan'kin, V.V. Perelygin, D.A. Smolin

LIT

V.V. Palchik, N.N. Voytishin

3. Upgrade of the CMS detectors

I.A. Golutvin

Realization

VBLHEP

V.Yu. Alexakhin, S.V. Afanasiev, P.D. Bunin, N.V. Gorbunov, V.Yu. Karjavin, A.M. Kurenkov, Yu.V. Ershov, S.E. Vasiliev, A.V. Zarubin, A.M. Makan'kin, A.I. Malakhov, V.V. Perelygin, V.A. Smirnov, B.S. Yuldashev

LIT

V.V. Palchik, N.N. Voytishin

**4. Research physics programme
with the CMS detector**

S.V. Shmatov

Realization

I.A. Golutvin

V.Yu. Alexakhin, S.V. Afanasiev, M.G. Gavrilenko, I.N. Gorbunov, I.I. Belotelov, P.D. Bunin, A.V. Zarubin, A.Yu. Kamenev, L.G. Kobylets, A.V. Lanev, M.V. Savina, A.I. Malakhov, S.G. Shulga, B.S. Yuldashev

LIT

V.V. Korenkov, D.A. Oleynik, G.A. Ososkov, V.V. Palchik, A.Sh. Petrosyan, N.N. Voytishin

BLTP

G.A. Kozlov, A.B. Arbuzov, A.V. Kotikov, A.V. Sidorov, A.V. Efremov, S.G. Bondarenko, R.S. Pasechnik, O.V. Teryaev

DLNP

G.A. Golovanov, P.X. Khristova, M. Finger, M. Finger (Jr.), N.B. Skachkov, A.N. Skachkova, A.Yu. Verkheev

**5. Development of software for
distributed computation, data
processing and analysis based
on GRID-technology**

V.V. Korenkov

Realization

LIT

V.V. Mitsyn, V.V. Palchik, R.N. Semenov, E.A. Tikhonenko, I.A. Filozova, N.N. Voytishin

VBLHEP

I.I. Belotelov, I.N. Gorbunov, N.V. Gorbunov, A.O. Golunov, S.V. Shmatov

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	Foundation ANSL
Austria	Vienna	HEPHY
Belarus	Minsk	NC PHEP BSU INP BSU
	Gomel	BelSUT GSU
Belgium	Louvain-la-Neuve	UCL
	Antwerp	UA
	Brussels	ULB VUB
	Mons	UMONS
Brazil	Rio de Janeiro, RJ	CBPF UERJ UFRJ
	Sao Paulo, SP	Unesp
Bulgaria	Sofia	SU INRNE BAS
CERN	Geneva	CERN
China	Hefei	USTC
	Beijing	IHEP CAS PKU
Croatia	Split	Univ.
Cyprus	Nicosia	UCY
Czech Republic	Prague	CU
Estonia	Tallinn	NICPB
Finland	Helsinki	UH HIP
	Jyväskylä	UJ
	Oulu	UO
	Tampere	TUT
France	Annecy-le-Vieux	LAPP
	Lyon	IPNL
	Saclay	IRFU
	Strasbourg	IPHC
Georgia	Tbilisi	HEPI-TSU AIP TSU
Germany	Berlin	HUB
	Aachen	RWTH
	Karlsruhe	KIT
Greece	Athens	INP NCSR “Demokritos” UoA

	Ioannina	UI
Hungary	Budapest	Wigner RCP
	Debrecen	Atomki
		UD
India	Mumbai	BARC
		TIFR
	Bhubaneswar	IOP
	Chandigarh	PU
Iran	Tehran	IPM
Italy	Bari	INFN
	Bologna	INFN
	Catania	INFN LNS
	Florence	INFN
	Genoa	INFN
	Padua	INFN
	Pavia	INFN
	Perugia	INFN
	Pisa	INFN
	Rome	INFN
	Turin	INFN
Mexico	Mexico	Cinvestav
New Zealand	Auckland	Univ.
	Christchurch	UC
Pakistan	Islamabad	QAU
Poland	Warsaw	UW
	Otwock-Swierk	NCBJ
Republic of Korea	Kwangju	CNU
	Naju	DU
	Namwon	SU
	Seoul	KU
		Konkuk Univ.
		SNUE
	Chongju	CBNU
Russia	Moscow	ITEP
		LPI RAS
		NNRU ‘MEPhI’
		SINP MSU
		NIKIET
	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Dolgoprudny	MIPT
	Novosibirsk	NSU
	Protvino	IHEP
	Snezhinsk	VNIITF
	St. Petersburg	Electron

	Zhukovsky	MDB
Serbia	Belgrade	INS "VINČA"
Slovakia	Bratislava	STU
Spain	Madrid	CIEMAT
		UAM
	Oviedo	UO
	Santander	IFCA
Switzerland	Zurich	ETH
		UZH
	Villigen	PSI
	Basel	Uni Basel
Taiwan	Taipei	NTU
	Chung-Li	NCU
Turkey	Adana	CU
	Ankara	METU
Ukraine	Kharkov	KFTI
		ISC NASU
		KhNU
United Kingdom	London	Imperial College
	Didcot	RAL
	Bristol	Univ.
USA	Ames, IA	ISU
	Baltimore, MD	JHU
	Batavia, IL	Fermilab
	Blacksburg, VA	Virginia Tech
	Boston, MA	BU
		NU
	Cambridge, MA	MIT
	Chicago, IL	UIC
	College Park, MD	UMD
	Columbus, OH	OSU
	Davis, CA	UCDavis
	Gainesville, FL	UF
	Evanston, IL	NU
	Houston, TX	Rice Univ.
	Iowa City, IA	UIowa
	Lincoln, NE	UNL
	Livermore, CA	LLNL
	Los Alamos, NM	LANL
	Los Angeles, CA	UCLA
	Lubbock, TX	TTU
	Madison, WI	UW-Madison
	Minneapolis, MN	U of M
	Notre Dame, IN	ND
	Oxford, MS	UM

	Pasadena, CA	Caltech
	Pittsburgh, PA	CMU
	Piscataway, NJ	Rutgers
	Princeton, NJ	PU
	Riverside, CA	UCR
	Rochester, NY	UR
	Tallahassee, FL	FSU
	Tuscaloosa, AA	UA
Uzbekistan	Tashkent	INP AS RUz

Studies of the Nucleon and Hadron Structure at CERN

Leader: A.P. Nagaytsev
Scientific leader: I.A. Savin

Participating Countries and International Organizations:

Armenia, Belarus, Bulgaria, CERN, Czech Republic, France, Germany, Israel, Italy, Japan, Poland, Russia, Switzerland, Ukraine, United Kingdom, USA.

Scientific Programme

Studies of the Primakoff reactions and diffractive processes. Studies of the generalized parton distributions in various exclusive processes and participation in construction of new electromagnetic calorimeter. Studies of the exclusive production of photons, pions and vector mesons in DIS and DVCS. Measurements of nucleon structure in the Drell-Yan processes. Study of inclusive and semi-inclusive processes in Deep Inelastic Scattering (DIS) of muons and hadrons on polarized targets. The measurements of the new structure functions characterizing the transverse quark distributions in polarized nucleons.

- Measurements of the nucleon structure functions, polarized parton distributions.
- Pion and kaon polarizabilities measurements.
- Search of new bound states of quarks and gluons.
- Measurements of nucleons structure in the Drell-Yan processes.
- Studies of the inclusive production of photons, pions and ρ -mesons in DIS and DVCS.
- Software creation and development for simulation and data analysis. System support of CERN software in COMPASS-II.
- Creation of the new electromagnetic calorimeter for COMPASS-II.
- Detector preparation for the COMPASS-II spectrometer.

Expected main results in 2016:

- Measurement of asymmetries in processes of the exclusive birth of photons (DVCS), π -mesons and vector mesons.
- Participation in the data taking.
- Maintenance of the hadron calorimeter HCAL1 and muon system MW1.
- Preparation for a data taking the new electromagnetic calorimeter ECALO. Support of ECALO during data taking.
- Software development and simulation of the various reactions, studied in COMPASS-II. Analyzing of the COMPASS-II data at JINR and publications preparation.
- Theoretical studies for COMPASS-I and COMPASS-II.

List of projects:

Project	Leader	Priority (period of realization)
1. COMPASS-II	A.P. Nagaytsev	1 (2011 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
I. Experiment COMPASS	A.P. Nagaytsev	Data taking Data analysis
1. Hadron calorimeter	I.A. Savin O.P. Gavrilchuk	Maintenance
VBLHEP	G.V. Meshcheryakov, N.N. Vlasov, A.S. Yukaev, V.A. Anosov	
DLNP	A.S. Selyunin	
2. Electromagnetic calorimeter	A.P. Nagaytsev, Z.V. Krumshstein	Preparation R&D
VBLHEP	V.V. Astakhov, O.P. Gavrilchuk, G.V. Meshcheryakov, A.S. Yukaev, N.S. Rogacheva, O.M. Kuznetsov, V.A. Anosov	
DLNP	A.I. Antoshkin, V.M. Kudryavtsev, M.V. Nikitin, I.E. Tchirikov-Zorin, N.V. Anfimov, T.V. Rezinko, I.A. Orlov, V.V. Tchalyshhev, A.V. Rybnikov, D.V. Fedossev, A.S. Selyunin, A.G. Olshevskiy, O.V. Gromov	
3. Muon system	G.D. Alekseev	Maintenance
DLNP	V.M. Abazov, L.S. Vertogradov, N.I. Zhuravlev, N.A. Kutchinsky, V.L. Malyshev, A.A. Piskun, A.G. Samartsev, V.V. Tokmenin	
4. Software development. Data analysis	E.V. Zemlyanichkina	Realization
VBLHEP	I.A. Savin, D.V. Peshekhonov, G.I. Smirnov, N.O. Mitrofanov, A.P. Nagaytsev, O.M. Kuznetsov, Yu.I. Ivanshin, N.S. Rogacheva, R.R. Akhunzyanov, R. Gushcherski, A.V. Ivanov, V.S. Batozskaya, E.A. Salmina	
DLNP	A.G. Olshevsky, A.V. Guskov, Z.V. Krumshstein, E.O. Mitrofanov, K.Yu. Gasnikova, I.A. Orlov, T.V. Rezinko, A.V. Rybnikov, A.S. Selyunin	
LIT	P.V. Zrelov	

5. Measurements of generalized parton distributions and transverse spin structure in Drell-Yan processes.	A.P. Nagaytsev	Realization
Development of new electro-magnetic calorimeter	I.A. Savin	
VBLHEP	O.P. Gavriishchuk, G.V. Meshcheryakov, O.M. Kuznetsov, Yu.I. Ivanshin, R.R. Akhuzyanov, N.S. Rogacheva, E.V. Zemlyanichkina, A.V. Ivanov	
DLNP	A.G. Olshevskiy, Z.V. Krumshtein, A.V. Guskov, K.Yu. Gasnikova, I.A. Orlov, N.V. Anfimov, T.V. Rezinko, A.V. Rybnikov, A.S. Selyunin	
BLTP	A.V. Efremov, O.V. Teryaev	
6. Preparation of the project on measurement of proton form-factor ratios at 13–15 GeV/c	I.A. Savin	Project preparation
	N.M. Piskunov	
VBLHEP	O.P. Gavriishchuk, G.V. Meshcheryakov	
II. Theoretical studies	A.V. Efremov	Realization
BLTP	S.B. Gerasimov, O.V. Teryaev, A.V. Kotikov, A.E. Dorokhov, N.I. Kochelev, A.M. Sidorov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	Foundation ANSL
Belarus	Minsk	NC PHEP BSU
Bulgaria	Sofia	JIPNR-Sosny NASB INRNE BAS
CERN	Geneva	SU CERN
Czech Republic	Prague	CU
France	Saclay	IRFU
Germany	Bielefeld Bochum Bonn Freiburg Hamburg Heidelberg Munich Mainz Erlangen Tel Aviv	Univ. RUB UniBonn Univ. DESY MPIK LMU TUM JGU FAU TAU
Israel		

Italy	Turin	INFN
	Trieste	INFN
	Frascati	INFN LNF
Japan	Chiba	Toho Univ.
	Nagoya	Nagoya Univ.
	Osaka	OCU
	Sendai	Tohoku Univ.
	Tsukuba	KEK
	Yamagata	Yamagata Univ.
Poland	Warsaw	UW
Russia	Moscow	SINP MSU
	Moscow, Troitsk	LPI RAS
	Gatchina	INR RAS
	Protvino	PNPI
	Zurich	IHEP
Switzerland	Kharkov	UZH
Ukraine	Liverpool	ISMA NASU
United Kingdom	Urbana, IL	Univ.
USA		I

02-1-1086-2009/2017

Priority:

1

Status:

In-progress

Strangeness in Hadronic Matter and Study of Inelastic Reactions Near Kinematical Borders

Leaders:

E.A. Strokovsky
E.S. Kokoulina

Participating Countries and International Organizations:

Belarus, Czech Republic, Germany, Japan, Russia, Ukraine.

Scientific Programme

Strangeness in hadronic matter and study of boundary effects:

study of stabilizing effects of strangeness in nuclear matter and properties of the lightest hypernuclei;
study of multi-particle dynamics in inelastic proton-proton and proton-nucleus interactions with extremely high multiplicity;
study of spectra and yields of soft photons in deuteron-nucleus and nucleus-nucleus interactions.

Expected results:

- Data on production cross sections for hyper-fragments of relativistic nuclei. Data on the lifetimes and binding energies of the lightest hypernuclei $^4_{\Lambda}H$, $^3_{\Lambda}H$, $^6_{\Lambda}H$; search for $^6_{\Lambda}H$. Study of the decay channels, including non-mesonic decays of the $^{10}_{\Lambda}Be$ and $^{10}_{\Lambda}B$ hypernuclei.
- New experimental data about the drip-line location for loosely bound light hypernuclei with high neutron excess. Development of theory of the neutron-rich hyper nuclei and models of their production in non-central nucleus-nucleus interactions.
- New experimental data about soft photon emission in deuteron-nuclei and other nuclei-nuclei interactions, including study of dependence of their energy spectra on electric charges of the projectile and target nuclei, as well as on multiplicity of secondaries.
- Development of theoretical and phenomenological models for description of data on the soft photon yields in the deuteron-nuclei and other nuclei-nuclei interactions, differentiated on multiplicity of secondaries.
- Construction of two-arm electromagnetic calorimeter for soft photon registration in a wide region of emission angles for study of interference patterns, for search of new resonances and verification of theoretical predictions about new phenomena in a dense nuclear matter.

Expected main results in 2016:

- Modernization of the FFE, DAQ and tracking systems of the NIS-GIBS spectrometer.
- Data taking on the hyper-nuclear program (search for the hyper-hydrogen 6) using the NIS-GIBS spectrometer at extracted beams of deuterons and 7Li nuclei.
- Analysis of data from LEPS spectrometer on vector-meson photoproduction by polarized photons.
- Analysis of data on soft ($E_\gamma < 50$ MeV) photon emission in deuteron-nuclei and other nuclei-nuclei interactions at kinetic energies above 2 GeV/nucleon.
- Preparation of the NEMAN project aimed on study of photon emission in non-central collisions of relativistic (with kinetic energies above 1 GeV/nucleon) light and heavy nuclei with nuclei at the BM@N setup.

List of projects:

Project	Leader	Priority (period of realization)
1. HyperNIS	E.A. Strokovsky	1 (2010 – 2018)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Experiment NIS–GIBS	E.A. Strokovsky J. Lukstins	Realization Data taking
VBLHEP	V.D. Aksinenko, R.A. Salmin, V.P. Balandin, S.N. Bazylev, P.A. Rukoyatkin, A.A. Feschenko, S.N. Plyashkevich, Yu.T. Borzunov, A.I. Maksimchuk, V.B. Chumakov, V.Yu. Ivanenko, O.V. Okhrimenko, A.I. Golokhvastov, S.A. Avramenko, M.H. Anikina, A.V. Averianov, A.M. Korotkova, N.G. Parfenova, S.V. Starikova, V.B. Dunin + 2 students, A.V. Konstantinov	
DLNP	V.V. Tereschenko	
OCE	A.N. Parfenov	
2. Experiment NEMAN	E.S. Kokoulina V.A. Nikitin	Project preparation Data taking
VBLHEP	V.I. Kireev, V.V. Avdeychikov, Yu.A. Chentsov, I.A. Rufanov, M.V. Tokarev, Yu.P. Petukhov, A.N. Aleev, A.I. Yukaev, N.K. Zhidkov, V.B. Dunin + 3 students, V.P. Balandin, N.F. Furmanets, Yu.T. Borzunov, N.A. Kuzmin, P.K. Manyakov, A.V. Konstantinov	
BLTP	Yu.A. Bystritsky	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	NC PHEP BSU BSUIR
	Gomel	GSTU GSU
Czech Republic	Prague Řež	CTU UJV NPI ASCR
Germany	Frankfurt/Main Jülich	Univ. FZJ
Japan	Osaka	RCNP

Russia	Moscow	SINP MSU
	Protvino	IHEP
	Syktyvkar	DM Komi SC UrB
Ukraine	Kiev	RAS BITP NASU

02-0-1065-2007/2019

Priority:

1

Status:

In-progress

Development of the JINR Basic Facility for Generation of Intense Heavy Ion and Polarized Nuclear Beams Aimed at Searching for the Mixed Phase of Nuclear Matter and Investigation of Polarization Phenomena at the Collision Energies up to $\sqrt{s_{NN}} = 11$ GeV

Leaders: A.S. Sorin

V.D. Kekelidze

G.V. Trubnikov

I.N. Meshkov

A.D. Kovalenko

Participating Countries and International Organizations:

Armenia, Azerbaijan, Belarus, Bulgaria, CERN, China, Czech Republic, Egypt, France, Georgia, Germany, Italy, Japan, Moldova, Poland, Romania, Russia, Slovakia, South Africa, Sweden, Ukraine, USA.

Scientific Programme

Search and investigation of phase transitions and critical phenomena in strongly interacting matter at extremely high baryon densities, of nucleon spin structure, study of polarization phenomena in few-body systems and light nuclei. Development of theoretical models of these processes and theoretical support of the experiments. Development of the Nuclotron accelerator complex as a basic facility for studying relativistic nuclear collisions in the range of atomic masses $A = 1-197$ and the construction of the BM@N detector. Development and construction of the heavy ion collider NICA, multipurpose detector (MPD/NICA) and spin physics detector (SPD/NICA) for the collide experiments with heavy ions. Modernization of the extraction beam lines. Carrying out of experiments with nuclear beams and polarized deuteron beams at the Nuclotron.

Expected main results in 2016:

- Development and extension of the NICA “White Paper” – project physics program. Continuation of theoretical studies of non-perturbative QCD processes, development and tests of the models for the nuclear matter at high temperatures and densities aimed at investigation of phases of nuclear matter, dynamics of nuclear collisions at extremely high baryonic densities and observation of these phenomena in P-odd effects and spin asymmetries.
- The Nuclotron modernization in framework of the Nuclotron–NICA project: modernization of the accelerator stations, design and construction of the beam injection/extraction systems, continuation of tests of the new heavy ion source KRION–6T, technical improvement of the cryogenic and injection complex. Development of the system for beam diagnostics. Tests of the source for polarized particles SPI. Annual dedicated machine development runs at Nuclotron on first priority tasks within running time of 400 hours.
- Start of the new linear injector ($z/A \geq 0.14$) and RFQ fore-injector of LU–20. Construction of the prototypes related to the collider magnetic system and development of the beam cooling systems; tests of the stochastic cooling system prototype at Nuclotron. Start of mass-production of the superconducting magnets for NICA and the prototype for FAIR, modernization of the engineering infrastructure.
- Completion of the technical design project to put new injector, booster, collider and beam lines of the NICA complex. Development of the engineering infrastructure of the project, start of the civil engineering.
- Preparation of technical project for beam cooling systems manufacturing.
- Realization of the plan of works for BM@N project.
- Realization of the technical project of the MPD solenoid and the order for its manufacturing. Prototyping the detector elements for the first stage of the project. MPD Technical Design Project preparation.

- Preparation of the Conceptual Design Project to study nucleon spin structure with SPD. Continuation of theoretical studies of the Matveev–Muradyan–Tavkhelidze–Drell–Yan processes, production processes and other processes in light polarized nuclei collisions.
- Nuclotron runs dedicated to physics and machine development within running time of 1000 hours.
- Development of the NICA/MPD/BM@N/SPD computer infrastructure.

List of projects:

Project	Leader	Priority (period of realization)
1. Nuclotron–NICA	G.V. Trubnikov	1 (2011 – 2020)
2. MPD	V.D. Kekelidze	1 (2011 – 2020)
3. BM@N	M.N. Kapishin	1 (2012 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
1. Theoretical investigations, lattice QCD calculations and development of the models for description of properties of excited nuclear matter at high temperatures and compressions, dynamics of nuclear interactions at extremely dense baryon matter, spin and P-odd effects	A.S. Sorin O.V. Teryaev D. Blaschke	Realization
BLTP	A.V. Efremov, A.S. Hvorostukhin, E.-M. Ilgenfritz, S.B. Gerasimov, M.K. Volkov, A. Parvan, Ya.N. Klopot, A.G. Oganesyan, A. Frisen	
LIT	Yu.L. Kalinovsky, Zh. Musulmanbekov, E.G. Nikonov	
DLNP	G.I. Lykasov	
VBLHEP	V.D. Kekelidze, R. Lednický, Kh.U. Abraamyan, M.A. Kozhin, S.G. Reznikov, V.N. Zhezher, O.V. Rogachevsky, V. Voronyuk, P. Batyuk	
2. Nuclotron–NICA: development of the technological systems of the accelerator ring, injection complex and extracted beam channels in framework of the NICA project	G.V. Trubnikov A.V. Butenko V.I. Volkov A.O. Sidorin I.N. Meshkov A.D. Kovalenko	Realization

VBLHEP

H.G. Khodzhibagyan + 3 pers., N.N. Agapov, V.I. Batin + 5 pers., A.S. Averichev + 4 pers., V.I. Lipchenko, Yu.A. Mitrofanova, A.I. Pleshakov + 5 pers., E.Yu. Filippova, E.Yu. Ivanenko, D.V. Lobanov, A.V. Alfeev, V.A. Monchinsky, A.I. Govorov + 7 pers., V.V. Seleznev, R.G. Pushkar, K.A. Levterov, A.A. Voronin, B.V. Golovensky, K.B. Shevchenko, V.P. Wadeev, D.A. Lyusev, I.V. Shirikov, A.V. Smirnov + 5 pers., A.R. Galimov, A.V. Nesterov, G.L. Kuznetsov, O.A. Kunchenko, R.V. Pivin, A.M. Bazanov, E.E. Donets, E.D. Donets, D.E. Donets, V.B. Shutov, D.O. Ponkin, V.S. Alexandrov, V.A. Andreev, V.A. Isadov, A.V. Eliseev, S.V. Romanov, V.V. Tarasov, A.E. Kirichenko + 3 pers., D.V. Monakhov, B.V. Vasilishin, O.S. Kozlov, O.I. Brovko, A.M. Nikitin, V.M. Shumkov + 5 pers., O.V. Prozorov, A.V. Gromov + 3 pers., S.A. Rumyantsev, L.P. Skiba, A.N. Pisulina, I.V. Kudashkin, G.P. Reshetnikov, N.N. Blinnikov, L.E. Bogdan, K.N. Gurylev, E.V. Ivanov + 3 pers., Z.I. Smirnova, V.N. Karpinsky, A.L. Osipenkov + 3 pers., N.G. Kondratev, A.V. Kudashkin, A.A. Shurygin, Yu.M. Nozhenko + 3 pers., N.A. Filippov + 3 pers., A.S. Vinogradov, N.A. Blinov + 4 pers., A.Yu. Starikov, P.A. Rukoyatkin + 3 pers., A.V. Filippov, N.I. Lebedev, E.V. Gorbachev, V.V. Fimuskin, G.D. Shirkov, V.V. Kobets, A.V. Alfeev + 3 pers., N.V. Semin, V.P. Chernyaev + 8 pers., A.A. Fateev + 3 pers., N.D. Topilin + 5 pers., A.V. Tuzikov, N.A. Shurkhno, V.M. Slepnev + 4 pers.

3. R&D work, construction of the prototypes and full-scale superconducting magnets for NICA booster and collider

VBLHEP

G.V. Trubnikov
G.G. Khodzhibagyan
A.D. Kovalenko
S.A. Kostromin

R&D
Realization

4. Commissioning of the heavy ion source (KRION-6 T), commissioning the polarized particle source (SPI) for the NICA complex

VBLHEP

E.D. Donets
E.E. Donets
V.V. Fimushkin

Realization

V.B. Shutov + 3 pers., A.Yu. Ramzdorf, D.E. Donets, A.Yu. Boitsov, D.O. Ponkin, V.P. Wadeev, Yu.V. Prokofichev, L.V. Kutuzova, A.V. Wadeev, A.I. Govorov, V.V. Seleznev, A.V. Shabunov, K.A. Levterov, S.N. Sedykh + 1 pers., A.D. Kovalenko

<p>5. Development and construction of the beam injection/extractin systems, beam transportation channels for NICA elements. Development of the control systems for beam diagnostics</p>	<p>V.I. Volkov V.A. Mikhaylov</p>	<p>Realization</p>
<p>VBLHEP</p>	<p>A.V. Butenko, B.V. Vasilishin, O.S. Kozlov, A.G. Kochurov, L.A. Leonov, A.V. Eliseev, V.A. Andreev + 1 pers., V.M. Gorchenco, S.V. Mikhaylov, A.M. Butenko, G.M. Salnikova, V.A. Isadov, S.V. Romanov, A.E. Kirichenko, P.A. Rukoyatkin, R.I. Kukushkina, V.S. Alexandrov, A.V. Tuzikov, A.A. Fateev, N.I. Lebedev, V.V. Tarasov, L.I. Kosukhina, G.S. Sedukh, T.V. Rukoyatkina, V.V. Kovalev, N.V. Pilyar, G.E. Koroleva, M.E. Pushkin, E.V. Gorbachev, R.A. Smolkov, A.V. Alfeev, I.Ya. Nefedev, V.N. Karpinsky, A.L. Osipenkov, A.I. Sidorov</p>	
<p>6. Development of the cryogenic systems for Nuclotron–NICA</p>	<p>N.N. Agapov H.G. Khodzhibagyan</p>	<p>Projecting Realization</p>
<p>VBLHEP</p>	<p>V.I. Batin + 6 pers., H. Malinovsky + 5 pers., V.M. Drobin, Yu.T. Borzunov, A.V. Konstantinov, L.V. Petrova, E.A. Kulikov, A.S. Averichev + 4 pers., V.I. Lipchenko, V.E. Kurinov, Yu.A. Mitrofanova + 3 pers., A.I. Pleshakov + 5 pers., S.A. Smirnov, E.Yu. Filippova, E.Yu. Ivanenko, D.V. Lobanov</p>	
<p>7. Technical design and construction of the NICA injection complex</p>	<p>A.V. Butenko V.V. Kobets I.N. Meshkov V.A. Monchinsky</p>	<p>Realization</p>
<p>VBLHEP</p>	<p>A.O. Sidorin, A.I. Govorov, V.V. Seleznev + 4 pers., K.A. Levterov, A.A. Voronin, B.V. Golovensky, K.V. Schevchenko, V.P. Vadeev, D.A. Lyusev, I.V. Shirikov, A.V. Smirnov + 3 pers., A.V. Nesterov, A.M. Bazanov, N.D. Topilin, A.I. Sidorov + 1 pers., A.A. Fateev, I.G. Lebedeva, S.N. Sedykh, A.P. Kozlov, V.V. Kosukhin</p>	
<p>8. Technical design and construction of the NICA booster synchrotron and its technological systems</p>	<p>A.V. Butenko V.A. Mikhaylov I.N. Meshkov</p>	<p>Project preparation Realization</p>
<p>VBLHEP</p>	<p>G.G. Khodzhibagyan + 5 pers., S.A. Kostromin, A.V. Smirnov + 3 pers., A.R. Galimov, A.V. Nesterov, G.L. Kuznetsov, O.A. Kunchenko, R.V. Pivin, A.M. Bazanov, V.V. Seleznev, N.N. Agapov + 8 pers., V.I. Batin + 5 pers., V.N. Karpinsky, A.L. Osipenkov, O.I. Brovko, N.D. Topilin, S.V. Rabtsun, Yu.V. Gusakov, A.V. Shabunov, Yu.A. Tumanova, V.I. Volkov + 5 pers., B.V. Vasilishin, O.S. Kozlov, V.A. Andreev, A.V. Eliseev, S.V. Romanov, A.E. Kirichenko, P.A. Rukoyatkin, A.V. Tuzikov, A.A. Fateev, N.I. Lebedev, V.V. Tarasov, T.V. Rukoyatkina, E.V. Gorbachev, A.V. Alfeev, V.N. Karpinsky + 3 pers., A.L. Osipenkov + 4 pers.</p>	

DLNP

S.L. Yakovenko, E.V. Akhmanova, A.G. Kobets,
A.Yu. Rudakov, N.A. Rybakov

9. Technical design, R&D and construction of the heavy ion collider NICA with energy $\sqrt{s_{NN}} = 4 \div 11$ GeV and average luminosity $1 \cdot 10^{27} \text{ cm}^{-2} \cdot \text{s}^{-1}$ and light polarized ions on the base of Nuclotron – M

I.N. Meshkov
G.V. Trubnikov
A.O. Sidorin
A.D. Kovalenko

Project preparation
Realization

VBLHEP

G.G. Khodzhibagyan + 5 pers., A.V. Butenko, A.V. Smirnov + 3 pers., S.A. Kostromin, A.R. Galimov, G.L. Kuznetsov, R.V. Pivin, A.M. Bazanov, N.N. Agapov + 8 pers., V.I. Batin + 5 pers., V.N. Karpinsky + 3 pers., N.V. Semin, V.D. Kalagin, N.D. Topilin, Yu.V. Gusakov, A.V. Shabunov, E.V. Muraveva, A.A. Makarov, Yu.A. Tumanova, V.I. Volkov + 5 pers., B.V. Vasilishin, O.S. Kozlov, V.A. Andreev, A.V. Eliseev, S.V. Romanov, A.E. Kirichenko, P.A. Rukoyatkin, A.V. Tuzikov, A.A. Fateev, N.I. Lebedev, V.V. Tarasov, T.V. Rukoyatkina, E.V. Gorbachev, A.V. Alfeev, A.L. Osipenkov + 4 pers., V.A. Monchinsky, O.I. Brovko + 3 pers., V.M. Zhabitsky, G.D. Shirkov, V.S. Alexandrov, A.V. Filippov, A.V. Tuzikov, E.I. Urazakov

DLNP

A.G. Kobets + 2 pers., T.A. Stepanova, L.V. Soboleva, E.V. Akhmanova, A.A. Sidorin, S.L. Yakovenko

LRB

G.N. Timoshenko, V.N. Buchnev, V.Yu. Shchegolev

10. Design and construction of the MPD detector. Preparation of the Technical Design Project. R&D and construction of the first-stage detector elements: time-projection chamber, time-of-flight system, electromagnetic calorimeter, zero-degree calorimeter, internal tracker

V.D. Kekelidze
A.S. Sorin
V.M. Golovatyuk

R&D
Technical proposal

VBLHEP

S.V. Volgin, N.M. Vladimirova, V.A. Babkin, S.N. Lobastov, Yu.I. Fedotov, H.U. Abraamyan, A.B. Anisimov, M.A. Kozhin, O.P. Gavrilchuk, N.A. Kuzmin, A.I. Yukaev, E.V. Kostyukhov, Yu.V. Zanevsky, Yu. Lukstins, O.V. Fateev, A.M. Korotkova, V.F. Chepurnov, S.V. Razin, V.N. Zryuev, A.V. Averyanov, A.G. Bazhazhin, S.V. Vereshchagin, A.G. Litvinenko, A.Yu. Isupov, V.F. Peresedov, I.I. Migulina, V.A. Nikitin, O.V. Rogachevsky, V.D. Peshekhonov, K.V. Gertszenberger, Yu. Fedorishin, A.I. Zinchenko, Dzh. Drnoyan,

	I.A. Tyapkin, I.V. Gapienko, G.D. Kekelidze, V.V. Myalkovsky, Yu.T. Kiryushin, S.A. Movchan, V.M. Lysan, S.V. Khabarov, V.S. Khabarov, A.V. Vishnevsky, Yu.K. Potrebenikov, D.T. Madigozhin, N.A. Molokanova, I.A. Polenkevich, S.N. Shkarovsky, Yu.A. Murin, V.A. Vasendina, V.A. Budilov, V.A. Nikitin, N.K. Zhidkov, V.I. Yurevich, G.S. Averichev, D.N. Bogoslovsky, V.B. Dunin, L.G. Efimov, E.M. Kislov, A.A. Povtoreiko, V.V. Tihomirov, G.A. Yarygin, A.N. Zubarev, S.V. Bazylev, V.M. Slepnev, I.V. Slepnev, A.B. Shutov, A.E. Baskakov, A.V. Shchipunov, V.Yu. Rogov, N.A. Shutova, R.V. Nagdasev, S.P. Merts, P. Batyuk, V.V. Voronyuk		
DLNP	A.G. Olshevskiy, Z.V. Krumshtain + 8 pers.		
LIT	V.V. Ivanov, P.G. Akishin, P.I. Kisel, O.Yu. Derenovskaya, Zh.Zh. Musulmanbekov, A.M. Raportirenko, P.V. Zrelov		
11. Design and construction of the superconducting solenoidal and magnet yoke	<p>A.S. Vodopyanov</p> <table border="1" style="float: right; margin-right: 20px;"> <tr><td>R&D</td></tr> <tr><td>Technical proposal</td></tr> </table>	R&D	Technical proposal
R&D			
Technical proposal			
VBLHEP	S.G. Gordeev, A.A. Efremov, Yu.Yu. Lobanov, V.H. Dodokhov, E.M. Kislov, N.D. Topilin		
12. Design and creation of the read-out and slow control system	<p>S.V. Bazylev</p> <table border="1" style="float: right; margin-right: 20px;"> <tr><td>Project preparation</td></tr> <tr><td>Realization</td></tr> </table>	Project preparation	Realization
Project preparation			
Realization			
VBLHEP	V.M. Slepnev, I.V. Slepnev, A.E. Baskakov, A.B. Shutov, A.V. Shchipunov, V.Yu. Rogov, N.A. Shutova, R.V. Nagdasev, S.V. Sergeev, A.F. Mukhamatnabaev		
13. Preparation of the physical program and SPD detector project for studying of the spin effects at NICA complex	<p>I.A. Savin A.D. Kovalenko V.V. Kukhtin</p> <table border="1" style="float: right; margin-right: 20px;"> <tr><td>Project preparation</td></tr> <tr><td>Realization</td></tr> </table>	Project preparation	Realization
Project preparation			
Realization			
VBLHEP	A.P. Nagaytsev, G.V. Meshcheryakov, E.V. Zemlyanichkina, A.I. Zinchenko, N.S. Rogacheva, D.V. Peshekhonov, V.D. Peshekhonov, Yu.I. Ivanshin, V.V. Myalkovsky, A.V. Ivanov, N. Dzhavadov, O.M. Kuznetsov, A.I. Malakhov, B. Marineva, F. Ahmadov, R.R. Akhunyanov, G.I. Smirnov, E.A. Strokovsky, R. Lednický, S.S. Shimansky, N.D. Topilin, V.P. Ladygin, P.K. Kurlikin, A.K. Kurlikin, V.A. Anosov, A.A. Baldin, A.P. Cheplakov, I.A. Golutvin, I.P. Yudin		
DLNP	Z.V. Krumshtain, R. Abramishvili, A.V. Guskov, I.A. Orlov, N.V. Anfimov, I.E. Chirikov-Zorin, I.B. Gongadze, A.L. Gongadze, M. Finger(junior), M. Finger, A. Janata, M. Slunechka, V. Slunechkova, N.B. Skachkov, G.A. Shelkov		
LIT	T.A. Strizh, V.V. Palchik		
BLTP	A.V. Efremov, O.V. Teryaev, G.A. Kozlov, A.V. Radyushkin, A.V. Sidorov, Yu.I. Uzikov		

14. Development of computer infrastructure for NICA complex	Yu.K. Potrebenikov O.V. Rogachevsky	Realization
VBLHEP	B.G. Schinov, Yu.I Minaev, V.L. Svalov, V.F. Dydyshko, D.T. Madigozhin, N.A. Molokanova, D.V. Peshekhonov, I.A Polenkevich, S.N. Shkarovsky	
LIT	M.V. Bashashin, D.V. Kekelidze, V.V. Korenkov	
15. Technical design and development of the engineering infrastructure of Nuclotron–NICA	I.N. Meshkov V.D. Kalagin G.V. Trubnikov G.D. Shirkov	Projecting Realization
VBLHEP	N.D. Topilin, A.V. Shabunov, E.V. Serochkin, A.A. Makarov, S.V. Rabtsun, N.V. Semin + 10 pers., V.M. Stepanov + 6 pers., A.M. Karetnik, V.P. Chernyaev, A.N. Sotnikov, V.Yu. Shilov, M.I. Migulin, E.M. Khabarova, A.V. Alfeev, O.M. Timoshenko	
DLNP	Yu.A. Budagov, S.L. Yakovenko	
OCE	A.V. Dudarev + 1 pers.	
AS&CC Office	A.B. Vishnevsky, Yu.N. Balandin	
GA&C	Yu.N. Denisov, S.O. Lukjanov	
16. Works on realization of the experiment Baryonic matter at Nuclotron (BM@N)	M.N. Kapishin V.P. Ladygin P. Senger Yu.A. Murin	Realization
VBLHEP	V.V. Avdeychikov, A.V. Averyanov, S.A. Avramenko, V.D. Aksinenko, A.V. Alfeev, V.S. Alfeev, V.A. Babkin, S.N. Bazylev, V.P. Balandin, I.V. Boguslavsky, P. Batyuk, S.P. Merts, O.V. Rogachevsky, V.A. Vasendina, T.A. Vasiliev, N.M. Vladimirova, A.V. Vishnevsky, S.V. Volgin, V.V. Voronyuk, V.I. Voskoboinik, O.P. Gavriishchuk, V.M. Golovatyuk, A.I. Golokhvastov, Yu.V. Gurchin, V.I. Demidova, V.B. Dunin, Yu.V. Zanevsky, A.I. Zinchenko, V.N. Zryuev, A.P. Ierusalimov, E.-M. Ilgenfritz, A.Yu. Isupov, Yu.-T. Karachuk, V.D. Kekelidze, G.D. Kekelidze, Yu.T. Kiryushin, E.S. Kokoulina, V.I. Kolesnikov, A.D. Kovalenko, A.M. Korotkova, A.V. Kuznetsov, N.A. Kuzmin, A.K. Kurilkin, P.K. Kurilkin, E.A. Ladygin, N.B. Ladygina, S.P. Lobastov, Yu. Lukstins, A.I. Malakhov, V.V. Myalkovsky, V.A. Nikitin, P.V. Nomokonov, O.V. Okhrimenko, V.V. Pavluchkov, Yu.P. Petukhov, O.Yu. Pechenova, V.D. Peshekhonov, S.M. Piyadin, S.G. Reznikov, P.A. Rukoyatkin, I.A. Rufanov, A.V. Shabunov, V.M. Slepnev, I.V. Slepnev, A.S. Sorin, E.A. Strokovsky, S.Ya. Sychkov, A.A. Terekhin, A.V. Terletsky, V.V. Tikhomirov, N.D. Topilin, O.V. Fateev, Yu.I. Fedorov, V.S. Khabarov, S.V. Khabarov, A.N. Khrenov, A.V. Shutov, A.I. Yukaev	

LIT	T.O. Ablyazimov, V.P. Akishin, P.G. Akishin, D.V. Belyakov, O.Yu. Derenovskaya, P.V. Zrelov, V.V. Ivanov, P.I. Kisel, A.M. Raportirenko, V. Sheynast
FLNP	E.P. Litvinenko
BLTP	O.V. Teryaev

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	NC PHEP BSU JIPNR-Sosny NASB “Planar” BSUIR
	Gomel	GSU GSTU
Bulgaria	Sofia	INRNE BAS ISSP BAS TU-Sofia LTD BAS
	Blagoevgrad	SWU
	Plovdiv	PU
CERN	Geneva	CERN
China	Beijing	“Tsinghua”
Czech Republic	Liberec	TUL
	Prague	CU
France	Nantes	SUBATECH
Egypt	Cairo	ECTP
Germany	Darmstadt	GSI
	Dresden	ILK
	Giessen	JLU
	Erlangen	FAU
	Frankfurt/Main	Univ. FIAS
	Mainz	JGU
	Regensburg	UR
	Jülich	FZJ
Japan	Nagoya	Nagoya Univ.
Georgia	Tbilisi	AIP TSU
Italy	Turin	INFN
Moldova	Chișinău	MSU IAP ASM
Poland	Chorzow	Franko-Term

	Warsaw	IEL
		WUT
	Wroclaw	ILT&SR PAS
	Lublin	UMCS
	Otwock-Swierk	NCBJ
Romania	Bucharest	INOE2000
Russia	Moscow	IFIN-HH INCDIE ICPE-CA LPI RAS ITEP MSU Cryogenmash Geliymash NRC KI IBMP RAS INR RAS BelSU Compressormash BINP SB RAS IHEP Neva-Magnet DM Komi SC UrB RAS NPI TPU ISTOK IMS SAS PJSU UŽ UCT UJ WITS
Slovakia	Moscow, Troitsk Belgorod Kazan Novosibirsk Protvino St. Petersburg Syktyvkar Tomsk Fryazino Bratislava Košice Žilina	
South Africa	Cape Town Johannesburg	
Sweden	Stockholm Uppsala	SU TSL
Ukraine	Kiev Kharkov	BITP NASU KhNU KFTI
USA	Batavia, IL Upton, NY Stony Brook, NY	Fermilab BNL SUNY

02-0-1127-2016/2018

Priority:

1

Status:

New

Advanced Studies on Systems of New Generation Accelerators and Colliders for Fundamental and Applied Research

Leader:

G.D. Shirkov

Deputies:

Yu.A. Budagov

G.V. Trubnikov

Participating Countries and International Organizations:

Armenia, Belarus, CERN, Czech Republic, Germany, Georgia, Greece, Italy, Japan, Poland, Russia, Slovakia, South Africa, United Kingdom, Ukraine, USA.

Scientific Programme

JINR participation in international collaborations for the design, creation and improvement of new generation accelerators and colliders by scientific researches and experimental development in the field of particle accelerators physics: design of cryomodules and accelerating structures with superconducting cavities; studies of free electron laser physics, development and construction of diagnostic and accelerator systems applied for ultra short dense bunches in the linear electron accelerators; development and construction of systems applied for formation and diagnostics of ultra short dense bunches in the linear electron accelerators; design and construction of the facility for performance of fundamental and applied researches based on monochromatic directed fluxes and beams of positrons and orthopositronium atoms; construction of test facilities for accelerating structures investigation; development and creation of a new generation instrumentation for precision laser metrology of accelerators and detector complexes to increase their luminosity and work parameters. Common investigations in the field of laser-plasma accelerators. On a base of electron linac bench: construction of the stand for calibration of electromagnetic calorimeters and investigations of other detectors and their characteristics; creation of complex for the laboratory and practical trainings of students and PhD students – future engineers from JINR member states.

Expected main results in 2016:

- Dependency of the beam emittance on the charge and gun electrodes construction investigation. Photoinjector laser optical transportation beamline mounting. Fabrication and investigation of the “transparent” thin-film. 30-35 kV photogun construction. Photogun integration into the photoinjector prototype accelerating structure. Main photoinjector systems commissioning.
- Commissioning of Linac-200 fourth accelerating section with beam energy up to 200 MeV. Design of the UV FEL vacuum beamline and magnet system. Beam extraction into atmosphere for detector parameters investigation.
- Designing and construction of prototype of compact vacuumed two-coordinates Precision Laser Inclinometer with 1 nrad resolution and Absolute Distance Meter with 1 μm resolution for distance of 1–10 m. The final phase of R&D’s on niobium cavities.
- Design and construction of the cryogenic source of monochromatic positrons with the closed loop LiHe cooling system and the emitter of the activity of 30 mCi. Construction and commissioning of the positron transfer channel and the experimental station, development of the gamma radiation detector of a high resolution.
- Investigation of electron beam and FEL physics: investigation of infrared radiation from JINR undulator at FLASH and reconstruction of beam pulse current on basis of this radiation, search of SASE regime at FLASH2 by using of microchannel plate detectors, first test experiments with three XFEL microchannel plate detectors, formation of 3D ellipsoidal shape electron bunches in PITZ with new laser system.

- Development of education program on the base on working with real Linac–200 equipment for students and PhD students – future engineers from JINR member states; laboratory and practical training at Linac–200 accelerator.
- Preparation of the proposal of the JINR participation in international collaborations on the design study of future high-energy colliders.

List of projects:

Project	Leader	Priority (period of realization)
1. Design, construction and test of prototype elements for New generation accelerators and colliders for fundamental and applied purposes.	G.D. Shirkov G.V. Trubnikov	1 (2016 – 2016)
2. The precision laser metrology for accelerators and detector complexes	Yu.A. Budagov M.V. Lyablin	1 (2016 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Construction of the photoinjector prototype based on DC accelerating structure integrated into electron gun with the “transmissive” photocathode and laser driver of the picosecond range.	N.I. Balalykin M.A. Nozdrin	Technical proposal Realization
VBLHEP	V.F. Minashkin, V.G. Shabratov, A.V. Shevelkin, G.V. Trubnikov	
2. Electron beam test bench based on the linear accelerator with the energy up to 200 MeV for accelerating structures properties investigations, FEL R&D, semiconducting structures investigation aimed on new detectors parameters improvement and other applied research.	G.D. Shirkov V.V. Kobets M.A. Nozdrin	Technical proposal Realization
VBLHEP	V.G. Shabratov, A.V. Skrypnik, A.N. Ukhanov, V.F. Minashkin	
DLNP	A.M. Artikov, Yu.A. Budagov, Yu.I. Davidov, V.N. Duginov, V.V. Glagolev, E.M. Syresin	
UC	S.Z. Pakulyak	

3. R&D's on high-precision Laser metrology of the spatial position of the accelerators units including ground motion monitoring for colliders luminosity maintenance; Research on the components of Nb-cavities.	DLNP	Yu.A. Budagov M.V. Lyablin	Technical proposal Realization
		N.S. Azaryan, V.Yu. Batusov, Yu.I. Davidov, D.L. Demin, V.V. Glagolev, V.I. Kolomoets, S.M. Kolomoets, V.M. Romanov, B.M. Sabirov, A.V. Sazonova, S.N. Studenov, A.K. Sukhanova, G.T. Torosyan	
4. Creation of the positron of a high intensity with the closed loop LHe cooling system; electron cooling of positrons and orthopositronium generation; development of positron annihilation spectroscopy method with construction of the dedicated positron transfer channel.	VBLHEP	G.V. Trubnikov, G.D. Shirkov	Realization
		I.N. Meshkov A.G. Kobets P. Horodek	
5. Investigation on intense electron beams and FEL. Development and construction of diagnostic and accelerator systems applied for ultra-short dense bunches in the linear electron accelerators.	DLNP	E.V. Akhmanova, V.I. Khilinov, O.S. Orlov, A.Yu. Rudakov, A.A. Sidorin, L.V. Soboleva, T.A. Stepanova, V.I. Trubnikov	Realization
		V.M. Drobin, V.V. Seleznev	
6. Preparation of the proposal of the JINR participation in the FCC design study at CERN. Preparation of the proposals of JINR participation in international collaborations for future high energy colliders.	VBLHEP	E.M. Syresin O.I. Brovko M.V. Yurkov	Realization
		N.A. Morozov, A.F. Chesnov, R.S. Makarov, D.S. Petrov, V.M. Romanov	
	DLNP	A.Yu. Grebentsov, O.A. Myslinskaya	Preparation
		G.D. Shirkov G.V. Trubnikov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	ANSSP
Belarus	Minsk	BSUIR

Bulgaria	Sofia	SPMRC NASB
CERN	Geneva	PTI NASB
Czech Republic	Prague	INP BSU
Germany	Darmstadt	INRNE BAS
	Hamburg	CERN
	Heidelberg	CTU
	Zeuthen	GSI
Georgia	Tbilisi	DESY
Greece	Athens	MPIK
Italy	Pisa	DESY
	Frascati	HEPI-TSU
	Genoa	UoA
Japan	Tsukuba	INFN
Poland	Krakow	INFN LNF
Russia	Moscow	INFN
	Moscow, Troitsk	KEK
	Nizhny Novgorod	NINP PAS
	Novosibirsk	SSDI
	Ryazan	NNRU “MEPhI”
	Sarov	INR RAS
Ukraine	Kiev	IAP RAS
	Kharkov	BINP SB RAS
United Kingdom	Oxford	RSU
South Africa	Cape Town	VNIIEF
Slovakia	Bratislava	PEWI NASU
USA	Upton, NY	IERT NASU
	Batavia, IL	JAI
		iThemba LABS
		IEE SAS
		BNL
		Fermilab

02-1-1097-2010/2018

Priority:

1

Status:

Extended

Study of Polarization Phenomena and Spin Effects at the JINR Nuclotron-M Facility

Leader: A.D. Kovalenko
Deputies: N.M. Piskunov
V.P. Ladygin
M. Finger (Jr.)
R.A. Shindin

Participating Countries and International Organizations:

Belarus, Bulgaria, CERN, Czech Republic, France, Germany, Japan, Poland, Romania, Russia, Slovakia, Sweden, Switzerland, Ukraine, United Kingdom, USA, Uzbekistan.

Scientific Programme

Methodical support of the experiments at polarized beams of the Nuclotron-M and NICA facilities, including development of polarimetry systems. Measurement of analyzing power for the reaction $p + CH_2$ at polarized proton momentum up to 7.5 GeV/c and polarized neutrons momentum 4.5 GeV/c at the setup ALPOM-2. Measurement of tensor analyzing power and spin correlation in $d \rightarrow p$ reaction in the deuteron core area with the use of polarized 3He target and polarized deuteron beam of the Nuclotron-M. Study of 2N- and 3N-correlations in deuteron-proton elastic scattering and deuteron break-up reactions at the Nuclotron internal target. Works on modernization of Saclay–Argonne–JINR polarized proton target (setup PPT). The analysis of set of the np spin observables at 0° (the total np cross section differences), using polarized targets and quasi-monochromatic relativistic 1.2–3.6 GeV neutron beams. Determination of the forward scattering NN amplitudes over this energy region. Comparison of the obtained data with QCD motivated model calculations. Study of charge-exchange processes in dp -interactions at the setup STRELA. Development of theoretical models for description of the simplest nuclear systems taking into account relativistic effects, meson and quark-gluon components of the internal movement. Theoretical analysis of experimental data obtained at Nuclotron-M. The study of the properties of strongly interacting matter utilizing polarization phenomena in hadron-nucleon and lepton-nucleon interactions, and in the decay of polarized radioactive atomic nuclei. Study of highly excited nuclear matter and collective effects in nuclear media; delta and other nucleonic resonance excitations on protons and nuclei. Preparation of the setup DELTA-LNS and data taking on the light neutral mesons production in polarized nucleons and nucleus interactions.

Expected main results in 2016:

- Works:
 - a) on the construction low energy proton and deuteron polarimeter within the frames of the program: “Spin Physics Research Infrastructure at the Nuclotron”;
 - b) on the measurements of analyzing power of neutron-CH scattering at polarized neutron momentum from 3 to 4.5 GeV/c.
- Completion of stages of the approved projects and collaborative protocols within the frames of their real financial support, including:
 - a) realization of the projects ALPOM-2 and DSS;
 - b) experiments at the setup ALPOM-2 analysis of the collected data from DELTA-SIGMA setup.
- Participation in the design and construction of BM@N setup in accordance with general plan.
- Participation in the joint scientific programs and experiments, design and test of the new detectors and electronics for the use at SPS (CERN), RHIC (BNL), TJNAF (Newport News), FAIR (GSI) in accordance with the approved collaborative agreements.

- Continuation of the development of the new methods to calculation of the amplitudes and polarization characteristics of deuteron fragmentation and deuteron elastic scattering on protons and nuclei taking into account FSI and relativistic effects.

List of projects:

Project	Leader	Priority (period of realization)
1. ALPOM-2	N.M. Piskunov	1 (2010 – 2016)
2. DSS	V.P. Ladygin A.I. Malakhov T. Yesaka	1 (2010 – 2018)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Works on the development: of spin physics research infrastructure at the Nuclotron and other facilities	A.D. Kovalenko	Realization
VBLHEP	V.P. Ladygin, S.G. Reznikov, P.K. Kurilkin, S.M. Piyadin, Yu.V. Gurchin, V.V. Glagolev, V.I. Sharov, A.I. Malakhov, A.P. Nagaytsev, I.A. Savin, A.N. Livanov, R.A. Shindin, V.V. Fimushkin, A.M. Taratin	
BLTP	V.V. Burov, V.K. Lukyanov, A.V. Efremov, O.V. Teryaev	
DLNP	M. Finger, M. Finger (Jr.)	
LIT	R.V. Polyakova + 1 pers.	
2. ALPOM-2 Project	N.M. Piskunov E. Tomasi-Gustafsson C.F. Perdrisat V. Punjabi	Data taking
VBLHEP	V.V. Glagolev, I.M. Sitnik, A.A. Povtoreyko, Yu.P. Buhuev, D.A. Kirillov, P.A. Rukoyatkin, O.P. Gavriishchuk, S.N. Bazylev, A.D. Kovalenko, R.A. Shindin, A.N. Livanov	
3. DSS Project	A.I. Malakhov V.P. Ladygin T. Yesaka	Preparation Data taking
VBLHEP	S.G. Reznikov, A.K. Kurilkin, P.K. Kurilkin, S.M. Piyadin, Yu.V. Gurchin, A.A. Terekhin, Yu.-T. Karachuk, A.N. Livanov, A.N. Khrenov, N.B. Ladygina, A.P. Ierusalimov, A.Yu. Isupov	
DLNP	G.I. Lykasov	
4. Modernization of the polarized proton target infrastructure (setup PPT)	N.S. Borisov R.A. Shindin	Preparation Data taking
VBLHEP	R.A. Shindin	

DLNP	Yu.A. Usov, Yu.A. Plis, N.A. Bazhanov, A.N. Fedorov	
5. Development of the Delta-Sigma program for future experiments at setup BM@N	A.D. Kovalenko V.I. Sharov R.A. Shindin	Data analysis Project preparation
VBLHEP	E.V. Chernykh, P.K. Manyakov, Yu.T. Borzunov, N.A. Kuzmin, I.P. Yudin	
DLNP	N.S. Borisov, Yu.A. Usov, M. Finger, M. Finger (jr.), E.I. Bunyatova, M. Slunečhka, V. Slunečhkova, A. Yanata	
FLNP	S.B. Borzakov, Ts. Panteleev	
BLTP	N.V. Kochlev	
LIT	R.V. Polyakova + 1 pers.	
6. Experiments on the program STRELA	N.M. Piskunov	Data taking Data processing
VBLHEP	V.V. Glagolev, I.M. Sitnik, Yu.P. Bushuev, A.A. Povtoreyko, D.A. Kirillov, S.N. Bazylev, P.K. Manyakov	
7. Theoretical calculations of polarized processes	V.V. Burov V.K. Lukyanov	Data analysis
BLTP	V.V. Burov	
VBLHEP	N.B. Ladygina, A.P. Ierusalimov	
8. Spin effects in hadron-nucleon and lepton-nucleon interactions	M. Finger	Data analysis
DLNP	E.I. Bunyatova, M. Slunečhka, V. Slunečhkova, M. Finger (Jr.), A. Yanata	
9. Works on the program DELTA-2 (INR RAS - JINR)	A.B. Kurepin A.N. Livanov	Preparation Data taking
VBLHEP	S.N. Bazylev, A.P. Ierusalimov, P.K. Manyakov, V.P. Ladygin, Yu.S. Anisimov, S.M. Piyadin	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	INP BSU
Bulgaria	Sofia	UCTM
CERN	Geneva	CERN
Czech Republic	Prague	CU CTU
	Brno	ISI ASCR
	Liberec	TUL
	Řež	NPI ASCR
France	Saclay	IRFU
	Orsay	IPN Orsay

Germany	Dresden Bochum Jülich	TU Dresden RUB FZJ
Japan	Tokyo Hiroshima Osaka	UT Hiroshima Univ. RCNP
Poland	Otwock-Swierk	NCBJ
Romania	Bucharest	INCDIE ICPE-CA
Russia	Gatchina Moscow	PNPI LPI RAS NRC KI INR RAS
Slovakia	Moscow, Troitsk Bratislava Košice	IP SAS IEP SAS PJŠU
Sweden	Žilina	UŽ
Switzerland	Uppsala	TSL
Ukraine	Geneva Villigen	UniGe PSI
United Kingdom	Kharkov	KFTI
USA	Glasgow Upton, NY Newport News, VA Norfolk, VA Williamsburg, VA	U of G BNL JLab NSU W&M
Uzbekistan	Tashkent	INP AS RUz Assoc.“P.-S.” PTI

02-1-1087-2009/2017

Priority:

1

Status:

In-progress

Research on Relativistic Heavy and Light Ion Physics. Experiments at the Nuclotron, SPS and SIS18

Leader: A.I. Malakhov
Deputy: S.V. Afanasiev

Participating Countries and International Organizations:

Armenia, Belarus, Bulgaria, CERN, China, Czech Republic, France, Germany, Japan, India, Kazakhstan, Mongolia, Poland, Romania, Russia, Slovakia, Sweden, Switzerland, Tajikistan, USA, Uzbekistan.

Scientific Programme

Search for manifestation of quark-gluon degrees of freedom in collisions of relativistic nuclei and phase transitions in nuclei and exotic resonances. Study of nuclear multifragmentation processes. The Nuclotron internal target experiments. Asymptotics in nuclear collisions and nucleon clusters. Detector development for relativistic heavy-ion experiments at the CERN, BNL and GSI. Investigation of the interactions of nuclei at energy 20-158 GeV on a nucleon on NA61/SHINE experiment (SPS, CERN). Study of hadron production in hadron-nucleus interactions. Use of these data for precise predictions of neutrino fluxes in neutrino oscillation experiments at accelerators. Participation in HADES experimental programs. Studies of transmutation cross sections of radioactive nuclear wastes. Study of fragmentation of light stable and radioactive nuclei with beams of secondary nuclei and data analysis. Study of the properties strong interaction matter. Study of the particles properties in nuclear matter at the Nuclotron.

Expected main results in 2016:

- Continuation of experiments with the internal target at the Nuclotron. Preparation and carrying out of experiments with extracted beams at the Nuclotron. Development of the software for modeling and processing experimental data.
- Participation in realization NA61. Study of hadron production in proton-carbon interactions at 30 GeV in the NA61/SHINE experiment at CERN. Use of these data for improved predictions of neutrino fluxes and precise determination of neutrino oscillation parameters in the T2K experiment in Japan.
- Participation in experimental data taking of *AuAu* (1.25 GeV) with HADES spectrometer. Furter participation in data analysis of *dp* (1.25 GeV) and *np* (3.5 GeV).
- Experimental study of the properties of hot nuclei produced in the collisions of the relativistic deuterons with heavy target. Measuring and analysis of the relative velocity correlation functions of pairs of intermediate fragments created in the reaction. The elaboration of the trigger system for determination of the total time-scale of hot nucleus disintegration will be done.
- Study of multiparticle dynamics in terms of masses and energies of colliding objects and centrality of interaction. Mathematical modeling of experiments on investigation of the properties of highly excited states of nuclear matter in relativistic nuclear collisions and the mechanism of quark hadronization in the process of pion pair production.
- Search for eta-mesic nuclei formed in *dA* collisions, the determination of the total cross section of eta-nucleus production in *dA* collisions and its energy and A-dependence, the construction and production of the neutron detector for this experiment. Investigation of scintillators at high beam intensity.
- Analysis of emulsions irradiated with the nuclear beams 7Be , ${}^{10}C$, ${}^{12}N$. Irradiation of emulsions with secondary beams of radioactive ${}^{11}C$. Heavy nucleus exposure.

- Study of nuclear interactions depending on projectile mass and energy with the beams of relativistic nuclei at the Nuclotron and other accelerators with the photo-emulsion method. Study of fragmentation, multifragmentation, multiparticle production together with correlations between them at interaction of nuclei of various energies with photo-emulsion nuclei. Search for collective effects in central nuclear-nuclear collisions in photo-emulsions.
- Search and study of new phenomena based on the data obtained using bubble chambers; Theoretical interpretation of these results. Creation of the data base of experimental data and educational programs in the field of relativistic nuclear physics.
- Study of deep subthreshold processes, applied and educational programs at MARUSYA setup. Construction of electromagnetic detector of MARUSYA setup and test channel and corresponding electronics for detector testing.
- Investigations with light and heavy ions for applied research.

List of projects:

Project	Leader	Priority (period of realization)
1. HADES	Yu.V. Zanevsky V.P. Ladygin,	1 (2010 – 2016)
2. NA61	A.I. Malakhov	1 (2012 – 2017)
3. FASA-3	V.A. Karnaughov	1 (2013 – 2017)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
1. Experiment HADES	A.I. Malakhov Yu.V. Zanevsky	Data taking Data analysis
VBLHEP	O.V. Fateev, C.V. Razin, V.P. Ladygin, A.K. Kurilkin, P.K. Kurilkin, A.P. Ierusalimov, V.F. Tchepurnov, A.Yu. Troyan, A.V. Belyaev	
BLTP	V.D. Toneev	
DLNP	G.I. Lykasov	
2. Experiment NA61/SHINE	A.I. Malakhov G.L. Melkumov	Data taking Preparation Data analysis
VBLHEP	D.A. Artyemenkov + 2 pers, D.K. Dryablov, A.Yu. Isypov, V.I. Kolesnikov, V.A. Kireev, M.A. Kozhin	
DLNP	B.A. Popov, S.A. Bunyatov	
3. Experiment BECQUEREL	P.I. Zarubin	Data taking
VBLHEP	V.V. Rusakova, D.A. Artemenkov, V. Bradnova, N.O. Kornegrutsa, P.P. Kattabekov, L.Z. Mamatkulov, P.A. Rukoyatkin	

4. Project FASA-3

V.A. Karnaughov

Preparation
Data taking

DLNP

S.P. Avdeev, V.V. Kirakosyan, W. Kartch

FLNR

G.V. Mushinsky, O.V. Strekalovsky

VBLHEP

P.A. Rukoyatkin

5. Search for and study of η -mesic nuclei in pA collisions at the Nuclotron

S.V. Afanasiev
G.A. Sokol

Preparation
Data taking
Upgrade

VBLHEP

S.V. Afanasiev + 4 students, Yu.S. Anisimov, A.F. Elishev, A.Yu. Isypov, Z.A. Igamkulov, D.K. Dryablov, L.V. Korniyushina

6. Search and investigation of new phenomena using information obtained with bubble chambers and their theoretical interpretation. Creation of data base of experimental data and educational programs in the field of relativistic nuclear physics

A.A. Baldin
V.V. Glagolev

Data analysis

VBLHEP

A.V. Belyaev, V.V. Ilyushchenko, A.Yu. Troyan + 2 pers., A.P. Ierusalimov, S.G. Arakelyan, O.V. Rogachevsky, S.G. Stetsenko

7. Investigation of deep subthreshold processes, applied and educational programs at MARUSYA set up

A.A. Baldin

Preparation
Data taking

VBLHEP

V.A. Arefiev, S.V. Afanasiev, A.V. Belyaev, B.N. Guskov, I.V. Kudashkin, A.I. Kudashkin, I.V. Slepnev + 4 pers., S.G. Stetsenko, A.Yu. Troyan, A.V. Shabunov, S.S. Shimansky, I.P. Yudin, E.E. Perepelkin, I.G. Voloshina, T.V. Shavrina

BLTP

V.V. Burov, S.G. Bondarenko

8. Investigation with light and heavy ions for applied research

A.I. Malakhov

Realization
Preparation
Data taking

VBLHEP

N.N. Agapov, Yu.S. Anisimov, A.D. Kovalenko

Collaboration

Country or International Organization

City

Institute or Laboratory

Armenia

Yerevan

Foundation ANSL

YSU

Belarus

Minsk

NC PHEP BSU

Bulgaria

Sofia

INRNE BAS

CERN

Geneva

CERN

China	Beijing	IHEP CAS
	Wuhan	CIAE
Czech Republic	Prague	CCNU
	Řež	IMC ASCR
France	Orsay	NPI ASCR
Germany	Darmstadt	IPN Orsay
		TU Darmstadt
		GSI
	Dresden	HZDR
	Frankfurt/Main	Univ.
	Giessen	JLU
	Heidelberg	Univ.
	Munich	TUM
	Siegen	Univ.
Japan	Osaka	RCNP
	Tokyo	UT
	Tsukuba	Univ.
India	Jaipur	Univ.
	Mumbai	BARC
Kazakhstan	Almaty	IPT
Mongolia	Ulaanbaatar	IPT MAS
		NEC
Poland	Krakow	NINP PAS
	Lodz	UL
	Otwock-Swierk	NCBJ
	Warsaw	WUT
Romania	Bucharest	UB
		IFIN-HH
		INCDIE ICPE-CA
		ISS
	Constanța	UOC
Russia	Moscow	SINP MSU
		LPI RAS
		ITEP
	Moscow, Troitsk	INR RAS
	Chernogolovka	ISMAN RAS
	Smolensk	SmolGU
	St. Petersburg	FIP
	Sarov	VNIIEF
Slovakia	Bratislava	IP SAS
	Košice	PJSU
Sweden	Lund	LU
Switzerland	Villigen	PSI
	Geneva	UniGe
	Zurich	ETH

Tajikistan	Dushanbe	PHTI ASRT
USA	Berkeley, CA	Berkeley Lab
	Iowa City, IA	UIowa
	Norfolk, VA	NSU
	Upton, NY	BNL
	Williamsburg, VA	W&M
Uzbekistan	Tashkent	Assoc.“P.-S.” PTI
	Jizakh	JSPI
	Samarkand	SSU

02-0-1066-2007/2020

Priority:

1

Status:

Extended

Investigation of the Properties of Nuclear Matter and Particle Structure at the Collider of Relativistic Nuclei and Polarized Protons

Leaders: R. Lednický
Yu.A. Panebratsev

Participating Countries and International Organizations:

Armenia, Azerbaijan, Czech Republic, France, Germany, Poland, Russia, Slovakia, USA.

Scientific Programme

Investigation of the properties of nuclear matter with extremely high density and temperature, search for the signs of the quark deconfinement and possible phase transitions at the collisions of heavy nuclei at the energies of the Relativistic Heavy Ion Collider (RHIC). Measurement of spin dependent structure functions of nucleons and nuclei using polarized RHIC beams.

Expected main results in 2016:

- The data on heavy ion and polarized proton–proton and polarized proton nucleus collisions taken in the STAR experiment at RHIC.
- Beam energy scan in the energy range 7–200 GeV. Study of AuAu, UU, CuCu, ${}^3\text{He}$ Au collisions.
- Measurements of event structure, collective variables, correlation characteristics, femtosopic correlation functions and high P_T processes.
- Measurement of spin depended and gluon structure functions in polarized proton collisions with Al and Au nuclei.
- Participation in JINR–BNL and JINR–CERN joint educational programs.

List of projects:

Project	Leader	Priority (period of realization)
1. STAR	Yu.A. Panebratsev R. Lednický	1 (2010 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Participation in the spin physics program in STAR experiment at RHIC	Yu.A. Panebratsev	Data taking Data analysis
VBLHEP	M.V. Tokarev, T.G. Dedovich, A.O. Kechechyan, L.G. Efimov, A.N. Zubarev, V.V. Tikhomirov, V.B. Dunin, V.I. Yurevich, D.N. Bogoslavsky, G.A. Yarygin, A.A. Povtoreyko, V.Yu. Rogov, S.V. Sergeev	

2. The study of polarized proton collisions with nuclei at 200 GeV	M.V. Tokarev	Realization
VBLHEP	V.V. Lyuboshits, T.G. Dedovich, A.A. Aparin	
LIT	Zh.Zh. Musulmanbekov	
BLTP	O.V. Teryaev, A.E. Dorokhov, S.V. Goloskokov	
3. The study of event structure, collective effects, femtososcopic correlations and high pT processes	R. Lednický	Realization
	Yu.A. Panebratsev	
VBLHEP	P. Filip, M.V. Tokarev, S. Vokal, A.O. Kechechyan, N.Ya. Tchankova-Bnzarova, T.G. Dedovich, L.G. Efimov, I.-Zh. Bnzarov, G.S. Averichev, G.N. Agakishiev, A.A. Aparin, O.V. Rogachevsky	
LIT	G.A. Ososkov	
4. Participation in the heavy ion program in STAR experiment at RHIC. Beam-energy scan.	Yu.A. Panebratsev	Data taking Data processing Data analysis
VBLHEP	P. Filip, M.V. Tokarev, S. Vokal, A.O. Kechechyan, N.Ya. Tchankova-Bnzarova, T.G. Dedovich, L.G. Efimov, I.-Zh. Bnzarov, G.S. Averichev, E.V. Potrebenikova, B.G. Shchinov, G.N. Agakishiev, O.V. Rogachevsky	
LIT	V.V. Korenkov, N. Balashov	
5. Development of the software and formation of the infrastructure for the STAR data processing at JINR	Yu.A. Panebratsev	Realization
	V.V. Korenkov	
VBLHEP	E.V. Potrebenikova, A.O. Kechechyan, A.A. Aparin, N.Ya. Tchankova-Bnzarova, G.N. Agakishiev	
LIT	N. Balashov, G.A. Ososkov	
6. Participation in JINR-BNL and JINR-CERN joint educational programs	Yu.A. Panebratsev	Realization
	E.V. Potrebenikova	
VBLHEP	V.V. Belaga, N.E. Sidorov, K.V. Klygina, M.S. Stetsenko, P.D. Semchukov, A.V. Shoshin, E.I. Golubeva, N.I. Vorontsova, M.P. Osmachko	
UC	S.Z. Pakulyak, I.A. Smirnova	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	Foundation ANSL
Azerbaijan	Baku	IRP ANAS
Czech Republic	Prague	CU
	Řež	UJV

		NPI ASCR
France	Nantes	SUBATECH
Germany	Heidelberg	Univ.
Poland	Warsaw	WUT
Russia	Moscow	NNRU “MEPhI”
		ITEP
	Protvino	IHEP
	St. Petersburg	SPbSU
Slovakia	Bratislava	IP SAS
	Košice	PJSU
USA	Berkeley, CA	Berkeley Lab
	Bloomington, IN	IU
	Detroit, MI	WSU
	Lemont, IL	ANL
	Upton, NY	BNL
	Los Angeles, CA	UCLA
	New Haven, CT	Yale Univ.
	University Park, PA	Penn State

02-1-1088-2009/2016

Priority:

1

Status: Approved for completion
in 2016

ALICE. Study of Interactions of Heavy Ion and Proton Beams at the LHC

Leader: A.S. Vodopyanov

Participating Countries and International Organizations:

Armenia, Bulgaria, CERN, China, Croatia, Czech Republic, Denmark, France, Germany, Greece, Hungary, India, Italy, Mongolia, Netherlands, Norway, Poland, Republic of Korea, Romania, Russia, Slovakia, South Africa, Sweden, Switzerland, Ukraine, United Kingdom, USA.

Scientific Programme

1. Participation in the preparation of ALICE upgrade (Photon spectrometer PHOS, assembly of the setup).
2. Realization of experiments at the LHC.
3. Physics research program at the ALICE detector.
4. Development and upgrade of data analysis computing GRID–ALICE in Russia.

Expected main results in 2016:

- Participation in the R&D for the upgrade of photon spectrometer PHOS.
- Participation in the physics project preparation. Physics simulation of heavy ions and protons interactions at LHC energies.
- Data analysis. Preparation of publications.
- Upgrade, testing and supporting of GRID.

List of projects:

Project	Leader	Priority (period of realization)
1. ALICE	A.S. Vodopyanov	1 (2010 – 2019)
2. R&D for the ALICE Photon Spectrometer	A.S. Vodopyanov	1 (2010 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other Division of JINR Responsible person	Main researchers	
1. Particle detectors VBLHEP 2. Physical process simulation and data analysis VBLHEP	A.S. Vodopyanov B.V. Batyunya	<div style="border: 1px solid black; padding: 2px; display: inline-block;">Realization</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Realization</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">Realization</div>

M.Yu. Barabanov, Yu.A. Belikov, D.D. Emelyanov,

	S.S. Grigoryan, A.V. Taranenko, N.N. Zhigareva	L.V. Malinina, A.G. Fedunov	E.P. Rogachya, K.P. Mikhaylov
DLNP	G.I. Lykasov		
LIT	R.M. Yamaleev		
BLTP	D. Blaschke, A.V. Sidorov		
3. ALICE. Computing in the distributed environment—GRID	A.S. Vodopyanov		Realization
VBLHEP	B.V. Batyunya, A.G. Fedunov, G.G. Stiforov		
LIT	V.V. Mitsyn		
4. Photon Spectrometer PHOS	A.S. Vodopyanov P.V. Nomokonov		Realization
VBLHEP	N.V. Gorbunov, N.A. Kuzmin, Yu.P. Petukhov, S.A. Rufanov, I.A. Zaporozhets		

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	Foundation ANSL
Bulgaria	Sofia	SU
CERN	Geneva	CERN
China	Beijing	CIAE
	Wuhan	CCNU
Croatia	Zagreb	RBI
Czech Republic	Prague	IP ASCR
	Řež	UJV
Denmark	Copenhagen	NBI
France	Clermont-Ferrand	LPC
	Lyon	UCBL
	Nantes	SUBATECH
	Orsay	IPN Orsay
	Saclay	IRFU
	Strasbourg	CRN
Germany	Darmstadt	GSI
	Heidelberg	Univ.
	Frankfurt/Main	Univ.
	Marburg	Univ.
	Münster	Univ.
Greece	Athens	UoA
Hungary	Budapest	Wigner RCP
India	Aligarh	AMU
	Bhubaneswar	IOP
	Calcutta	VECC

		SINP
	Chandigarh	PU
	Jammu	Univ.
Italy	Bari	INFN
	Bologna	INFN
	Cagliari	INFN
	Catania	UniCT
	Legnaro	INFN LNL
	Padua	INFN
	Rome	INFN
	Salerno	INFN
	Turin	INFN
	Vercelli	UPO
Mongolia	Ulaanbaatar	IPT MAS
Netherlands	Amsterdam	NIKHEF
	Utrecht	UU
Norway	Bergen	UiB
	Oslo	UiO
Poland	Krakow	NINP PAS
	Warsaw	IEL
	Otwock-Swierk	WUT
Republic of Korea	Gangneung	NCBJ
Romania	Bucharest	GWNU
Russia	Gatchina	ISS
	Moscow	PNPI
		ITEP
	Moscow, Troitsk	NNRU "MEPhI"
	Novosibirsk	NRC KI
	Protvino	SINP MSU
	Sarov	INR RAS
	St. Petersburg	BINP SB RAS
		IHEP
Slovakia	Bratislava	VNIIEF
	Košice	FIP
South Africa	Cape Town	STU
Sweden	Lund	PJSU
Switzerland	Lausanne	UCT
United Kingdom	Birmingham	LU
Ukraine	Kharkov	EPFL
	Kiev	Univ.
USA	Columbus, OH	KFTI
	Oak Ridge, TN	BITP NASU
		OSU
		ORNL

02-1-1107-2011/2016

Priority:

1

Status: Approved for completion
in 2016

Development and Construction of the Prototype of a Complex for Radiotherapy and Applied Research with Heavy-Ion Beams at the Nuclotron-M

Leaders: S.I. Tyutyunnikov

Participating Countries and International Organizations:

Armenia, Australia, Belarus, Bulgaria, Czech Republic, India, Germany, Greece, Moldova, Mongolia, Poland, Romania, Russia, Serbia, Slovakia, Ukraine.

Scientific Programme

Investigation of new aspects of electronuclear power engineering and process of energy production and radioactive waste transmutation at various subcritical setups.

Expected main results:

- Investigation of physical characteristics of the following setups: “the lead target plus graphite moderator” (set-up “Gamma-3”), the massive uranium target with a lead reflector – (set-up “Quinta”), the quasi infinite uranium target BURAN at the energies of the Nuclotron proton and deuteron beams within the range from 0.6 up to 12.0 GeV. Data on the multiplicities and special distribution of energy-time neutron spectra. Study on possibilities of energy production and radioactive waste processing at massive targets of natural (depleted) uranium and thorium on the base of basic principles of nuclear relativistic technologies.

Expected main results in 2016:

- Completion of the development of a heavy ion beam spatial monitoring system; On-line operational test at the Nuclotron-M experiments.
- Development of detector for measuring the radiation dose rate based on diamond and silicon detectors.
- Study on efficiency of heating FEL ferromagnetic nano-clusters with microwave radiation regarding the feasibility of its application to the cancer cell destruction.
- Study of neutron generation and multiplication in heavy targets (Pb, U, etc.) at the Nuclotron proton and deuteron beams within the energy range from 1.0 to 8.0 GeV. Data taking on energy release, number of fissions, plutonium recovery, on neutron energy spectra and neutron spatial distribution in the uranium target (set-up “Quinta”) and in the lead target with graphite moderator (“Gamma-3” set-up). Precise definition of transmutation rate for highly toxic long-lived radioactive waste (^{129}I , ^{237}Np , ^{238}Pu , ^{239}Pu and ^{241}Am) in the neutron fields with reinforced hard component.
- The technical specifications elaboration and carrying out the 1-st stage of design work on the construction of the experimental setup “Buran”, based on the quasiinfinite target of depleted uranium with the mass of ~21 tonns.
- Investigation of the mechanism of the influence of coherent high power microwave radiation on the radioactive decay of nuclei.

List of projects:

Project	Leader	Priority (period of realization)
1. Study of deep subcritical electronuclear systems and feasibility of their application for energy production and radioactive waste transmutation Part II – quasi infinite target	S.I. Tyutyunnikov	1 (2011 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Elaboration of the technical specifications for the quasi infinite target “Buran”	S.I. Tyutyunnikov I.P. Yudin A.A. Baldin V.A. Panasik	Realization
2. Development of the technical specifications for detecting system of the “Buran” setup	A.A. Baldin A. Berlev N.I. Zamyatin V.M. Slepnev S.V. Khabarov	Realization
3. Development and experimental study of the detectors for neutron registration at the Nuclotron-M beams	A.A. Baldin A. Berlev A.V. Vishnevsky N.I. Zamyatin S.E. Vasil'ev A.M. Makankin A.I. Shafranovskaya Z.Ya. Sadygov	Realization
4. Development and production of the detectors for the ions energy measurement within the range E=0.1÷1 GeV/nucleon. Experiments at the Nuclotron-M beams	N.I. Zamyatin A.E. Cheryemukhin A.I. Shafranovskaya S.V. Khabarov Yu.S. Kovalev	Realization
5. The modernization of spectralanalitic complex for activation measurements	E.V. Strekalovskaya V.N. Shalyapin Yu.S. Kovalev	Data taking
6. Study of radioactive waste transmutation and research on neutron generation and energy release in heavy targets (Pb, U, Th, etc.) at the Nuclotron deuteron and neutron beams within the energy interval from 0.5 to 6 GeV/nucleon	A.A. Baldin I.P. Yudin M. Paraipan I.V. Kudashkin	Data taking Data processing Upgrade
VBLHEP	A. Berlev, S.V. Vasil'ev, A.V. Vishnevsky, N.M. Vladimirova, N.I. Zamyatin, E.V. Kostyukhov, A.M. Makankin, I.I. Mar'in, I.V. Kudashkin, M. Paraipan, E.V. Strekalovskaya, S.V. Khabarov, A.I. Shafranovskaya	

DLNP	I. Adam, V.M. Tsupko-Sitnikov, A.A. Solnyshkin, Zh. Hushvaktov, V.I. Stegaylov, L. Zavortka	
FLNP	Yu.N. Kopach, V.I. Furman, N.A. Gundorin	
LRB	V.Yu. Shchyegolev	
RFMD	B.A. Shestakov, N.N. Kalyakin + 2 pers.	
7. Investigation of the mechanism of the influence of coherent high power microwave radiation on the radioactive decay of nuclei	S.N. Sedykh E.A. Perelshtein V.N. Shalyapin S.I. Tyutyunnikov I.A. Kryachko	Realization
VBLHEP	A.K. Kamiksls, V.V. Efimov, Yu.S. Kovalev, V. Dzhavadova	
8. Production of the monitoring elements for the superconducting systems	Yu.P. Filippov	R&D
VBLHEP	I.D. Kakorin + 6 pers.	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU
Australia	Sydney	Univ.
Belarus	Minsk	NC PHEP BSU
		JIPNR-Sosny
		NASB
		INP BSU
		SPMRC NASB
Bulgaria	Sofia	INRNE BAS
Czech Republic	Řež	UJV
	Brno	BUT
	Prague	CTU
Germany	Darmstadt	TU Darmstadt
	Marburg	Univ.
	Jülich	FZJ
Greece	Thessaloniki	AUTH
India	Mumbai	BARC
	Jaipur	Univ.
Moldova	Chișinău	IAP ASM
Mongolia	Ulaanbaatar	IPT MAS
Poland	Warsaw	WUT
	Krakow	NINP PAS
	Otwock-Swierk	NCBJ
Russia	Moscow	Atomenergomach
	Dubna	BSINP MSU

		IAS “Omega”
	Obninsk	MRRC
		IPPE
	St. Petersburg	KRI
	Tomsk	TPU
Romania	Bucharest	ISS
		UMF
	Iași	INCDIE ICPE-CA
Serbia	Belgrade	UAIC
Slovakia	Bratislava	INS “VINČA”
		SOSMT
		IP SAS
		CU
Ukraine	Kharkov	KFTI
	Uzhgorod	NUU

Nuclear Physics (03)

Accelerator Complex of Ion Beams of Stable and Radioactive Nuclides (DRIBs-III)

Leaders: G.G. Gulbekyan
 S.N. Dmitriev
Scientific leader: M.G. Itkis
 Yu.Ts. Oganessian

Participating Countries and International Organizations:

Belgium, Bulgaria, CERN, China, Czech Republic, Democratic People's Republic of Korea, Egypt, France, Germany, Italy, Kazakhstan, Mongolia, Poland, Romania, Russia, Serbia, Slovakia, South Africa, Ukraine, Uzbekistan, USA.

Scientific Programme

The implementation of the DRIBs-III project, including the development of the FLNR cyclotron complex, drastic extension of the experimental laboratory bases (new physical facilities), development of accelerator systems in attempts to increase beam intensity and improve the quality of beams of stable and radioactive nuclides in the energy range from 5 to 100 MeV/nucleon with a view to significantly improve the efficiency of experiments on synthesis and study of the properties of new superheavy elements, extend experimental programme with beams of radioactive nuclides, improve accelerator stability and reduce their energy consumption.

Expected results in 2016:

- Development of the infrastructure of a new fragment separator ACCULINNA-2. Conducting test experiments at the ACCULINNA-2 fragment separator (U-400M cyclotron) using beams of light ions with energies of 30 to 50 MeV/nucleon.
- Conducting experiments with beams of medium-mass ions at 6-15 MeV/nucleon at the U-400M cyclotron.
- Production of intense beams of highly charged ions heavier than Xe, using the superconducting ion source and U-400M cyclotron.
- Implementation of the experimental programme on synthesis of new isotopes in the region of superheavy elements using a Cf target at the U-400 cyclotron.
- Implementation of the research programme on production of ^{50}Ti and ^{58}Fe intense beams at test benches and accelerators with a view to prepare experiments on synthesis of superheavy elements with $Z > 118$.
- Investigation of the production of beams of exotic ^6He ions using electron beam bremsstrahlung. Development of electronics and performing experiments with beams at the MT-25 microtron.
- Development of new methods of beam diagnostics for stable and radioactive nuclides.
- Optimization of transport systems of beams of stable and radioactive nuclides.
- Project development, development and testing of the high-current DC-280 accelerator facilities.
- Development of a new separation facility based on stopping reaction products in gas and their resonance laser ionization.

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
1. Development of the U-400M and U0400R complexes	B.N. Gikal	Preparation Data taking
FLNR	P.G. Bondarenko, S.L. Bogomolov, A.V. Reshetov, N.F. Osipov, G.N. Ivanov, S.V. Pashenko, M.V. Habarov, I.V. Kalagin, N.Yu. Kazarinov, I.A. Ivanenko	
LIT	V.V. Korenkov, P.G. Akishin, E.A. Airian	
DLNP	G.A. Karamysheva, E.V. Samsonov, S.B. Vorozhtsov	
VBLHEP	S.A. Kostromin, A.A. Fateev, N.I. Lebedev	
LRB	V.E. Aleynikov	
2. ECR ion sources development	S.L. Bogomolov	Preparation
FLNR	A.A. Efremov, G.N. Ivanov, V.Ya. Lebedev, V.V. Behterev, N.Yu. Yazvitskiy	
VBLHEP	E.D. Donets, V.M. Drobin	
3. The MT-25 microtron development	S.V. Mitrofanov	Preparation Data taking
FLNR	A.G. Belov, Yu.G. Teterev, S.V. Pashenko, M.V. Habarov, N.F. Osipov, V.A. Semin	
4. Development of a new FLNR experimental hall	G.G. Gulbekian	Preparation
FLNR	B.N. Gikal, V.A. Kostyrev, N.F. Osipov, P.G. Bondarenko, S.L. Bogomolov, A.V. Reshetov, S.V. Pashenko, M.V. Habarov, I.V. Kalagin, N.Yu. Kazarinov, I.A. Ivanenko, V.A. Verevochkin, K.Yu. Kazchishin	
5. Development of the fragment separator ACCULINNA-2 project	A.S. Fomichev	Preparation
FLNR	S.A. Krupko, C.G. Belogurov, A.V. Gorshkov, V.A. Gorshkov, G.M. Ter-Akopian, A.A. Bezbakh, M.S. Golovkov, P.G. Sharov, S.I. Sidorchuk, R.S. Slepnev, G. Kaminsky, A.G. Knyazev, V. Chudoba, R. Wolski	
6. Development of the VASSILISSA (SHELS) separator	A.V. Eremin	Preparation
FLNR	O.N. Malyshev, A.I. Svirikhin, I.N. Izosimov, V.I. Chepigin, M.L. Chelnokov, A.V. Isaev, V.M. Popov, A.N. Kuznetsov, E.A. Sokol, D.E. Katrasev, V.A. Sbitnev	

7. Development of the gas catcher project	A.M. Rodin	Preparation
FLNR	L. Krupa, A.V. Belozerov, S.A. Yukhimchuk, A.V. Guljaeva, V.S. Salamatin, I. Sivachek, S.V. Stepansov	
8. Creation of a new gas-filled separator	A.G. Popeko	Preparation
FLNR	O.N. Malyshев, A.I. Svirikhin, A.V. Eremin, A.V. Isaev	
9. Development of the project of a separator based on resonance laser ionization	S.G. Zemlyanoy	Preparation
FLNR	V.I. Zhemenik, G.V. Myshinskiy, E.M. Kozulin, K.P. Marinova	
10. Design and creation of a pre-separator for radiochemical SHE studies	A.G. Popeko N.V. Aksenov	Preparation
FLNR	G.A. Bozhikov, A.V. Sabelnikov, Yu.V. Albin	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belgium	Leuven	KU Leuven
	Louvain-la-Neuve	IBA
Bulgaria	Sofia	LTD BAS
		INRNE BAS
CERN	Geneva	CERN
China	Lanzhou	IMP CAS
Czech Republic	Prague	VP
	Řež	CU
Democratic People's Republic of Korea	Yonbyon	NPI ASCR
Egypt	Cairo	IAASTMT
	Shibin al Kawm	CU
France	Caen	GANIL
	Grenoble	LPSC
	Orsay	IPN Orsay
	Vannes	SigmaPhi
	Strasbourg	IPHC
Germany	Darmstadt	GSI
Italy	Catania	INFN LNS
Kazakhstan	Almaty	INP
	Astana	BA INP

Mongolia	Ulaanbaatar	NRC NUM
Poland	Krakow	NINP PAS
	Warsaw	HIL WU
Romania	Bucharest	IEP WU
Russia	Moscow	IFIN-HH
		N&V
	Nizhny Novgorod	GPI RAS
	Novosibirsk	ITEP
	Sarov	IAP RAS
	St. Petersburg	BINP SB RAS
	Vladimir	VNIIEF
Serbia	Belgrade	NIIIEFA
Slovakia	Bratislava	ELMAG
South Africa	Cape Town	INS "VINČA"
Ukraine	Kiev	IP SAS
Uzbekistan	Samarkand	iThemba LABS
USA	College Station, TX	KINR NASU
	Livermore, CA	SSU
	Nashville, TN	Texas A&M
	Oak Ridge, TN	LLNL
		VU
		ORNL

03-5-1094-2010/2016

Priority:

1

Status: Approved for completion
in 2016

Synthesis and Properties of Nuclei at the Stability Limits

Leader: M.G. Itkis

Scientific leader: Yu.Ts. Oganessian

Participating Countries and International Organizations:

Belgium, Bulgaria, CERN, China, Czech Republic, Finland, France, Germany, Egypt, India, Italy, Japan, Kazakhstan, Mongolia, Poland, Romania, Russia, Slovakia, South Africa, Spain, Switzerland, Sweden, Ukraine, United Kingdom, USA.

Scientific Programme

Synthesis and investigation of the properties of nuclei at stability limits. Investigation of the mechanisms of heavy-ion-induced reactions. Study of physical and chemical properties of heavy and superheavy elements.

Expected main results in 2016:

- Conducting experiments on synthesis of new isotopes of element 118 as well as neutron-deficient isotopes of Fl and element 115 in reactions with ^{48}Ca ions.
- Preparation of the experiment aimed at detailed spectroscopy of the decay properties of the ^{288}Rf isotope and its daughter products, using the modernized separator VASSILISSA (SHELS) + GABRIELA. Conducting model experiments to study the decay properties of the Rf and Db isotopes.
- Preparation and conduct of experiments to study the chemical properties of element 113.
- Data acquisition during mass measurement of the ^{283}Cn isotope produced as a daughter product in the $^{48}\text{Ca} + ^{242}\text{Pu}$ reaction using the modernized mass separation system of the MASHA setup. Data acquisition on the mechanisms of complete fusion and multinucleon transfer reactions for nuclei close to the neutron shell closure $N = 126$ using mass-spectroscopic methods.
- Production and study of the properties of new neutron-rich heavy and superheavy nuclei in binary multi-nucleon transfer processes and quasi-fission. Data acquisition on the properties of nuclei at nucleon drip-lines. Study of multicluster decay of heavy and superheavy nuclei. Development of physical setups.
- Investigation of the structure of the exotic nuclei ^5H , ^{10}Li , ^{17}Ne , and ^{27}S using radioactive beams.
- Study of the properties of nuclear reactions with loosely bound cluster nuclei over a broad range of energies (5-25 A MeV). Measurement of individual reaction channel cross-sections leading to the formation of new nuclei at the drip-line. Manufacture of detectors for the high-resolution magnetic analyzer MAVR aimed to register nuclear reaction products.
- Theoretical studies of mechanisms of heavy-ion-induced reactions.
- Development of the knowledge base on nuclear physics accessible through the Internet.
- Investigation of shapes and sizes of exotic nuclei employing laser spectroscopy methods.

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
1. Synthesis of new isotopes of superheavy elements at DGFRS	V.K. Utyonkov	Data taking

FLNR

F.Sh. Abdullin, A.A. Voinov, A.M. Zubareva,
V.I. Krashonkin, A.N. Polyakov, R.N. Sagaidak,
V.G. Subbotin, A.M. Sukhov, Yu.S. Tsyanov,
I.V. Shirokovsky, M.V. Shumeiko

2. **α -, β - and γ - spectroscopy
of heavy nuclei at the modernized
VASSILISSA (SHELS) separator**

A.V. Yeremin

Data taking

FLNR

O.N. Malyshев, A.I. Svirikhin, I.N. Izosimov, V.I. Chepigin,
M.L. Chelnokov, A.V. Isaev, Yu.A. Popov, A.N. Kuznetsov,
A.A. Kuznetsova, A.G. Popeko, E.A. Sokol, D.E. Katrasev,
V.M. Popov, V.A. Sbitnev

3. **Chemical properties of superheavy
elements**

S.N. Dmitriev

Data taking

FLNR

N.V. Aksenov, V.Ya. Lebedev, Yu.V. Albin, G.A. Bozhikov,
V.I. Vakatov, M.G. Voronyuk, G.K. Vostokin, I. Zvara,
E.V. Krasnoyarova, Ch.G. Kim, K.V. Lebedev,
Z. Myanovska, O.V. Petrushkin, A.V. Rykhlyuk,
A.V. Sabelnikov, G.Ya. Starodub, E.E. Tereshatov

4. **Experiments at the magnetic
analyzer of superheavy atoms
MASHA**

A.M. Rodin

Data taking

FLNR

L. Krupa, A.V. Belozerov, E.V. Chernusheva,
V.Yu. Vedeneev, A.V. Guljaev, A.V. Guljaeva,
A.B. Komarov, S. Motychak, A.V. Podshibyakin,
V.S. Salamatin, I. Sivachev, S.V. Stepantsov,
A.S. Novoselov, S.A. Yukhimchuk

5. **Study of the processes of
fusion-fission, quasi-fission and
multinucleon transfer reactions.
CORSET-DEMON, CORSAR, and
MiniFOBOS setups**

M.G. Itkis

Data taking

FLNR

E.M. Kozulin, A.N. Baranov, A.A. Bogachev,
V.V. Volkov, Yu.M. Itkis, S. Ilic, E.M. Gazeeva,
G.N. Knyazheva, N.I. Kozulina, K.V. Novikov,
D.V. Kamanin, I.A. Alexandrova, A.A. Alexandrov,
V.E. Zhuchko, E.A. Kuznetsova, Yu.V. Pyatkov,
E.O. Savelieva, Yu.B. Semenov, O.N. Solodov,
A.O. Strekalovsky, O.V. Strekalovskiy, J.M. Harka

6. **Study of the structure of exotic
nuclei near and beyond the
drip-line at the ACCULINNA and
COMBAS fragment separators**

A.S. Fomichev

Data taking

FLNR	G.M. Ter-Akopian, M.S. Golovkov, L.V. Grigorenko, A.V. Gorshkov, V.A. Gorshkov, A.G. Knyazev, S.A. Krupko, A.A. Bezbakh, Yu.L. Parfenova, S.I. Sidorchuk, R.S. Slepnev, G. Kaminsky, V. Chudoba, R. Wolski, P.G. Sharov, S.A. Rimzhanova, S.G. Belogurov, Yu.M. Sereda, A.G. Artukh, A.N. Vorontsov, S.A. Klygin, G.A. Kononenko, D.A. Kislukha, N.A. Tarantin, E. Batchuluun
BLTP	S.N. Ershov, I.A. Egorova
7. Investigation of reactions induced by stable and radioactive ion beams leading to the formation of exotic nuclei	Yu.E. Penionzhkevich Data taking
FLNR	D.T. Aznabaev, E.A. Voskoboinik, M.P. Ivanov, S.M. Lukyanov, V.A. Maslov, K.O. Mendibaev, N.K. Skobelev, Yu.G. Sobolev, Z.D. Pokrovskaya, R.V. Revenko, V.I. Smirnov, D.A. Testov
8. Theoretical studies of nuclear reaction mechanisms	A.V. Karpov
FLNR	A.S. Denikin, V.V. Samarin, M.A. Naumenko, E.A. Cherepanov, Yu.A. Muzichka, V.A. Rachkov, V.V. Saiko
9. Development and maintenance of the knowledge base on nuclear physics accessible through Internet	A.V. Karpov A.S. Denikin Data taking
FLNR	V.V. Samarin, V.A. Rachkov, M.A. Naumenko, V.V. Saiko
10. Laser spectroscopy of isotopes	S.G. Zemlyanoy Data taking
FLNR	V.I. Zhemenik, G.V. Myshinskiy, K.P. Marinova

Collaboration

Country or International Organization	City	Institute or Laboratory
Belgium	Brussels	ULB
	Leuven	KU Leuven
Bulgaria	Sofia	INRNE BAS
CERN	Geneva	CERN
China	Beijing	PKU
	Lanzhou	CIAE
Czech Republic	Prague	IMP CAS
	Řež	VP
Egypt	Giza	CTU
	Shibin al Kawm	NPI ASCR
		CU
		MU

Finland	Jyväskylä	UJ
France	Caen	GANIL
	Orsay	CSNSM
	Saclay	IPN Orsay SPhN CEA DAPNIA
	Strasbourg	CRN IPHC
Germany	Berlin	HZB
	Darmstadt	GSI
	Frankfurt/Main	Univ.
	Tübingen	Univ.
	Mainz	JGU
India	Manipal	MU
	Calcutta	VECC
Italy	Catania	INFN LNS
	Legnaro	INFN LNL
	Messina	UniMe
	Naples	Unina
Japan	Tokai	JAEA
	Wako	RIKEN
Kazakhstan	Almaty	INP
	Astana	ENU
Mongolia	Ulaanbaatar	NRC NUM
Poland	Warsaw	UW
	Krakow	NINP PAS
	Poznan	AMU
Romania	Bucharest	IFIN-HH UB
Russia	Moscow	IPCE RAS MSU MUCTR NNRU “MEPhI” NRC KI SINP MSU
	Moscow, Troitsk	INR RAS
	Moscow, Zelenograd	RIMST
	Cheboksary	ChSU
	Dimitrovgrad	SSC RIAR
	Gatchina	PNPI
	Sarov	VNIIEF
	St. Petersburg	KRI IPTI RAS
	Voronezh	VSU
Slovakia	Bratislava	CU

		IP SAS
South Africa	Stellenbosch	SU
	Cape Town	iThemba LABS
	Pretoria	Unisa
Spain	Huelva	UHU
	Madrid	CSIC
Switzerland	Villigen	PSI
Sweden	Göteborg	Chalmers
Ukraine	Kiev	KINR NASU
United Kingdom	Manchester	UoM
USA	College Station, TX	Texas A&M
	East Lansing, MI	MSU
	Lemont, IL	ANL
	Livermore, CA	LLNL
	Nashville, TN	VU
	Oak Ridge, TN	ORNL

03-2-1100-2010/2018

Priority:

1

Status:

Extended

Non-Accelerator Neutrino Physics and Astrophysics

Leaders:

V.B. Brudanin
A. Kovalik
E.A. Yakushev

Participating Countries and International Organizations:

Armenia, Belgium, Bulgaria, Czech Republic, Finland, France, Germany, Kazakhstan, Mongolia, Poland, Romania, Russia, Slovakia, Ukraine, USA, United Kingdom, Uzbekistan.

Scientific Programme

Search for and investigation of double-neutrino and neutrinoless modes of double beta-decay, clarification of the neutrino nature Majorana or Dirac, absolute neutrino mass scale and hierarchies. Search for the neutrino magnetic moment and dark matter. Investigation of galactic and extragalactic neutrino sources, diffusive neutrino cosmic background, search for exotic particles (monopoles). Application of the neutrino detector for a distant investigation of process inside of the reactor core of Kalinin Nuclear Power Plant. Search for sterile neutrinos. Spectroscopy of nuclei far from stability. Development of new methods for charged and neutral particle detection.

Expected main results in 2016:

- Data taking in the $2\beta0\nu$ -decay measurements of ^{106}Cd , ^{82}Se , ^{150}Nd , ^{76}Ge with the SuperNEMO and GERDA spectrometers.
- Processing of experimental data and determination of $T_{1/2}(2\beta2\nu)$ for ^{48}Ca , ^{96}Zr , ^{130}Te , ^{116}Cd , ^{150}Nd , ^{82}Se and ^{76}Ge .
- Data taking with the GEMMA-II spectrometer at the Kalinin Nuclear Power Plant; getting an upper limit for the neutrino magnetic moment at the level of $\sim 2 \cdot 10^{-11} \mu_B$.
- Forty of FID800 detectors will cumulative fiducial mass 24 kg will be installed in the upgraded EDELWEISS setup. Data taking will be started in order to reach a WIMP-nucleon scattering cross-section sensitivity of $5 \cdot 10^{-45} \text{ cm}^2$.
- Research and development of the semiconductor-based detecting systems for the GERDA and MAJORANA experiments. Beginning of data taking in the experiment on the search for the ^{76}Ge $2\beta0\nu$ -decay.
- Deployment and extention of the first cluster “Dubna” at Baikal-GVD array. Data taking and extraction of physical results with the detector.
- Investigation of KLL and KMM Auger electrons in ^{65}Zn , ^{67}Cu , ^{67}Ga and $^{152,154,155}\text{Eu}$ decays.
- Design and creation of the low-threshold (~ 200 eV) HPGe detector. Production of low-background plastic scintillators for the SuperNEMO experiment.
- Design and creation of the reactor antineutrino detector DANSS. Start of data taking.

List of projects:

Project	Leader	Priority	(period of realization)
1. SuperNEMO	O.I. Kochetov	1	(2013 – 2018)
2. GEMMA-II	V.B. Brudanin	1	(2010 – 2018)
3. EDELWEISS-II	E.A. Yakushev	1	(2010 – 2018)

4. G&M (GERDA)	A.A. Smolnikov	1 (2010 – 2018)
5. BAIKAL	I.A. Belolaptikov	1 (2009 – 2018)
6. DANSS	V.B. Brudanin V.B. Brudanin V.G. Egorov	1 (2011 – 2018)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
1. SuperNEMO Project	O.I. Kochetov	R&D Data taking
DLNP	V.A. Bednyakov, D. Filosofov, V.E. Kovalenko, V.V. Timkin, V.I. Tretyak, F. Mamedov, I. Shermak, I.I. Kamnev, O.V. Vagina, D. Karaivanov, Yu. Shitov	
BLTP	F. Simkovic	
2. TGV Project	N.I. Rukhadze I. Shtekl	Data taking
DLNP	V.G. Sandukovsky, F. Mamedov, I. Shermak, S.L. Katulina	
BLTP	F. Simkovic	
3. G&M (GERDA–MAJORANA Project)	A.A. Smolnikov K.N. Gusev	Preparation Data taking
DLNP	V.G. Sandukovsky, V.B. Brudanin, A.A. Klimenko, A.V. Lubashevsky, D.R. Zinatulina, S.L. Katulina, N.S. Rumyantseva, E.A. Shevchik, I.V. Zhitnikov, I. Shermak	
BLTP	F. Simkovic	
4. GEMMA-II Project	V.B. Brudanin V.G. Egorov	Modernization Data taking
DLNP	D.V. Medvedev, N.S. Rumyantseva, M.V. Fomina, M.V. Shirchenko, A.S. Kuznetsov, E.A. Yakushev	
5. EDELWEISS-II Project	E.A. Yakushev	Data taking
DLNP	V.A. Bednyakov, S.V. Rozov, S.V. Fateev, L.L. Perevoshchikov, D.V. Filosofov, A.V. Lubashevsky	
6. BAIKAL Project	I.A. Belolaptikov V.B. Brudanin	Preparation Data taking
DLNP	V.G. Egorov, K.V. Konishev, V.P. Lomov, M.B. Milenin, A.V. Korobchenko, A.A. Perevalov, E.N. Pliskovski, A.I. Panfilov, B.A. Shaibonov, F.A. Shamakhov, M.V. Shirchenko, A.A. Klimenko, Z. Hons, I.E. Rozova, A.V. Salamatin, A.A. Smagina	

7. DANSS Project

V.B. Brudanin
V.G. Egorov

Preparation

DLNP

D.R. Zinatulina, E.A. Shevchik, I.V. Zhitnikov,
N.S. Rumyantseva, M.V. Fomina, V. Belov, A.S. Kuznetsov,
I.E. Rozova, M.V. Shirchenko

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU Foundation ANSL
Belgium	Leuven	KU Leuven
Bulgaria	Sofia	INRNE BAS
Czech Republic	Plovdiv	PU
	Prague	CTU
	Řež	NPI ASCR
Finland	Jyväskylä	UJ
France	Orsay	CSNSM LAL
	Bordeaux	CENBG
	Caen	UNICAEN
Germany	Heidelberg	MPIK
	Mainz	JGU
Kazakhstan	Almaty	INP
Mongolia	Ulaanbaatar	NRC NUM NEC
Poland	Krakow	NINP PAS AGH-UST
	Lublin	UMCS
	Otwock-Swierk	NCBJ
Romania	Bucharest	IFIN - HH UB
Russia	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Voronezh	VSU
	Moscow	NRC KI SC "VNIINM" NNRU "MEPhI"
		ITEP
		SINP MSU
		INTRA
		RADON
	Sarov	VNIIEF
	St. Petersburg	SPbSU IPTI RAS

	Tomsk	NPI TPU
Slovakia	Bratislava	IHCE SB RAS
Ukraine	Kiev	CU
	Kharkov	IEE SAS
USA	Irvine, CA	KINR NASU
	Austin, TX	ISC NASU
United Kingdom	London	UCI
	Manchester	UT
Uzbekistan	Tashkent	UCL
	Samarkand	UoM
		INP AS RUz
		IAP NUU
		SSU

03-2-1101-2010/2016

Priority:

1

Status:

Extended

Physics of Light Mesons

Leader:

A.V. Kulikov

Deputy:

Z. Tsamalaidze

Participating Countries and International Organizations:

Belarus, Bulgaria, Croatia, Canada, Czech Republic, Georgia, Germany, Italy, Poland, Romania, Russia, Switzerland, USA, Japan.

Scientific Programme

Investigation of strong, weak and electromagnetic interactions of elementary particles and light nuclei at intermediate energies with the aim of determining symmetries and dynamics of the interactions. Development and construction of setups for experiments at accelerators for obtaining new information and testing the present theoretical views in the topics. Development of projects for new experiments and experimental methods for intermediate-energy physics.

Expected main results in 2016:

- Processing of the experimental data for decays $\mu^+ \rightarrow e^+ \gamma$ and $\pi \rightarrow e\nu$.
- Measurements of spin observables at longitudinally and transversely polarized COSY beam. Development of the polarimeter for the experiment on search for electric dipole moment.
- Data taking and data processing for $p + t$ fusion reaction using the muon catalysis method.
- Determination of branching ratios for reaction channels of pion interactions with the helium nucleus at the JINR Phasotron.
- Study of the dynamic behavior of magnetic nanoparticles at the cobalt ferrites by the muon spin rotation technique.
- Experiments with the “Active Target” (GDH).
- Measurement of A_N for the inclusive and exclusive reactions $\pi^- p \rightarrow \omega (782)n$ and $\pi^- p \rightarrow \eta' (958)n$.
- R&D on thin-wall straw-tubes for experiment COMET. Development, production and tests of the straw detector and electromagnetic calorimeter prototypes with a beam.

List of projects:

Project	Leader	Priority (period of realization)
1. SPRING	A.V. Kulikov	1 (2010 – 2016)
2. GDH&SPASCHARM	Yu. Usov A. Kovalik	1 (2011 – 2016)
3. COMET	A.V. Kulikov Z. Tsamalaidze	1 (2014 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other Division of JINR Responsible person	Main researchers	
1. SPRING Project	A.V. Kulikov	Data taking Data analysis
DLNP	V.I. Komarov, Yu.N. Uzikov, A.D. Volkov, G. Macharashvili, N. Kadagidze, S.N. Dymov, V.V. Shmakova, T.I. Azaryan, V.S. Kurbatov, D.A. Tsirkov, M.V. Zhabitsky	
2. GDH&SPASCHARM Project	Yu. Usov A. Kovalik	Data taking Data processing
DLNP	N.S. Borisov, N.A. Bazhanov, A.N. Fedorov, Yu.A. Plis, A.B. Lazarev, A.B. Neganov, A.B. Sadovsky, I.V. Gapienko	
BLTP	S.B. Gerasimov, S.S. Kamalov	
3. COMET Project	A.V. Kulikov Z. Tsamalaidze	R&D Realization
DLNP	P.G. Evtukhovich, A.S. Moiseenko, G. Macharashvili, V.G. Kalinnikov, E.P. Velicheva, S.N. Dymov, V.V. Shmakova, A.D. Volkov, V.P. Volnykh, B.M. Sabirov, N. Tsverava, T. Toriashvili, I.L. Evtukhovich, Kh. Khubashvili, E.M. Kulish, M.V. Nikitin, A.G. Samartsev, V.N. Duginov, K.I. Gritsai	
LIT	A. Khvedelidze	
FLNP	A.A. Kustov	
BLTP	G.A. Kozlov	
VBLHEP	S.A. Movchan, S.N. Shkarovsky, V.V. Elsha, T.L. Enik	
4. Experiment MEG-PEN	N.A. Kuchinskiy	Data processing
DLNP	V.A. Baranov, V.A. Kalinnikov, N.V. Khomutov, A.S. Korenchenko, S.M. Korenchenko, N.P. Kravchuk, E.S. Kuzmin, A.S. Moiseenko, A.M. Rozhdestvensky, Z. Tsamalaidze, E.P. Velicheva, V.P. Volnykh, A.S. Khrykin	
BLTP	Yu.M. Bystritsky	
5. Experiment PAINUC	N.A. Russakovich G. Piragino	Data taking Data analysis
DLNP	G.B. Pontecorvo, V.I. Lyashenko, N.S. Angelov, I.A. Belolaptikov, T.D. Blokhintseva, V.N. Frolov, V.M. Grebenyuk, V.E. Kovalenko, A.S. Moiseenko, A.M. Rozhdestvensky, S.A. Gustov	
LIT	V.V. Ivanov	

LRB	V.A. Panyushkin	
VBLHEP	P.N. Batyuk	
6. Experiment MUON	V.N. Duginov	Data taking
	T.N. Mamedov	Data analysis
DLNP	E.I. Bunyatova, K.I. Gritsaj, A.I. Rudenko, G.D. Soboleva	
FLNP	M. Balasoiu + 2 pers.	
7. Experiment TRITON	D.L. Demin	Data analysis
DLNP	A.M. Artikov, N.S. Azaryan, N.A. Baranova, A.I. Boguslavsky, V.P. Volnykh, K.I. Gritsaj, V.N. Duginov, V.I. Kolomoets, A.D. Konin, A.P. Kustov, N.N. Kashirina, T.N. Mamedov, A.I. Puzynin, A.I. Rudenko, A.V. Simonenko, Yu.A. Polyakov, S.A. Gustov, N.A. Shakun, E.V. Kolesov, V.I. Smirnov, E.D. Gorodnichev	
FLNR	S.A. Yukhimchuk	
LRB	V.B. Buchnev, V.Yu. Schegolev	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	NC PHEP BSU BSU IP NASB INP BSU
Bulgaria	Sofia	SU
Czech Republic	Prague	CU
	Řež	NPI ASCR
France	Saclay	IRFU
Croatia	Zagreb	RBI
Canada	Vancouver	TRIUMF
Georgia	Tbilisi	HEPI-TSU
Germany	Aachen	RWTH
	Heidelberg	Univ.
	Jülich	FZJ
	Cologne	Univ.
	Dresden	HZDR
	Mainz	JGU
	Münster	Univ.
	Stuttgart	MPI-MF
Italy	Frascati	INFN LNF
	Ferrara	Unife
	Rome	Univ. "La Sapienza"
	Turin	INFN

Japan	Kyoto Osaka Tsukuba	Kyoto Univ. Osaka Univ. KEK
Poland	Krakow Otwock-Swierk	NINP PAS NCBJ
Romania	Bucharest Timișoara	IFIN - HH CCTFA
Russia	Alexandrov Gatchina Dolgoprudny Moscow	VNIISIMS PNPI MIPT ITEP GPI RAS SINP MSU NRC KI INR RAS
Switzerland	Moscow, Troitsk Sarov Zurich Villigen	VNIIEF UZH PSI
USA	Charlottesville, VA Pittsburgh, PA Tucson, AZ	UVa Pitt UA

03-2-1102-2010/2018

Priority:

1

Status:

Extended

Improvement of the JINR Phasotron and Design of Cyclotrons for Fundamental and Applied Research

Leaders: G.A. Karamysheva

Scientific leader: S.L. Yakovenko

L.M. Onischenko

Participating Countries and International Organizations:

Belgium, China, Poland, Japan, Uzbekistan.

Scientific Programme

Improvement of the JINR Phasotron and beam channels. Design of the cyclotrons for medical purposes. Development of the cyclotron method for high-current beam acceleration.

Expected main results in 2016:

- Modernization of the automated beam channel control system of JINR Phasotron.
- Carrying out simulation and experimental works on AIC-144 cyclotron increase of the beam extraction factor. Participation in the development of the magnets for the beam transport line to the cabin of the eye melanoma therapy.
- Development of conceptual project superconducting cyclotron for the proton therapy.
- Study of nonscaling FFAG accelerator for obtaining high current beams for medical application.

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Improvement of the JINR Phasotron and beam channels	S.L. Yakovenko N.G. Shakun L.M. Onischenko	Realization
DLNP	A.S. Vorozhtsov, S.B. Vorozhtsov, S.A. Gustov, G.A. Kononenko, N.A. Morozov, I.V. Mirokhin, Yu.A. Polyakov, V.I. Smirnov, E.V. Samsonov, V.M. Romanov, V.A. Utkin	
2. Design and modernization of the cyclotrons for medical purpose	G.A. Karamysheva N.A. Morozov	Technical proposal
DLNP	A.S. Vorozhtsov, S.V. Gursky, S.B. Vorozhtsov, S.N. Dolya, O.V. Karamyshev, R.V. Galkin, D.S. Petrov, O.E. Lepkina, O.V. Lomakina, S.G. Shirkov, N.L. Zaplatin, G.G. Kazakova, I.N. Kiyan, V.M. Romanov, E.V. Samsonov, V.G. Sazonov, A.F. Sazonov, I.M. Sedyh	
LIT	I.V. Amirkhanov	

3. Research and development of the superconducting cyclotron for proton therapy for IPP CAS, Hefei, China	G.D. Shirkov	R&D
DLNP	R.V. Galkin, S.V. Gursky, O.V. Karamyshev, I.N. Kiyan, O.E. Lepkina, O.V. Lomakina, N.A. Morozov, E.V. Samsonov, A.F. Chesnov	
VBLHEP	A.S. Kostromin	
4. Development of the cyclotron method for high-current beam acceleration	L.M. Onischenko S.B. Vorozhtsov	Technical proposal
DLNP	A.S. Vorozhtsov, N.L. Zaplatin, E.V. Samsonov, V.L. Smirnov, V.M. Romanov, E.A. Saprykin	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belgium	Louvain-la-Neuve	IBA
China	Hefei	IPP CAS
Poland	Krakow	NINP PAS
Uzbekistan	Tashkent	INP AS RUz

03-4-1104-2011/2016

Priority:

1

Status: Approved for completion
in 2016

Investigations in the Field of Nuclear Physics with Neutrons

Leader: V.N. Shvetsov
Deputies: Yu.N. Kopatch
E.V. Lychagin
P.V. Sedyshev

Participating Countries and International Organizations:

Albania, Australia, Austria, Belarus, Belgium, Bulgaria, CERN, China, Croatia, Czech Republic, Egypt, Finland, France, Georgia, Germany, Hungary, Italy, Japan, Kazakhstan, Macedonia, Moldova, Mongolia, Norway, Poland, Republic of Korea, Romania, Russia, Serbia, Slovakia, Slovenia, South Africa, Switzerland, Thailand, Turkey, Ukraine, USA, Vietnam.

Scientific Programme

Experimental and theoretical investigations aimed at studying fundamental properties of the neutron, symmetry breaking effects in neutron-induced reactions, and fundamental interactions of neutrons with nuclei. Application of neutron physics methods in other fields of science and technology. Development and construction of detectors of neutrons and other ionizing radiation, as well as applied methods in nuclear physics with neutrons. Development of the Intense REsonance Neutron Source (IREN) and of the experimental base at the IREN and IBR-2 facilities.

Expected main results in 2016:

Development of the IREN source:

- Commissioning of the second section of the LUE-200 accelerator with the modulator DAWONSYS and clystron TH2129 Thomson.
- Trial operation of the accelerator consisting of two accelerating sections with a beam at a frequency of 25 - 50 Hz .
- Providing the neutron beam time of 1000 hours from IREN for physical experiments.
- Modernization of experimental beamline 4 (flight path 60 m) of the IREN facility.

Fundamental investigations of nuclear reactions with neutrons:

- Measurement of T-odd effects in the low-lying resonance of ^{235}U .
- Measurement of angular correlations of the gamma-ray emission in inelastic scattering of neutrons by various elements in the framework of the TANGRA project.
- Investigation of reactions $^{25}\text{Mg}(n,\alpha)^{22}\text{Ne}$, $^{91}\text{Zr}(n,\alpha)^{88}\text{Sr}$ and $^{144}\text{Nd}(n,\alpha)^{141}\text{Ce}$ for neutron energies $E_n = 5 - 6.5$ MeV at the facilities EG-5 (FLNP JINR) and EG-4.5 (Institute of High Energy Physics of the Chinese Academy of Sciences). Measurements of the reactions (n,p) and (n, α) for ^{35}Cl and ^{14}N in the energy range of 0.1 – 1 and 4 – 6.5 MeV.
- Commissioning of the data acquisition system based on the PIXIE-4 module for the alpha spectrometer.
- Measurement of the P-odd correlation in the reaction $^{10}\text{B}(n,\alpha)^7\text{Li}$ with an accuracy of 3×10^{-8} .
- Development and construction of a position-sensitive ionization chamber with 32-channel analog electronics; performing of test experiments at IBR-2. Development of a double ionization chamber with a Frisch grid for measurements of spectra and multiplicities of prompt fission neutrons in the reaction $^{235}\text{U}(n,f)$ at IBR-2 and IREN.

- Measurement of proton yields and energy distributions in the ternary fission of ^{252}Cf .
- Determination of parameters of the ferromagnetic neutron resonator for neutron energies of 0.062 – 1.3 eV. Measurement of the nuclear precession for protons.
- Completion of the analysis of experimental data from the experiment performed in Dalat (Vietnam) aimed at studying two-step cascades in thermal neutron capture by an Yb-171 target. Determination of the Cooper pair breaking threshold using the developed practical model of cascade gamma-decay.
- Determination of the main characteristics of the massive natural uranium target “Quinta” irradiated by deuterons with energies of 1-8 GeV.

Investigation of fundamental properties of the neutron, UCN physics:

- Detailed test of the dynamical theory of neutron diffraction on a moving grating as a methodical basis of the experiment for testing the equivalence principle for the neutron.
- Experimental determination of characteristics of resonance transitions between quantum states of neutrons in the gravitational field of the Earth using the GRANIT spectrometer.
- Establishing of a constraint on the product of coupling constants of scalar and pseudoscalar axion-like interaction at the level of 10^{-16} for distances $\sim 10 \mu\text{m}$ on the GRANIT spectrometer.
- Experimental investigation of the properties of different hydrogen- free oil coatings to determine the optimum trap coating material in the neutron lifetime measurement setup being developed.

Applied research:

- Analysis of the boron content in new composite materials by neutron spectroscopy at the IREN facility.
- Comparative analysis of the sensitivity of different non-destructive methods of elemental analysis.
- Investigation of surface layers using Elastic Recoil Detection method and Rutherford Backscattering Spectrometry.
- Mathematical and physical modeling and calibration of neutron and gamma detectors for spacecrafts.
- Development of a new control system for the pneumatic REGATA facility. Improvement of hardware and software for automation of the neutron activation analysis for the REGATA facility at the IBR-2 reactor. Creating a database of nuclear constants for calculation of absolute concentrations of elements using the absolute method in addition to the present relative method of calculation of concentrations.
- Participation in the UN Program on air quality in Europe - simultaneous collection of moss-biomonitoring and performing neutron activation analysis on a series of samples from the regions of Russia, Europe and Asia. Application of NAA in bionanotechnology, ecology, medicine and the development of novel materials within Russian and international projects.

List of projects:

Project	Leader	Priority (period of realization)
1. TANGRA	Yu.N. Kopatch Deputy: V.M. Bystritsky (DLNP)	1 (2014 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other Division of JINR	Main researchers	
1. Development of the IREN facility	V.N. Shvetsov	Upgrade
FLNP	V.G. Pjataev, V.A. Egorov, + 13 engineers, + 1 workers	
VBLHEP A.P. Sumbaev	V.V. Kobets, V.F. Minashkin, V.G. Shabratov, V.N. Zamrij, A.N. Skrypnik, J. Betscher	
DLNP	I.N. Meshkov	
2. Development of the beam infrastructure of IREN	V.N. Shvetsov	Upgrade
FLNP	V.G. Pjataev, A.A. Belyakov, P.V. Sedyshev, V.A. Trepalin, + 10 engineers	
3. Fundamental investigations of nuclear reactions with neutrons	Yu.N. Kopatch	Upgrade Data taking Data analysis
FLNP	G.S. Ahmedov, N.V. Bazjazjina, S.B. Borzakov, Vu Dyk Kong, Vu Dyk Fu, G.V. Daniljan, Ju.M. Gledenov, D.N. Grozdanov, N.A. Gundorin, Sh.S. Zeynalov, A.P. Kobzev, D. Mahajdik, M. Kulik, Zh.V. Mezentseva, V.V. Novitsky, I.A. Oprea, K.D. Oprea, L.B. Pikel'ner, Yu.N. Pokotilovskij, I.N. Ruskov, P.V. Sedyshev, M.V. Sedysheva, V.R. Skoj, A.M. Suhovoj, S.A. Telezhnikov, V.A. Hitrov, M. Tsulaja, Czan Tzjanfu, + 16 engineers, + 2 workers	
LIT	O.V. Zeynalova	
DLNP	V.A. Stolupin	
4. Investigation of the fundamental properties of the neutron, UCN physics	E.V. Lychagin	Upgrade Data taking Data analysis
FLNP	G.G. Bunatyan, S.V. Goryonov, V.K. Ignatovich, G.V. Kulin, D. Kustov, L.V. Mitsyna, A.Yu. Muzychka, Yu.N. Pokotilovskij, A.B. Popov, A.V. Strelkov, A.I. Frank, W.I. Furman, E.I. Sharapov, T.L. Enik, S.V. Gorunov, + 1 engineer	
5. Applied research	P.V. Sedyshev	Upgrade Data taking Data analysis

FLNP M.V. Frontasyeva, S.S. Pavlov, Yu.V. Alekseenok,
Sh. Allaybeu, A.S. Vasilev, K.N. Vergel, Z.I. Gorjajnova,
A.Ju. Dmitriev, I.I. Zinikovskaja, O.F. Culikov,
A. Madadzade, P.S. Nekhoroshkov, A.V. Kravtsova,
Doan Fan Thao Tien, G.Y. Khristozova, G.S. Ahmedov,
N.V. Bazjazjina, S.B. Borzakov, Vu Dyk Kong,
Vu Dyk Fu, Ju.M. Gledenov, N.A. Gundorin,
Sh.S. Zeynalov, A.P. Kobzev, Yu.N. Kopatch, M. Kulik,
D. Mahajdik, D.V. Magilin, Zh.V. Mezentseva,
V.V. Novitsky, I.A. Oprea, K.D. Oprea, L.B. Pikel'ner,
I.N. Ruskov, M.V. Sedysheva, V.R. Skoj, A.M. Suhovoj,
S.A. Telezhnikov, W.I. Furman, V.A. Hitrov, M. Tsulaja,
A. Sijabekov, G.V. Daniljan, + 24 engineers, + 5 workers

6. Project TANGRA

Yu.N. Kopatch

Upgrade
Data taking
Data analysis

FLNP

S.B. Borzakov, N.A. Gundorin, P.A. Dubasov,
Sh.S. Zeinalov, A.O. Zontikov, I.A. Oprea, K.D. Oprea,
L.B. Pikelner, A.V. Rogachev, P.V. Sedyshev, U.R. Skoi,
U.N. Shvetcov

VBLHEP

U.Yu. Aleksakhin, U.I. Zamjatin, E.U. Zubarev,
U.L. Rapackii, Yu.N. Rogov, R.A. Salmin,
M.G. Sapozhnikov, U.V. Slepnev, S.U. Khabarov

DLNP

U.M. Bystritskii, A.U. Krasnoperov, A.U. Sadovskii,
A.U. Salamatin

LRB

A.R. Krylov, G.N. Timoshenko

Collaboration

Country or International Organization	City	Institute or Laboratory
Albania	Tirana	UT
Australia	Melbourne	Univ.
Austria	Vienna	IAEA
	Innsbruck	Univ.
Belarus	Minsk	INP BSU SPMRC NASB
Belgium	Geel	IRMM
Bulgaria	Sofia	INRNE BAS
	Plovdiv	PU UFT
CERN	Geneva	CERN
China	Beijing	IHEP CAS
Croatia	Zagreb	RBI Oikon IAE
Czech Republic	Prague	CEI CTU
	Ostrava	VSB-TUO

Egypt	Alexandria	UO
	Cairo	Univ.
	Shibin al Kawm	EAEA
Finland	Jyväskylä	MU
	Oulu	UJ
France	Cadarache	UO
	Grenoble	CC CEA
		ILL
		LPSC
	Saclay	LLB
	Strasbourg	IPHC
Georgia	Tbilisi	AIP TSU
		TSU
Germany	Darmstadt	TU Darmstadt
	Dresden	HZDR
	Mainz	JGU
	Munich	TUM
	Tübingen	Univ.
Hungary	Budapest	RKK OU
Italy	Rome	ENEA
Japan	Kyoto	KSU
	Tsukuba	KEK
Kazakhstan	Almaty	INP
	Astana	ENU
	Ust-Kamenogorsk	TRCE
Macedonia	Skopje	UKiM
Moldova	Chișinău	IMB ASM
		IC ASM
Mongolia	Ulaanbaatar	CGL
		NRC NUM
Norway	Trondheim	NTNU
Poland	Gdansk	GUT
	Krakow	NINP PAS
	Lodz	UL
	Lublin	UMCS
	Opole	UO
	Otwock-Swierk	NCBJ
	Poznan	AMU
	Wroclaw	UW
Republic of Korea	Pohang	PAL
	Seoul	Dawonsys
	Taejon	KAERI
Romania	Bucharest	IFIN-HH
		ISS
		UB

	Baia Mare	TUCN-NUCBM
	Constanța	NIMRD
	Galați	UOC
	Iași	UG
	Oradea	UAIC
	Pitești	UO
	Râmnicu Vâlcea	SCN
	Târgoviște	I.C.S.I.
Russia	Moscow	UVT
		Atomenergomach
		GIN RAS
		IKI RAS
		IPCE RAS
		ITEP
		MSU
		NRC KI
		SINP MSU
		GPI RAS
	Moscow, Troitsk	INR RAS
	Borok	IBIW RAS
	Dubna	Dubna Univ.
	Gatchina	PNPI
	Irkutsk	LI SB RAS
	Ivanovo	ISUCT
	Izhevsk	UdSU
	Obninsk	IPPE
	Snezhinsk	VNIITF
	St. Petersburg	Botanic garden BIN RAS FIP SPSFTU Hermitage KRI
	Sevastopol	IBSS
	Tomsk	NPI TPU
	Tula	TSPU
	Voronezh	VSU
	Yekaterinburg	UrFU
Serbia	Belgrade	IPB Univ.
	Novi Sad	UNS
Slovakia	Bratislava	IP SAS IEE SAS ILE SAS CU

Slovenia	Ljubljana	GeoSS
South Africa	Pretoria	Unisa
	Stellenbosch	SU
	Bellville	UWC
Switzerland	Villigen	PSI
Thailand	Hat Yai	PSU
Turkey	Çanakkale	ÇOMU
Ukraine	Kiev	KINR NASU NUK
	Donetsk	DonIPE NASU
	Sumy	IAP NASU
	Uzhgorod	IEP NASU
	Kharkov	ISMA NASU KFTI
Vietnam	Hanoi	IOP VAST VNU
USA	Durham, NC	Duke
	Gettysburg, PA	GC
	Kingston, RI	URI
	Los Alamos, NM	LANL
	Oak Ridge, TN	ORNL

Condensed
Matter Physics,
Radiation
and Radiobiological
Research
(04)

04-4-1121-2015/2017

Priority:

1

Status:

In-progress

Investigations of Condensed Matter by Modern Neutron Scattering Methods

Leaders:

D.P. Kozlenko
V.L. Aksenov
A.M. Balagurov

Participating Countries and International Organizations:

Argentina, Azerbaijan, Belarus, Bulgaria, Czech Republic, Egypt, France, Germany, Hungary, Italy, Japan, Kazakhstan, Latvia, Moldova, Mongolia, Norway, Poland, Romania, Russia, Serbia, Slovakia, Spain, South Africa, Switzerland, Taiwan, Tajikistan, Ukraine, United Kingdom, Uzbekistan, Vietnam.

Scientific Programme

Investigations of structure, dynamics and microscopic properties of novel materials and nanosystems, interesting for fundamental research in the fields of condensed matter physics, chemistry, materials science, geophysics, and important for the development of nanotechnologies in the fields of electronics, pharmacology, medicine by neutron scattering and complimentary methods.

Expected main results in 2016:

Realization of the scientific program:

- Determination of parameters of atomic and magnetic structure of bulk and nanostructured functional materials demonstrating interesting physical phenomena and being promising for technological applications in a wide range of thermodynamic parameters; exploration of the role of cluster aggregation in the formation of physical properties.
- Analysis of nanoscale effects on structural and magnetic properties of colossal magnetoresistance manganites.
- Determination of atomic and magnetic structure parameters of oxide multiferroics.
- Revealing of structural modifications of electrodes of compact electric current sources during charging/discharging processes.
- Analysis of magnetic properties and proximity effects in magnetic layered nanostructures in constant and variable magnetic fields.
- Comparative analysis of structural aspects of stabilization of disperse systems and complex liquids with nonmagnetic and magnetic nanoparticles in bulk and interface boundaries.
- Determination of structural characteristics of nanosystems based on compositional C- and Si-containing materials.
- Determination of structural characteristics of magnetic elastomers and carbosilane dendrimers holding promise for technological applications.
- Determination of atomic structure and vibrational spectra of molecular complexes: ionic-molecular inclusive materials and complexes with electric charge transfer, structural and dynamical parameters of hydrogen bonding in bioactive materials.
- Determination of structural and functional characteristics of biological nanosystems.
- Determination of structural characteristics of lipid nanosystems modeling upper skin layer of human and mammal animals in order to study the transport of pharmacological drugs through the skin.

- Determination of regularities of occurrence of instability of rocks under high temperatures and pressures, in particular, during polymorphic phase transition for the development of models of the processes in the earthquake focus.
- Analysis of metamorphic, geodynamic and evolution processes in the lithosphere using the data about the texture of deep and near-surface earth rocks. Exploration of seismic anisotropy origin.
- Development of solid polycrystalline material models for prediction of their elastic, strength and thermal properties taking into account texture, inclusions, pores and microcracks.
- Determination of residual stresses in engineering materials of nuclear reactors, industrial materials and products – composites, reinforced systems, metalloceramics, shape memory alloys.
- Elaboration of radiation damage mechanisms of solid-state materials, obtaining of long-life operating data on radiation resistance of materials.

Realization of the instrument development program for the IBR-2 spectrometers:

- Creation of the final configuration of the DN-6 diffractometer and relevant infrastructure (detector system, mechanical units, set of high-pressure cells, infrastructure for loading pressure cells).
- Creation of the final configuration of the multifunctional reflectometer GRAINS (polarizing system, mechanical part and sample unit).
- Modernization of the available IBR-2 spectrometers (HRFD, YuMO, FSD, REFLEX, REMUR, NERA, SKAT, EPSILON, DIN-2PI) aimed at improving their instrumental parameters (neutron counting rate, background conditions, and extension of experimental opportunities).
- Completion of the reconstruction of the high-intensity DN-2 diffractometer into a real-time diffractometer (RTD).
- Creation of the test configuration of the small-angle spin-echo spectrometer on IBR-2 beamline 9.
- Creation of the basic configuration of the neutron radiography and tomography spectrometer on IBR-2 beamline 14.
- Installation and adaptation of the correlation spectrometer FSS (transported from HZG, Germany, via PNPI) to methodological and research activities on IBR-2 beamline 13.
- Development and testing of neutron scattering methods for condensed matter research including spin-echo, neutron standing waves, neutron magnetic resonance, radiography, tomography, etc.

List of projects:

Project	Leader	Priority (period of realization)
1. IINR	Yu.V. Nikitenko Deputy: N.A. Gundorin	1 (2015 – 2018)

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. Study of structure and properties of novel functional materials	A.M. Balagurov D.P. Kozlenko	Data taking

FLNP	A.I. Beskrovnyi, B.N. Savenko, E.B. Askerov, I.A. Bobrikov, E.V. Ermakova, N.O. Golosova, S.E. Kichanov, M.L. Craus, E.V. Lukin, A.I. Madadzada, G.M. Mironova, D.T. Neov, T.T. Nguen, A. Pawlukojc, A.V. Rutkauskas, N.Yu. Samoylova, S.G. Sheverev, V.A. Turchenko, U. Enhnaran, M.T. Vu	
2. Study of structure and properties of D.P. Kozlenko materials under extreme conditions		Data taking
FLNP	S.E. Kichanov, B.N. Savenko, E.V. Lukin, A.V. Rutkauskas, M.T. Vu, T.T. Nguen	
3. Study of fundamental regularities of real time processes in condensed matter	A.M. Balagurov	Data taking
FLNP	A.I. Beskrovnyi, I.A. Bobrikov, O.Yu. Ivanshina, G.M. Mironova, N.Yu. Samoylova, V.G. Simkin, U. Einhnaran, S.G. Sheverev	
4. Computer modeling of physical and chemical properties of novel crystalline and nanostructured materials	A. Pawlukojc	Data taking
FLNP	K.S. Druzicki, V.Yu. Kazimirow, K.M. Luczynska, J.M. Nowicka-Scheibe, D.M. Chudoba	
5. Study of magnetic properties of layered nanostructures	Yu.V. Nikitenko	Data taking
FLNP	S.V. Kozhevnikov, E.B. Dokukin, V.D. Zhaketov	
6. Study of structural characteristics of carbon- and silicon-based nanomaterials	V.L. Aksenov	Data taking
FLNP	T.V. Tropin, O.A. Kizima, A.A. Tomchuk, Zh. Narmandah	
7. Investigation of structure and molecular dynamics of biologically active materials and molecular ionic crystals	D.M. Chudoba	Data taking
FLNP	P. Bilski, K.S. Druzicki, E. Goremychkin, K.M. Luczynska, M. Ordon, A. Pawlukojc, I.L. Sashin, A. Filarowski	
8. Study of dispersed systems and complex liquids in bulk and at interface boundaries	M.V. Avdeev	Data taking
FLNP	V.I. Petrenko, K.T. Kholmurodov, A.V. Nagornyi, A.V. Tomchuk, I.V. Gapon	
9. Structural characterization of polymer nanodispersed materials	M. Balasoiu	Data taking
FLNP	A.I. Kuklin, A.Kh. Islamov, O. Ivan'kov, D.V. Solovyev, A.V. Rogachev	

10. Study of supramolecular structure and functional characteristics of biological materials	A.I. Kuklin	Data taking
FLNP	A.Kh. Islamov, T.N. Murugova, M. Balasoiu, A. Raewska, Yu.E. Gorshkova, O. Ivan'kov, R.V. Erhan, D.V. Solovyev, Yu.S. Kovalev, A.V. Rogachev	
LIT	D.V. Solovyev, T.V. Solovyeva	
11. Study of structure and properties of lipid membranes and lipid complexes	M.A. Kiselev	Data taking
LIT	E.V. Zemlyanaya, E.I.Zhabitskaya	
12. Study of texture and physical properties of Earth's rocks, minerals and engineering materials	Ch. Scheffzuek D.I. Nikolaev	Data taking
FLNP	R.N. Vasin, T.I. Ivankina, V.V. Sikolenko, T.A. Lychagina, I.Yu. Zel', B. Altangerel	
13. Non-destructive control of residual stresses in industrial products and engineering materials	G.D. Bokuchava	Data taking
FLNP	V.V. Sumin, R.N. Vasin, I.V. Papushkin, A.A. Kruglov, A.V. Tamonov, B. Muhametuly, Yu.V. Taran, D.M. Levin	
14. Neutron imaging of internal structure of industrial products, rocks and natural heritage objects	D.P. Kozlenko G.D. Bokuchava	Data taking
FLNP	B.N. Savenko, S.E. Kichanov, E.V. Lukin, A.V. Rutkauskas	
15. Study of radiation damage effects in condensed matter by X-ray spectroscopy	S.I. Tyutyunnikov (VBLHEP)	Data taking
VBLHEP	V.N. Shalyapin, V.V. Efimov, E.A. Efimova, Yu.S. Kovalev, A.V. Rogachev, N.I. Zamyatin, I.A. Kryachko	
16. Development of neutron scattering methods for interdisciplinary studies of nanosystems and materials	V.I. Bodnarchuk G.D. Bokuchava D.P. Kozlenko	Data taking
FLNP	S.V. Kozhevnikov, Yu.V. Nikitenko, S.P. Yaradaikin, S.E. Kichanov, E.V. Lukin	
17. Development of the IBR-2 spectrometer complex	A.M. Balagurov D.P. Kozlenko	Realization
FLNP	M.V. Avdeev, A.I. Beskrovnyi, I.A. Bobrikov, A.I. Kuklin, V.I. Bodnarchuk, D.M. Chudoba, A.S. Doroshkevich, Yu.V. Nikitenko, A.V. Petrenko, B.N. Savenko, I.L. Sashin, V.G. Simkin, V.I. Sukhanov, G.D. Bokuchava, Ch. Scheffzuek	

Collaboration

Country or International Organization	City	Institute or Laboratory
Argentina	Bariloche	CAB CNEA
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	IAP NASB INP BSU NC PHEP BSU SPMRC NASB RI PCP BSU
Bulgaria	Sofia	IE BAS IEES BAS IMS BAS INRNE BAS ISSP BAS
Czech Republic	Prague	CTU IG ASCR IMC ASCR IP ASCR
	Řež	NPI ASCR
Egypt	Cairo	EAEA
	Cairo	CU
France	Saclay	LLB
	Grenoble	IBS
Germany	Berlin	HZB BAM
	Bayreuth	Univ.
	Bochum	RUB
	Darmstadt	TU Darmstadt
	Dortmund	TU Dortmund
	Dresden	TU Dresden
	Göttingen	Univ.
	Geesthacht	GKSS
	Halle	MLU
	Hamburg	DESY
	Freiberg	TUBAF IMF TUBAF
	Jülich	FZJ
	Karlsruhe	KIT
	Kiel	CAU
		IFM-GEOMAR
	Leipzig	UoC
	Potsdam	GFZ
	Rostock	Univ.
	Stuttgart	MPI-FKF

Hungary	Budapest Szeged	Wigner RCP US
Japan	Nagano Minato	Shinshu Univ. Keio Univ.
Italy	Trento	UniTn
Latvia	Riga	ISSP UL
Moldova	Chișinău	lPE IC ASM IMB ASM
Kazakhstan	Rudny	RII
Mongolia	Ulaanbaatar	IPT MAS MUST
Norway	Trondheim	NGU
Poland	Warsaw Krakow Lublin Olsztyn Poznan Siedlce Szczecin Wroclaw	INCT JU NINP PAS UMCS UWM AMU UPH WPUT WUT UW
Romania	Bucharest Baia Mare Constanța Craiova Cluj-Napoca Iași Pitești Timișoara	IFIN-HH INCDIE ICPE-CA NIMP ISS UB UPB UMF UTM TUCN-NUCBM UOC UC INCDTIM RA BC-N UBB NIRDTP UAI UAIC SCN LMF CCTFA UPT UVT
Russia	Moscow	GC RAS

	IBMC
	IC RAS
	IEPT RAS
	IGEM RAS
	IGIC RAS
	IMET RAS
	INMI RAS
	IPCE RAS
	ITEP
	IPE RAS
	ISPM RAS
	NNRU “MEPhI”
	MIET
	MITHT
	MSU
	NIKIET
	NRC KI
	SINP MSU
	SC “VNIINM”
Moscow, Troitsk	HPPI RAS
	ISAN
	INR RAS
Belgorod	BelSU
Dolgoprudny	MIPT
Chernogolovka	ISSP RAS
Gatchina	PNPI
Kazan	KNRTU
Krasnoyarsk	SibFU
Nizhny Novgorod	UNN
	IPM RAS
Obninsk	IPPE
Perm	ICMM UrB RAS
	ITCh UrB RAS
Petrozavodsk	IG KRS RAS
Podolsk	GIDROPRESS
Rostov-on-Don	RIP SFU
St. Petersburg	IPTI RAS
	SPbSU
Sterlitamak	SSPA
Tomsk	NPI TPU
Tula	TSU
Yekaterinburg	IMP UB RAS
	UrFU
Serbia	INS “VINČA”
Belgrade	UNS
Novi Sad	

Slovakia	Bratislava	CU
	Košice	IEP SAS
South Africa	Pretoria	Necsa
Spain	Madrid	CENIM-CSIC
Switzerland	Villigen	PSI
	Zurich	ETH
Tajikistan	Dushanbe	IChem ASRT
Taiwan	Hsinchu	NSRRC
Ukraine	Kiev	IPMS NASU NUK ISC NASU
	Donetsk	DonNU DonIPE NASU
	Kharkov	IERT NASU KFTI
United Kingdom	Didcot	RAL
Uzbekistan	Tashkent	INP AS RUz
Vietnam	Hanoi	IOP VAST
	Da Nang	DTU

04-4-1105-2011/2016

Priority:

1

Status: Approved for completion
in 2016

Development of the IBR-2 Facility with a Complex of Cryogenic Neutron Moderators

Leaders:

A.V. Belushkin
A.V. Vinogradov

Participating Countries and International Organizations:

Azerbaijan, Mongolia, Poland, Romania, Russia, United Kingdom, USA.

Scientific Programme

The theme main task is to increase the efficiency of use of the IBR-2 facility for realization of the program of experimental investigations, maintenance of operational reliability and safety of the reactor, creation of a complex of cryogenic neutron moderators.

Expected main results in 2016:

- Maintenance of the IBR-2 reactor operation for physical investigations.
- Manufacturing of a reserve movable reflector MR-3R (with the extension of work through 2018).
- Construction of a test stand of a cryogenic moderator CM-201.
- Step-by-step replacement and upgrading of the technological and electrical equipment in accordance with the Rostechnadzor license requirements.

List of projects:

Project	Leader	Priority (period of realization)
1. Construction of a Complex of Cryogenic Moderators at the IBR-2 Facility	A.A. Belyakov	1 (2014 – 2016)

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. Regular operation of the IBR-2 facility FLNP	A.V. Dolgikh A.V. Vinogradov A.A. Belyakov, S.A. Tsarenkov, V.G. Ermilov, S.V. Rudenko, Yu.N. Pepelyshev, V.A. Trepalin, + 30 engineers, + 50 workers	Realization
2. Maintenance of the program of physical investigations FLNP	V.D. Ananiev A.V. Vinogradov A.V. Dolgikh A.A. Belyakov, Yu.N. Pepelyshev, V.A. Trepalin, S.V. Rudenko, + 30 engineers, + 50 workers	Realization

3. Experiments on a test stand of the cryogenic moderator CM-201. Development of a project, production and installation of the new cryogenic moderator CM-201 (with the extension of work to 2017). Design study of the cryogenic moderator CM-203. Mastering of the equipment of cryogenic moderators using a new cryogenic facility by "Linde"	A.A. Belyakov K.A. Mukhin	Realization
FLNP	V.D. Ananiev, S.A. Kulikov, E.P. Shabalin, + 15 engineers, + 15 workers	
4. Manufacturing of a reserve movable reflector MR-3R	A.V. Vinogradov A.V. Dolgikh	Realization
FLNP	A.A. Belyakov, V.D. Ananiev, + 5 engineers, + 5 workers	
5. Step-by-step replacement and upgrade of basic technological and electrical equipment	A.V. Vinogradov A.V. Dolgikh	Realization
FLNP	A.A. Belyakov, A.V. Trepalin, + 30 engineers, + 50 workers	

Collaboration

Country or International Organization	City	Institute or Laboratory
Azerbaijan	Baku	IRP ANAS
Mongolia	Ulaanbaatar	MUST
Poland	Krakow	AGH-UST
Romania	Bucharest	IFIN-HH
Russia	Moscow	NIKIEI Geliymash INEUM SYSTEMATOM SSDI
United Kingdom	Didcot	RAL
USA	Indianapolis, IN	IUPUI

04-4- 1122-2015/2017

Priority:

1

Status:

In-progress

Development of Experimental Facilities for Condensed Matter Investigations with Beams of the IBR-2 Facility

Leaders:

S.A. Kulikov

V.I. Prikhodko

Participating Countries and International Organizations:

Bulgaria, Czech Republic, France, Germany, Hungary, Republic of Korea, Romania, Russia, Slovak Republic, Ukraine, United Kingdom.

Scientific Programme

Development and construction of a control system of the cryogenic moderator CM-201 for IBR-2 beams № 1, 4, 5, 6, 9. Design of equipment, electronics and software for the complex of IBR-2 spectrometers; the development of the FLNP information and computing infrastructure according to the needs of the Laboratory and the development strategy of the JINR computer network.

Expected main results in 2016:

- Testing, operation and development of the cryogenic moderator CM-202 with control and monitoring systems. Investigation of mechanical, gas-dynamic, radiation and neutron-physical properties of new advanced materials for cold moderators on a test stand of CM-201 and a radiation research facility. Carrying out of experiments to study radiation resistance of materials and electronics.
- Development of engineering design of the ASTRA-M detector system for the FSD spectrometer. Putting into service of 2D PSD at the RTD and REMUR spectrometers. Development of methods for increasing the service life of MWPC-based PSD operating in direct beams of the IBR-2 reactor.
- Implementation of the project “Development of PTH sample environment system for the DN-12 diffractometer at the IBR-2 facility” (manufacturing of a magnet using HTSC tape and its installation into a cryostat; cryostat testing under laboratory conditions). Modernization of the cryostat on the RTD spectrometer.
- Putting into operation of new systems of sample temperature control at the HRFD, RTD and REMUR spectrometers. Introduction of devices for vertical and horizontal adjustment of detectors and their integration into the control system of actuators of the YuMO spectrometer.
- Development and manufacturing of new control and data acquisition electronics and putting into operation of a control system of the Fourier chopper for the FSS spectrometer.
- Development and application of the VITESS software package: simulation of reflectometric and GISANS experiments within the kinematic approximation; simulation of diffraction and diffuse scattering for thin films (including multilayer) with regular and rough surfaces.
- Development of the Sonix+ software package: its adaptation to 64-bit version of Windows and version 3 of the Python language; addition of programs for maintenance of new equipment at the request of users.
- Installation of a backup LAN server.

List of projects:

Project	Leader	Priority (period of realization)
1. Development of PTH sample environment system for the DN-12 diffractometer at the IBR-2 facility	A.N. Chernikov	1 (2015 – 2017)

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. Development of a control system of CM-201 moderator for neutron beams № 1, 4, 5, 6, 9	S.A. Kulikov E.P. Shabalin	Realization
FLNP	M.V. Bulavin + 5 engineers, + 7 workers, A.S. Kirilov + 2 engineers, A.P. Sirotin + 2 engineers	
2. Calculations and simulation of spectrometers' elements. Development of the VITESS software package	A.V. Belushkin	Realization
FLNP	E.S.A. Manoshin, S.A. Kulikov + 2 engineers	
3. Development and manufacturing of new control and data acquisition electronics for the FSS spectrometer	A.A. Bogdzel A.P. Sirotin	Realization
FLNP	F.V. Levchanovsky + 2 engineers, N.D. Zernin	
4. Development and implementation of gas-filled and scintillation detectors at the IBR-2 spectrometers	A.V. Belushkin S.A. Kulikov	Realization
FLNP	M.V. Avdeev, G.D. Bokuchava, A.I. Kuklin + 2 engineers, A.V. Churakov + 3 engineers, A.A. Bogdzel + 4 engineers, V.V. Zhuravlev, V.V. Kruglov, A.S. Kirilov + 1 engineer	
5. Development of data acquisition, control and experiment automation systems, as well as of Sonix+ software package at the IBR-2 spectrometers	V.I. Prikhodko A.P. Sirotin A.S. Kirilov	Realization
FLNP	A.A. Bogdzel + 2 engineers, F.V. Levchanovsky + 2 engineers, V.V. Zhuravlev + 3 engineers, S.M. Murashkevich + 2 engineers	
6. Creation of a cloud polygon “neutron physics” in cooperation with LIT; carrying out computations using IaaS and SaaS services. Development of FLNP network infrastructure in accordance with the development strategy of the JINR computer network	S.A. Kulikov V.I. Prikhodko	Realization
FLNP	G.A. Sukhomlinov + 2 engineers, A.S. Kirilov + 2 engineers, S.A. Manoshin + 1 engineer	
LIT	V.V. Korenkov + 2 engineers	

Collaboration

Country or International Organization	City	Institute or Laboratory
Bulgaria	Sofia	INRNE BAS
Czech Republic	Řež	NPI ASCR
France	Grenoble	ILL
	Saclay	LLB
Germany	Berlin	HZB
	Heidelberg	Univ.
	Magdeburg	OVGU
	Munich	TUM
	Karlsruhe	KIT
	Zeuthen	DESY
	Jülich	FZJ
Hungary	Budapest	Wigner RCP
Republic of Korea	Daejeon	NFRI
Romania	Bucharest	INCDIE ICPE-CA IFIN-HH
	Târgoviște	UVT
Russia	Moscow	NNRU "MEPhI" NRC KI
	Moscow, Troitsk	INR RAS
	Gatchina	PNPI
	Yekaterinburg	IMP UB RAS
	Nizhny Novgorod	IPM RAS
Slovakia	Bratislava	IMS SAS
Ukraine	L'viv	LPNU
United Kingdom	Didcot	RAL

04-4-1111-2013/2017

Priority:

1

Status:

In-progress

Multimodal Platform for Raman and Nonlinear Optical Microscopy and Microspectroscopy for Condensed Matter Studies

Leader: G.M. Arzumanyan

Participating Countries and International Organizations:

Armenia, Belarus, Germany, Latvia, Moldova, Poland, Romania, Russia, France.

Scientific Programme

Experimental studies of condensed matter by Raman, CARS (coherent antiStokes Raman spectroscopy), and SERS (surface-enhanced Raman spectroscopy) spectroscopy and microscopy. Research of structural and optical properties, surface morphology and other characteristics of condensed matter on the multimodal optical platform constructed on the basis of the confocal laser scanning microscope "CARS". Special attention will be given to the spectral-structural studies of membrane proteins using coherent and surface-enhanced Raman spectroscopy. The other research direction deals with up-conversion luminescence studies in different matrices (glass, glass-ceramics, films) activated by various rare-earth elements.

Expected main results in 2016:

- Structural and up-conversion luminescent properties of transparent oxyfluoride glass-ceramics doped with Eu³⁺, Tm³⁺, Yb³⁺.
- Study of luminescence in optically transparent and chemically stable rare-earth doped ZnO nanocrystals.
- Development of an alternative method of second order nonlinear imaging of chiral crystals (SONICC) on the multimodal optical platform.
- Highly selective spectral imaging of bacteriorhodopsin crystals using SONICC, Raman and CARS microscopy. Nanoplasmonic enhancement (10^{-5} - 10^{-6}) of Raman scattering (SERS) applied to various bio-samples. Determination of internal components of membrane protein in meso crystals using Raman, SERS and CARS spectroscopy and microscopy.

List of projects:

Project	Leader	Priority (period of realization)
1. Multimodal platform for Raman and nonlinear optical microscopy and microspectroscopy for condensed matter studies	N. Kučerka Deputy: V.I. Gordeliy	1 (2015 – 2017)

List of activities:

Activity or experiment Laboratory or other Division of JINR	Leaders Main researchers	Status
1. A complex study of structural and spectral properties of oxyfluoride glasses and nanoglassceramics doped with various rare earth elements (REE)	G.M. Arzumanyan	Realization

FLNP	V. Vartic, E.A. Kuznetsov, A.A. Kapitonova	
2. Up-conversion luminescence studies of sitalls based on nanoscale ZnO crystals	G.M. Arzumanyan	Realization
FLNP	V. Vartic, E.A. Kuznetsov, I.N. Melkova	
3. Development of methodology aimed at visualization and enhancement of the Raman scattering signal from biomolecules using CARS and SERS spectroscopy	G.M. Arzumanyan N. Kučerka	Data taking
FLNP	K.Sh. Voskanyan, K. Mamatkulov, N.V. Doroshkevich, M. Balasoiu, + 1 engineer	
4. Development of an alternative nonlinear optical imaging method SONICC for protein crystals	G.M. Arzumanyan	Data taking and realization
FLNP	N.V. Doroshkevich, K. Mamatkulov	
5. Creation of in meso crystallization concept based on the Raman, CARS and SANS investigations of the mechanisms of membrane proteins crystallization.	G.M. Arzumanyan N. Kučerka V.I. Gordeliy	Realization
FLNP	K.Sh. Voskanyan, N.V. Doroshkevich, K. Mamatkulov, A.I. Kuklin, + 1 engineer	
6. Upgrade of the software and development of the instrumental infrastructure of the optical platform to expand its capabilities and increase the measurement sensitivity.	G.M. Arzumanyan N. Kučerka	Realization
FLNP	K. Mamatkulov, A.A. Kapitonova	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	Inst. Physiology NAS RA
Belarus	Minsk	BSUIR
Germany	Jülich	FZJ
Latvia	Riga	ISSP UL
Moldova	Chișinău	IEEN ASM TUM

Poland	Lublin	UMCS
Russia	Moscow	PFUR
	Moscow, Zelenograd	NT-MDT Co.
	Dolgoprudny	MIPT
	St. Petersburg	NITIOM
Romania	Bucharest	IFIN-HH
France	Grenoble	UPB
		IBS

04-5-1076-2009/2016

Priority:

1

Status: Approved for completion
in 2016

Radiation Effects and Physical Basis of Nanotechnology, Radioanalytical and Radioisotope Investigations at the FLNR Accelerators

Leaders:

S.N. Dmitriev
P.Yu. Apel

Participating Countries and International Organizations:

Belarus, Bulgaria, China, Czech Republic, Germany, Hungary, Kazakhstan, Moldova, Mongolia, Poland, Romania, Russia, Serbia, Slovakia, South Africa, Spain, Ukraine, United Kingdom, USA.

Scientific Programme

Study of the effects produced by heavy ions in matter for potential applications of ion beams in nanoscience and nanotechnology. Work related to life sciences: production of ultrapure isotopes and study of the properties of radionuclides of practical importance. Upgrade of the FLNR accelerator complex to produce medical isotopes and develop methods of material modification.

Expected main results in 2016:

- Study of radiation stability of TiN_xZrN ceramics irradiated with high-energy heavy ions.
- Estimation of temperature dependence of structural changes induced by heavy ions of fission fragment energy in nanoparticles in ODS (oxide dispersion strengthened) alloys.
- Influence of synergistic effect of radiation defects and impurities on the development of helium, deuterium, and hydrogen blisters in silicon.
- Detailed study of the structure of track membranes in the nanometer range using high-resolution scanning electron microscopy.
- Development of a fabrication method and study of the properties of track membranes with several pore arrays and a selective layer.
- Study of surface and electric transport properties of composite track membranes with a hydrophobic layer.
- Methodological developments of synthesis and radiochemical separation of radionuclides which have great potential in nuclear medicine (^{195m}Pt, ^{117m}Sn, ²²⁷Th, ²²⁵Ac, ²¹³Bi). Radioecological studies (analysis and study of radionuclide distribution in ecosystems).
- Development of fabrication methods of SERS-active sensors based on immobilization of silver nanoparticles, thermal evaporation of metal and insulator layers on the track membrane surface and investigation of their efficiency.

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
1. Investigations of radiation damages in solids and formation of nanostructures	V.A. Skuratov P.Yu. Apel	Data taking
FLNR	A.Yu. Didyk, V.K. Semina, O.L. Orelovich, V.V. Shirkova, A.N. Nechaev, I.V. Blonskaja, L.I. Kravets, O.M. Ivanov, V.A. Kuzmin, V.A. Altynov	
LIT	I.V. Amirhanov, I.V. Puzynin, V.N. Robuk, E.G. Nikonov	
2. Investigation of materials using ECR ion source	V.F. Reutov	Preparation
FLNR	V.F. Reutov, A.S. Sokhatsky	
3. Production of ultra-pure isotopes	S.N. Dmitriev	Data taking
FLNR	O.D. Maslov, G.Ya. Starodub, A.V. Sabelnikov, Yu.V. Albin, G.A. Bozhikov, G.K. Vostokin, M.V. Gustova, T.P. Drobina	
4. Radioanalytical studies	O.D. Maslov	Data taking
FLNR	O.D. Maslov, N.G. Zaitseva	
5. Design of accelerator complexes for nuclear medicine and radiation physics	S.N. Dmitriev A.A. Chumbalov	Preparation Manufacturing
FLNR	B.N. Gikal, I.V. Kolesov, A.A. Chumbalov	

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	BSU BSTU NC PHEP BSU RIAPP BSU IOMR
Bulgaria	Gomel	GSU
China	Plovdiv	PU
Czech Republic	Beijing	Beijing Fert Co
Germany	Řež	NPI ASCR
	Darmstadt	GSI
	Quedlinburg	IST MiCryon Technik
Hungary	Budapest	ELTE

Kazakhstan	Almaty	INP
	Astana	BA INP
		ENU
		NU
Moldova	Chișinău	IAP ASM
Mongolia	Ulaanbaatar	NRC NUM
Poland	Warsaw	INCT
	Otwock-Swierk	NCBJ
	Lublin	UMCS
	Torun	UMK
Russia	Moscow	IC RAS
		ISPM RAS
		ITEP
		GPI RAS
		LPI RAS
		MATI
		SINP MSU
		TIPS RAS
	Dubna	Trackpore Technology IINC
	Chernogolovka	ISSP RAS
	Kaliningrad	IKBFU
	Kazan	KNRTU
	Novosibirsk	ISP SB RAS
	St. Petersburg	IPTI RAS
	Saratov	SSMU
Serbia	Belgrade	INS "VINČA"
Romania	Bucharest	INFLPR
Slovakia	Bratislava	BIONT
		CU
		IEE SAS
South Africa	Port Elizabeth	NMMU
	Bellville	UWC
	Pretoria	UP
Spain	Madrid	IA-CSIC
	Valencia	UV
Ukraine	Kharkov	IERT NASU
United Kingdom	London	NPL
USA	Ann Arbor, MI	U-M
	Knoxville, TN	UTK
	Oak Ridge, TN	ORNL
	Stanford, CA	SU

04-9-1077-2015/2017

Priority:

1

Status:

In-progress

Research on the Biological Effect of Heavy Charged Particles with Different Energies

Leaders: E.A. Krasavin
G.N. Timoshenko

Participating Countries and International Organizations:

Armenia, Belarus, Bulgaria, Czech Republic, Egypt, Italy, Moldova, Mongolia, Poland, Romania, Russia, Slovak Republic.

Scientific Programme

Theoretical and experimental research on the biological effect of heavy charged particles with different energies at JINR's basic facilities.

The research and development will include:

- Research on the regularities and mechanisms of the initiation of molecular disorders in the DNA structure and their repair; and radiation-induced apoptosis in human cells under exposure to radiations with different linear energy transfer (LET).
- Decoding of the mechanisms underlying cell hypersensitivity and hyperresistance to low doses of ionizing radiation.
- Acquisition of comparative data on the regularities of the induction of gene and structural mutations in mammalian and lower eukaryote cells by sparsely and densely ionizing radiations with different LET.
- Research on the mechanisms of the induction of retinal damage by heavy charged particles (HCP) and its repair.
- Research on the character of the HCP-induced damage of central nervous system (CNS) cells and regularities of their death. Identification of HCP-induced functional and morphological disorders in the CNS.
- Mathematical modeling of the effects induced by ionizing radiations with different LET at the molecular and cellular levels. Development and analysis of mathematical models of the molecular mechanisms of CNS structural and functional disorders induced by ionizing radiations.
- Calculation of the radiation shielding of new nuclear physics facilities; evaluation of the radiation environment and development of radiation safety systems.

Expected main results in 2016:

- To continue studying regularities in the induction, formation, and repair kinetics of HCP-induced clustered DNA double-strand breaks (DSBs) in human skin fibroblast nuclei.
- To study the expression of the genes encoding the proteins RAD51, DNA PKcs, NBS1, and MRE11, which participate in HCP-induced damage repair in human fibroblasts.
- To continue studying radiation-induced apoptosis mechanisms and different ways of HCP-induced DNA damage repair. To study the expression of the genes that encode the proteins and caspases participating in apoptosis induction in human fibroblasts by HCP.
- Using a Synergy H1m microplate reader, to evaluate the level of the reactive oxygen species and ERK protein kinase in mammalian cells exposed to gamma-rays and HCP.
- To continue studying regularities in the induction of gene and structural mutations in yeast cells by radiations with different LET.

- To continue research on the mutagenic effect of ionizing radiations on mammalian cells in the remote after irradiation. To perform a molecular analysis of HPRT-mutant subclones.
- To continue evaluating the retina's ability to recover after radiation exposure. To continue studying the mechanisms behind retina recovery: Mueller cell activation, expression of endogenous protectors in the retina, and expression of the oxidative stress proteins.
- To continue research on the apoptotic death of neurons in different sections of the rat and mouse brain at different times after exposure to radiations with different LET.
- To continue studying disorders in the exchange of monoamines and their metabolites in the prefrontal cortex, hippocampus, striatum, adjoining nucleus, and hypothalamus of the rat brain under exposure to gamma-rays, Bragg peak protons, and HCP.
- To continue the development of mathematical models of neurons' functional activity under exposure to radiations with different LET.
- To continue elaboration of model approaches to the quantitative estimation of the relation between the plastic processes in neurons participating in the formation of the brain's functional networks.
- To work out nonlinear dynamics methods for a neuron population (neural networks) that would allow describing the classical and quantum mechanisms of cognitive function realization.
- To develop mathematical models of axon transport of signals and molecules.
- To perform mathematical modeling of functional changes in the mammalian retina under exposure to genotoxic factors of different nature.
- To continue the development of mathematical models of DNA double-strand break induction and repair in mammalian and human cells.
- To ensure the conduction of the radiobiological experiments at the Nuclotron (the Laboratory of High-Energy Physics), U-400M cyclotron (the Laboratory of Nuclear Reactions), and the medical beam of the Phasotron (the Laboratory of Nuclear Problems).

List of projects:

Project	Leader	Priority (period of realization)
1. Research on the biological effect of heavy charged particles with different energies	E.A. Krasavin G.N. Timoshenko	1 (2015 – 2017)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other Division of JINR	Main researchers	
1. Radiobiological research at charged particle beams	E.A. Krasavin	<div style="border: 1px solid black; padding: 5px; width: fit-content;"> Data taking Realization Data taking </div>

LRB S.V. Aksanova, G.F. Aru, K.V. Belokopytova,
 O.V. Belov, P. Blaha, Yu.V. Bogdanova, A.V. Boreyko,
 A.N. Bugay, N.N. Budennaya, T.S. Bulanova,
 V.N. Chausov, E.B. Dushanov, D.V. Elsha, T.A. Fadeeva,
 T.B. Feldman, R.D. Govorun, E.V. Ilyina, A.A. Ivanov,
 L. Jezkova, A.N. Kokoreva, E.A. Kolesnikova,
 N.A. Koltovaya, O.V. Komova, I.V. Koshlan,
 N.A. Koshlan, M.A. Kovalenko, A. Kowalska, P.V. Kutsalo,
 E.A. Kuzmina, V.N. Lisy, K.N. Lyakhova, M.S. Lyashko,
 B. Munkhbaatar, K.O. Muranov, E.A. Nasonova,
 S.S. Negovlev, M.A. Ostrovsky, A.Yu. Parkhomenko,
 I.I. Ravnachka, Yu.S. Severyukhin, N.L. Shmakova,
 E.V. Smirnova, S.I. Tiunchik, V.A. Tronov, D.M. Utina,
 M.A. Vasilyeva, Yu.V. Vinogradova, S.V. Vorozhtsova,
 M.G. Zadnepryanets, E.M. Zaytseva, N.I. Zhuchkina,
 + 2 engineers, + 7 workers

2. Radiation research

G.N. Timoshenko

Preparation
 Data taking
 R&D

LRB

V.E. Aleinikov, L.G. Beskrovnaya, A.R. Krylov,
 V.A. Krylov,
 E.N. Lesovaya, + 10 engineers, + 2 workers

3. Training activity

E.A. Krasavin
S.Z. Pakuliak (UC)

LRB

V.E. Aleinikov, O.A. Bakerin, O.V. Belov, A.V. Boreyko,
 N.N. Budennaya, T.B. Feldman, R.D. Govorun,
 A.A. Ivanov, N.A. Koltovaya, O.V. Komova,
 M.M. Komochkov, I.V. Koshlan, Yu.V. Mokrov,
 M.A. Ostrovsky, A.Yu. Parkhomenko, G.N. Timoshenko

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU
Belarus	Gomel	IRB NASB
Bulgaria	Sofia	IE BAS INRNE BAS NCRRP
Czech Republic	Brno Prague Řež	IBP ASCR CTU NPI ASCR UJV
Egypt	Giza	CU
Italy	Udine	Uniud
Moldova	Chișinău	UnASM
Mongolia	Ulaanbaatar	NUM
Poland	Szczecin	US
Romania	Bucharest	UMF

		ISS
	Iași	UAIC
Russia	Moscow	IBMP RAS
		IHNA Ph RAS
		SF IPh
		ITEP
		MSU
	Astrakhan	ASU
	Sochi	SRI MP
	Vladivostok	FEFU
Slovakia	Bratislava	CU

04-9-1112-2013/2016

Priority:

1

Status:

Extended

Research on Cosmic Matter on the Earth and in Nearby Space; Research on the Biological and Geochemical Specifics of the Early Earth

Leaders:

E.A. Krasavin
A.Yu. Rozanov
V.N. Shvetsov

Participating Countries and International Organizations:

Italy, Norway, Poland, Romania, Russia, United Kingdom, USA.

Scientific Programme

Research and development will include:

- Biogeochemical studies of cosmic dust
- Studies of biofossils and organic compounds in meteorites and ancient terrestrial rocks
- Studies of cosmic matter with nuclear physics methods
- As a result of studying and generalizing the research materials on modern and fossil cosmic dust as well as ancient terrestrial objects and modern organisms of the extreme ecosystems, data will be obtained on the forms of ancient terrestrial and extraterrestrial life.

As the results:

- Obtaining new data on the amount of cosmic matter falling on the whole Earth's surface. Obtaining data on the dynamics of cosmic dust fallout on large territories.
- Evaluation of the following parameters of particles of extraterrestrial origin: morphology, structure, size distribution, and elemental, isotopic, and mineralogical composition. Assessment of changes in these characteristics in different plates in different time intervals.
- Creation of a cosmic dust collection, where dust microparticles will be characterized by quantity (concentration) and the size distribution.
- Obtaining new information on the role of microorganisms in the formation and evolution of life on the Earth and processes of weathering, precipitation growth, etc.
- Research on the synthesis of complex prebiotic compounds from formamide under exposure to ionizing radiations of different qualities with meteorite samples as catalysts.
- Generalization of the obtained data on the forms of ancient terrestrial and, possibly, extraterrestrial life.

Expected main results in 2016:

- Continuation of the detection and study of biofossils and organic matter in meteorites and the most ancient terrestrial rocks.
- Diagnostics of microorganism remnants in Archaean and Proterozoic rocks and evaluation of their organization level with nuclear physics methods. Research on the synthesis of complex prebiotic compounds from formamide under exposure to accelerated ions with different linear energy transfer.

List of projects:

Project	Leader	Priority (period of realization)
1. Research on cosmic matter on the Earth and in nearby space; research on the biological and geochemical specifics of the early Earth	E.A. Krasavin Scientific leader: A.YU. Rozanov	1 (2013 – 2016)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
1. Studies of biofossils in meteorites and ancient terrestrial rocks	A.Yu. Rozanov E.A. Krasavin	Data taking Realization Simulation
LRB	M.M. Astafyeva + 1 engineer	
2. Research on the synthesis of complex prebiotic compounds from formamide	R. Saladino	Data taking Realization Simulation
LRB	M.I. Kapralov + 1 student	
3. Biogeochemical and biological studies of cosmic dust	L.M. Gindilis	Data taking Realization Simulation
LRB	I.A. Bobrikov + 2 engineers	
4. Cosmic matter research with nuclear physics methods	V.N. Shvetsov (FLNP)	Data taking Realization Simulation
FLNP	A.Yu. Dmitriev, P.V. Sedyshev, M.V. Frontasyeva	

Collaboration

Country or International Organization	City	Institute or Laboratory
Italy	Rome	Univ. "La Sapienza"
	Viterbo	UNITUS
Norway	Trondheim	NTNU
Poland	Poznan	AMU
Romania	Bucharest	UB
Russia	Moscow	IGEM RAS IKI RAS MSU PIN RAS SAI MSU IPE RAS
	Borok	

United Kingdom
USA

Gatchina
Novosibirsk
Buckingham
Athens, AL

PNPI
BIC SB RAS
UB
ASU

04-2-1103-2010/2016

Priority:

1

Status:

Extended

Medical and Biological Research with JINR Hadron Beams

Leader: G.V. Mitsyn

Participating Countries and International Organizations:

Czech Republic, Poland, Romania, Russia.

Scientific Programme

Medico–biological and clinical research for the treatment of cancer patients with beams of heavy nuclear particles of the JINR Phasotron and for the accompanying diagnostics.

Expected main results in 2016:

- Continuation of clinical researches on proton therapy of cancer patients in room No 1. To evaluate the effectiveness of the conducted radiation treatment of different neoplasms.
- The work to increase functional capability of the developing 3D treatment planning software and its clinical tests in the treatment sessions.
- Test of the prototype equipment for dynamic conformal irradiation of deep-seated tumours with the proton beam.
- Development and improvement of detectors and tools for clinical dosimetry of the medical hadron beams.
- Exploration of the possibilities of laser radioprotection against damage after exposure to ionizing radiation in experimental mice like C57VL/6.
- Investigations of the molecular spectra of gene mutations induced by radiation in animal and human cells induced by ionizing radiation of different quality.

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other	Main researchers	
Division of JINR		
Responsible person		
1. Medico–biological and clinical research for the treatment of cancer patients and accompanying diagnostics at the medical–technical complex of JINR	G.V. Mitsyn	R&D
DLNP	S.V. Shvidky, I.V. Alexandrova, I.D. Alexandrov, A.V. Agapov, M.V. Alexandrova, K.P. Afanasieva, S.Yu. Bakaev, K.Sh. Voskanyan, V.N. Gaevsky, G.V. Donskaya, V.M. Breyev, D.M. Borovich, Ye.I. Luchin, S.V. Korablinova, I.I. Klochkov, L.N. Korovina, Ya.V. Kurgansky, A.G. Molokanov, S.A. Pisareva, M.V. Repin, D.K. Sobolev, S.S. Uglova, M.A. Zeitlina, K.N. Shipulin, K. Oancea, I.E. Miller, T.L. Demakova, A.V. Rzyanina, M.D. Ekimova	

Collaboration

Country or International Organization	City	Institute or Laboratory
Czech Republic	Řež	UJV
	Prague	PTC
Poland	Krakow	NINP PAS
	Otwock-Swierk	NCBJ
	Poznan	GPCC
Romania	Bucharest	UMF
		UB
Russia	Moscow	VIGG RAS
		IBMP RAS
	Dubna	RMAPE
	Obninsk	RCRC RAMS
		RDH-9
		MRRC

04-2-1126-2015/2017

Priority:

1

Status:

In-progress

Novel Semiconductor Detectors for Fundamental and Applied Research

Leader: G.A. Shelkov
Deputy: A.S. Zhemchugov

Participating Countries and International Organizations:

Belarus, CERN, Czech Republic, Germany, New Zealand, Russia, Ukraine.

Scientific Programme

Generic R&D of semiconductor radiation-resistant detectors based on new materials and of hybrid pixel detectors with high resolution for nuclear and particle physics. Development of the research infrastructure for semiconductor detector R&D, coupled with beam tests at the JINR facilities, to be used by groups from JINR and from the Member States. Scientific collaboration with research groups from other fields in feasibility studies of application of the newly developed detectors in others areas of science and technology (primarily in medicine and geology).

Expected main results in 2016:

- Systematic studies of radiation hardness and response of GaAs detectors in the beams of the JINR facilities.
- Production of prototypes of Timepix hybrid pixel detectors with GaAs sensor of thickness less than 1 mm. Study of their capabilities in detecting neutrons, fission fragments and charged tracks.
- Production of a prototype of the low-background GaAs-based hybrid pixel detector for TGV-2.
- Study of X-ray contrast media identification by spectral data.
- MARS-CT calibration and image processing aimed at geophysics studies.
- Test of the block of registration for an electromagnetic calorimetry.
- Project preparation about use of new semiconductor photodetectors in a calorimetry for high energy physics.

List of projects:

Project	Leader	Priority (period of realization)
1. Novel semiconductor detectors for fundamental and applied research	G.A. Shelkov	1 (2015 – 2017)

List of activities:

Activity or experiment	Leaders	Status
Laboratory or other Division of JINR Responsible person	Main researchers	

1. Project "Novel semiconductor detectors for fundamental and applied research"

G.A. Shelkov	Realization
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DLNP	A. Gongadze, M.I. Gostkin, A.V. Guskov, D.V. Dedovich, V.G. Elkin, S.A. Kotov, D.F. Kozhevnikov, V.G. Kruchonok, V.N. Pavlov, S.Yu. Porokhovoy, I.N. Potrap, L. Zavorka
FLNP	Yu.N. Kopach, G. Akhmedov, S.Yu. Telezhnikov
VBLHEP	J. Lukstins, A.M. Korotkova, D.O. Krivenkov, A.V. Averianov, C.B. Starikova
2. Use of new semiconductor photodetectors in a calorimetry for high energy physics	N.V. Anfimov
	Realization
DLNP	Z.V. Krumshteyn, A.I. Antoshkin, A.G. Olshevskiy, I.A. Orlov, T.V. Rezinko, A.V. Rybnikov, A.S. Selunin, V.V. Chalyshev, I.E. Chirikov-Zorin, D.V. Fedoseev
VBLHEP	I.A. Tyapkin, Z.Ya. Sadygov, T.Yu. Bokova, B. Marinova

Collaboration

Country or International Organization	City	Institute or Laboratory
Belarus	Minsk	JIPNR-Sosny NASB NC PHEP BSU
Czech Republic	Prague	CTU
CERN	Geneva	CERN
Germany	Hamburg	DESY
New Zealand	Christchurch	UC
Russia	Dubna Moscow	Dubna Univ. MSU ITEP INR RAS
Ukraine	Moscow, Troitsk Tomsk St. Petersburg Kharkov	TSU SPbSPU ISMA NASU

Networking,
Computing,
Computational
Physics
(05)

Information and Computing Infrastructure of JINR

Leader: V.V. Korenkov
Deputy: T.A. Strizh

Participating Countries and International Organizations:

Armenia, Azerbaijan, Belarus, Bulgaria, CERN, Czech Republic, Egypt, France, Georgia, Germany, Moldova, Mongolia, Poland, Romania, Russia, Slovakia, South Africa, Sweden, Ukraine, USA, Uzbekistan.

Scientific Programme

Further development of the JINR network, information and computing infrastructure for the research activity of the Institute and its Member States on the basis of present-day information technologies in accordance with the Seven-Year Plan for JINR development and its amendment in view of the creation of a Tier-1 level grid-infrastructure in JINR. Creation of a unified information and computing environment of the JINR Member States.

Expected main results in 2016:

- Extension of throughput performance, increase of reliability and availability of the main and backup dedicated fiber optic JINR-Moscow channels. Maintenance of the uninterrupted functioning of the LHCOPN and LHCONE networks for operating the JINR Tier-1 and Tier-2 centers. Provision of the functioning, modernization and increase of reliability of the JINR backbone.
- Scheduled increase of performance, expansion of the data storage systems and provision of functioning the Tier-1 centre in a 24x7 mode. Creation of the analytic system for the centre monitoring.
- Commissioning of a first stage of the multifunctional information and computer centre of storage, processing and analysis of JINR data which integrates a JINR grid-site of the Tier-2 level, a heterogeneous cluster and a cloud infrastructure. Increase of performance of the JINR Central information and computing complex and data storage systems to meet the requirements of the JINR scientific program. Development and equipping of the heterogeneous cluster "HybriLIT". Development and fitting up of the cloud infrastructure, provision on its base of the training and retraining of specialists on information technologies.

Provision of stable operation of the JINR grid-site in frames of regional, national and application-specific grid- and cloud- infrastructures.

Development of cooperation with the JINR Member States within the currently operating and created information and computing projects.

- Implementation of the first version of corporate information system. Modernization and maintenance of the hardware and software environment for the information, algorithmic and software support of JINR activities. Maintenance of the JINRLIB program library. Conducting a specialized section of the JINRLIB library for parallel programs. Addition of the library with instructional materials on the parallel programming technologies.

Support and development of the central information servers, participation in the development, creation and support of information sites of conferences and workshops, including hosting mode and cloud platform.

Continuation of work on introduction and support of the unified system 1C 8.2 UPP: development and introduction of a module on accounting persons invited (directed) to JINR; development and introduction of a module on accounting conferences; development and introduction of a module on persons detached for service; expansion of the functional of the module on accounting service habitation; development and introduction of a module on accounting motor transport; introduction of various specialized functional 1C UPP in the JINR self-supporting divisions; introduction of 1C UPP in the "Dubna" resort in Alushta.

Extension of the functionalities of the information control system of the NICA project based on the ADB2 system. Implementation of functional on introducing a planned profile of operations in ADB2; realization of functional on the formation of various consolidated reports on the project; development on the integration with the MS Project Professional.

Support and modernization of the JDS software, filling of the Authority collection with the JINE employees profiles, integration of the profiles of authors with the HEPNAMES collection, adjustment of the search machine Invenio in JDS for search in PIN.

- Modernization and development of the distributed educational and research grid-infrastructure, provision of training and retraining of IT specialists on its basis.

Organization of training courses on the parallel programming technologies on the basis of heterogeneous cluster "HybriLIT".

Trial operation of the Helpdesk system for JINR information and computing infrastructure user support.

List of activities:

Activity or experiment	Leaders
Laboratory or other Division of JINR	Main researchers
1. JINR telecommunication data links and JINR local area network	V.V. Korenkov A.G. Dolbilov
LIT	K.N. Angelov, A.I. Balandin, D.V. Belyakov, E.Yu. Bulaeva, A.I. Churin, S.V. Gavrilov, L.I. Gorodnicheva, N.M. Egoshina, M.F. Ermakova, V.A. Kapitonov, G.A. Korobova, E.Yu. Kulpin, N.N. Mischenko, M.S. Plyashkevich, L.A. Popov, Ya.I. Rozenberg, E.V. Toneeva, V.P. Sheyko, A.Yu. Zakomoldin
DLNP V.V. Glagolev	Yu.P. Ivanov
LRB V.A. Krylov	
BLTP A.P. Isaev	A.A. Sazonov
FLNP S.A. Kulikov	V.I. Prikhodko, G.A. Sukhomlinov
VBLHEP Yu.K. Potrebenikov	B.G. Shchinov, Yu.P. Minaev
FLNR S.I. Sidorchuk	S.V. Pashchenko, G.G. Gulbekyan
UC S.Z. Pakuliak	I.N. Semeniushkin
2. JINR Tier-1 center	V.V. Korenkov V.V. Mitsyn T.A. Strizh A.G. Dolbilov
LIT	N.S. Astakhov, A.S. Baginyan, S.D. Belov, A.P. Gavrish, A.O. Golunov, N.I. Gromova, I.S. Kadoczhnikov, I.A. Kashumin, I.S. Pelevanyuk, E.A. Tikhonenko, V.V. Trofimov, N.N. Voitishin, A.S. Vorontsov, V.E. Zhiltsov

VBLHEP
S.V. Shmatov

3. JINR Central Information and Computing Complex

LIT

I.N. Gorbunov, A.O. Golunov, I.I. Belotelov,
A.Yu. Kamenev

V.V. Korenkov
V.V. Mitsyn

N.S. Astakhov, S.D. Belov, D.V. Belyakov,
N.V. Chuenkova, A.G. Dolbilov, V.V. Galaktionov,
A.P. Gavrish, Eu.A. Grafov, N.I. Gromova,
I.S. Kadochnikov, A.S. Kamensky, I.A. Kashunin,
I.A. Kudasova, O.N. Kudryashova, N.A. Kutovskiy,
A.A. Lavrentiev, I.I. Lensky, S.B. Marchenko,
M.A. Matveev, S.V. Mitsyn, A.V. Nechaevsky,
I.K. Nekrasova, D.A. Oleynik, I.S. Pelevanyuk,
A.Sh. Petrosyan, D.I. Pryakhina, A.I. Radov,
V.T. Razuvakina, T.F. Sapozhnikova, E.A. Tikhonenko,
V.V. Trofimov, A.S. Vorontsov, A.V. Uzhinskiy,
S.E. Zhabkova, V.E. Zhiltsov

4. Information and software support of the research-and-production activity at JINR

LIT

P.V. Zrelov
V.V. Korenkov
M.V. Bashashin

T.O. Ablyazimov, N.A. Balashov, A.V. Baranov,
D.V. Belyakov, A.A. Bogolubskaya, N.A. Davyudova,
S.V. Duchits, V.P. Gerdt, T.M. Goloskokova, D.S. Golub,
N.V. Jerusalimova, I.A. Filozova, L.A. Kalmykova,
A.A. Karlov, D.V. Kekelidze, S.A. Kretova, S.V. Kunyaev,
G.A. Kurmaeva, N.A. Kutovskiy, A.A. Kutovskaya,
L.A. Lukstinia, O.G. Melnikova, G.G. Musulmanbekov,
S.A. Nechitailo, E.A. Paschenko, V.V. Pervushov,
M.S. Plyashkevich, E.Yu. Polyakova, L.V. Popkova,
A.V. Prikhodko, V.M. Pushkina, A.M. Raportirenko,
A.P. Sapozhnikov, T.F. Sapozhnikova, S.V. Semashko,
R.N. Semenov, A.V. Sheyko, G.V. Shestakova,
D.B. Stankus, V.A. Stepanenko, T.S. Syresina,
N.N. Vorobieva, V.M. Yagafarova, A.G. Zaikina,
T.N. Zaikina

V.F. Borisovskiy

A.V. Philippov, K.V. Turusina

V.V. Korenkov
T.A. Strizh

5. Development of a system of training and advanced training of IT professionals based on educational and research infrastructure and creation of an information system to provide assistance to users (Helpdesk)

SOICO
N.A. Russakovich

VBLHEP
Yu.K. Potrebenikov

LIT N.A. Balashov, A.V. Baranov, S.D. Belov,
V.V. Galaktionov, T.M. Goloskokova, N.I. Gromova,
I.S. Kadochnikov, D.V. Kekelidze, N.A. Kutovskiy,
V.V. Mitsyn, S.V. Mitsyn, I.K. Nekrasova,
A.V. Nechaevsky, D.A. Oleynik, A.Sh. Petrosyan,
D.V. Podgainy, T.F. Sapozhnikova, R.N. Semenov,
O.I. Streletsova, E.A. Tikhonenko, V.V. Trofimov,
A.V. Uzhinskiy, V.E. Zhiltsov, M.I. Zuev

UC
S.Z. Pakuliak

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	Foundation ANSL IIAP NAS RA YSU
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	NC PHEP BSU JIPNR-Sosny NASB BNTU
Bulgaria	Gomel Sofia	GSTU INRNE BAS SU
CERN	Blagoevgrad Geneva	SWU CERN
Czech Republic	Prague	IP ASCR
Egypt	Giza	CU
France	Marseille	CPPM
Georgia	Tbilisi	GRENA TSU UG GTU
Germany	Darmstadt Frankfurt/Main Hamburg Karlsruhe Munich Zeuthen	GSI Univ. DESY KIT LMU DESY
Moldova	Chișinău	ASM IMCS ASM IAP ASM RENAM
Mongolia	Ulaanbaatar	II MAS MUST NUM

Poland	Krakow	CYFRONET
	Poznan	AMU
	Wroclaw	WUT
Romania	Bucharest	IFA
	Cluj-Napoca	IFIN-HH
Russia	Moscow	INCDTIM
		IOC RAS
		IPI RAN
		IITP RAS
		ISP RAS
		ITEP
		JSCC RAS
		KIAM RAS
		MPEI
		MSU
		RCC MSU
		RIPN
		NRC KI
		RSCC
		SINP MSU
		SRI "Voskhod"
	Moscow, Troitsk	INR RAS
	Cherkessk	NCSHTA
	Chernogolovka	SCC IPCP RAS
	Dubna	LITP RAS
		Adm. of Dubna
		BSINP MSU
		Dubna Univ.
		Raduga
		Tensor
		SEZ "Dubna"
		SCC "Dubna"
	Gatchina	PNPI
	Nizhny Novgorod	UNN
	Novosibirsk	BINP SB RAS
	Pereslavl-Zaleskiy	PSI RAS
	Protvino	IHEP
	Puschino	IMPB RAS
	Samara	SSAU
	St. Petersburg	FIP
		ITMO
		CC SPbSU
		SPbSU
		SPbSPU
Slovakia	Košice	IEP SAS

South Africa	Cape Town	UCT
Sweden	Lund	LU
USA	Arlington, TX	UTA
	Batavia, IL	Fermilab
	Chicago, IL	UChicago
	Pasadena, CA	Caltech
	Upton, NY	BNL
Ukraine	Kiev	BITP NASU NTUU KPI
	Kharkov	KFTI
Uzbekistan	Tashkent	IMIT AS RUz

Methods, Algorithms and Software for Modeling Physical Systems, Mathematical Processing and Analysis of Experimental Data

Leaders:

Gh. Adam
P.V. Zrelov

Participating Countries and International Organizations:

Armenia, Australia, Belarus, Belgium, Brazil, Bulgaria, Canada, CERN, Czech Republic, Egypt, France, Georgia, Germany, Greece, India, Italy, Japan, Kazakhstan, Moldova, Mongolia, Poland, Portugal, Romania, Russia, Slovakia, South Africa, Switzerland, Taiwan, Tajikistan, Ukraine, USA, Vietnam.

Scientific Programme

Research in the field of computational mathematics and computational physics, directed to the creation of mathematical methods, algorithms, and software for the numerical or symbolic-numerical solution of topics arising in experimental and theoretical studies, by using the newest computational tools. This subject area includes a wide spectrum of investigations underway at JINR in high energy physics, nuclear physics, condensed matter physics, biophysics, information technologies, etc. which demand the development of new mathematical methods and approaches for modeling physical processes, processing and analysis of experimental data. A distinctive feature of these investigations is the close cooperation of LIT with research groups from all the JINR laboratories and from Member State institutions.

Expected main results in 2016:

- Formulation and investigation of chirally invariant transport equations for quark matter including: collective meanfields, strong correlations (bound state formation), hadron-hadron scattering, heavy-quark transport and particle production (Schwinger effect).

Development of numerical and analytical methods of investigation of nonlinear models of physics and application of the obtained results to the study of the interaction of gaseous nanocluster beams with matter and to the characterization of the gradient optical waveguides.

Study of general properties of nucleus-nucleus interactions at energies planned by NICA/MPD, CBM and PANDA experiments using hadronic models of Geant4 package. Numerical modeling of the mechanism of the enhanced strange particle production at NICA energies.

3D modeling of the superconducting magnets for the NICA (JINR) and for SIS100 (FAIR, GSI, Darmstadt).

Study of nuclear physical processes of isotope accumulation and burnout in extended targets and subcritical fission systems; software maintenance of current experiments on target irradiation with protons and nuclei.

Development of new algorithms for computing Coulomb corrections to observables of the Moliere-Fano multiple scattering theory and to the Migdal functions $G(s)$ and $F(s)$ of the quantum Landau-Pomeranchuk effect theory (DIRAC collaboration).

Development of methods and programs, including parallel ones, for numerical investigations of nuclear-physical processes involving the hybrid microscopic optical potential model.

Development of numerical methods and algorithms to study the properties of quantum quasi-stationary states in a two-barrier open well.

Development of methods for solving the Lorentz-Newton equation and beam dynamics calculation for defining the new operating modes of the multipurpose isochronous cyclotrons: DC-280 (FLNR, JINR), AIC-144 (INP, PAS).

Development of numerical-analytical methods for modeling phase transitions and transient processes in physical systems encountered in studies conducted at JINR (graphite-diamond, Josephson junction stacks, thermal conductivity in technical installations).

Interval-dependent quadrature sums in Bayesian automatic adaptive quadrature.

Implementation of a software package for the calculation of the rectangular matrix of the amplitudes of reflection and transmission and the corresponding wave functions for multi-channel scattering problems.

Development of new approaches to analytical and numerical investigation of actual problems of the modern cosmology in view of recent cosmological data.

Modeling the structure of polydisperse vesicular systems of phospholipids, including phospholipid transport of nano-systems and nano-medicaments, based on data from small-angle neutron and x-ray scattering.

Investigation of localized structures and critical regimes in dissipative media described by non-linear Schroedinger equations.

Development of a novel approach based on utility rate equations, for describing the evolution of complex systems.

- Development or updating of methods, algorithms and software for recording rare processes in different detectors of the CBM setup (STS, MuCh, TRD, MVD) using high-performance computing systems.

Development of a database system for the CBM experiment (definition, agreement, and clarification of the general concepts, creation of a prototype database of the individual elements and detectors of the CBM setup).

Development, testing and implementation of a new algorithm for constructing track-segments in the cathode strip chambers of the CMS setup.

Development and application of the “CATIA-GDML Geometry Builder”. Adaptation, development, implementation and user support of the FAIRRoot based simulation and analysis frameworks for JINR scientific groups. Deployment of the CATIA v5 CAD system in JINR: localization, training and user support.

Development of algorithms and software for the recognition of particle trajectories in the MPD and BM@N experiments.

The use of robust methods for the detection of stochastic processes anomalies.

Development of numerical methods, algorithms and software for metric analysis based reconstruction of nonlinear functional dependencies and for random processes forecasting.

Design and development of effective methods and algorithms based on piecewise polynomial approximation of high order complex functional dependencies and smoothing experimental data using the basic element method.

Creation and investigation of a pool of effective signatures of HERO calorimeter response as a source of input data vectors to artificial neural net of increased accuracy in the cosmic ray energy reconstruction problem.

Extension of the capabilities for small-angle scattering data modeling (program “Fitter”) and development, in the framework of the “SAS” program, of the primary data processing for multi-wire ring detectors for the YuMO spectrometer at the IBR-2 reactor.

Refinement and improvement of the method of analysis of the sample temperature dependent phase transitions in spectra collected in experiments on HRFD at IBR-2.

- Creation of support within the information-computer environment of the heterogeneous cluster “HybriLIT” that allow users carry out parallel computations with the use of new hybrid computing architectures, develop their own applications, get prompt support and participate in tutorials on parallel programming technologies that are held by the leading specialists in the field of high performance computing.

Development of algorithms for numerical investigation of multi-dimensional models that are based on evolutionary equations used for modeling physical processes in different materials (the mentioned processes appear at irradiation with heavy ions and pulsed beams), for modeling Josephson barriers in high-temperature superconductors. Program realization of obtained algorithms for carrying out computations on HybriLIT.

Development of effective algorithms for the solution of molecular dynamics equations on hybrid computing infrastructures.

Hybrid architecture adaptation of algorithms and program complexes designed for solution of multi-dimensional boundary problems of Schroedinger type equations used in investigations of mathematical models of many - particle quantum systems.

Development and implementation of new parallel algorithms into the MCTDHB software complex designed for investigation of multi-dimensional dynamics of bosons' interaction in magneto optical traps.

Development of the trigger software for the MuCh detector using the method of cellular automata and technologies of parallel computing.

Adaptation and optimization of algorithms for the search and reconstruction of the parameters of particle trajectories under simultaneous processing on multiple many-core CPU and GPU architectures.

Development of three-dimensional finite element mesh generation methods and parallel algorithms for hp-adaptive highly accurate calculations of three-dimensional non-linear magnetic fields.

- Symbolic-numeric description of the entangled space for two-qubit mixed states.

Development of discrete combinatorial models for quantum systems with gauge structures and design of computer programs for the investigation of such models.

Design of algorithms and programs to study resonant tunneling of composite particles through repulsive barriers in restricting potentials.

Partial implementation in Maple of the reduction algorithm for Feynman diagrams by means of generalized recurrence relations.

Study of non-equilibrium behaviour of trapped atoms under strong alternating perturbations.

Numerical investigation of spin dynamics of magnetic nanoclusters and development of models for quantum information processing.

List of activities:

Activity or experiment	Leaders	Main researchers
Laboratory or other Division of JINR		
1. Mathematical and computation methods for simulation of complex physical systems	Gh. Adam P.V. Zrelov I.V. Puzynin	S. Adam, P.G. Akishin, I.V. Amirkhanov, E.A. Ayrjan, A.S. Ayriyan, I.V. Barashenkov, I.L. Bogolubsky, A.M. Chervyakov, O. Chuluumbaatar, H. Grigorian, Yu.L. Kalinovsky, K.V. Lukyanov, A. Machavariani, N.V. Makhaldiani, T.I. Mikhailova, I.V. Molodtsova, E.G. Nikonov, D.I. Podgainy, R.V. Polyakova, T.P. Puzynina, V.S. Rikhvitsky, V.N. Robuk, B. Saha, A.A. Sapozhnikov, N.R. Sarkar, I. Sarkhadov, S.I. Serdyukova, Z.A. Sharipov, V.A. Stepanenko, O.I. Streltsova, Z.K. Tukhliev, A.V. Volokhova, R.M. Yamaleev, E.P. Yukalova, E.V. Zemlyanaya, E.I. Zhabitskaya
LIT	P.V. Zrelov Gh. Adam V.V. Ivanov	
2. Software complexes and mathematical methods for processing and analysis of experimental data		

LIT T.O. Ablyazimov, P.G. Akishin, E.P. Akishina,
 V.P. Akishina, E.I. Aleksandrov, I.N. Aleksandrov,
 D.A. Baranov, O.Yu. Derenovskaya, N.D. Dikoussar,
 V.P. Filinova, A.A. Kazakov, A.I. Kazymov, P.I. Kisel,
 B.F. Kostenko, Gh.E. Kozlov, L.Yu. Kruglova,
 I.N. Kukhtina, M.A. Mineev, G.A. Ososkov,
 E.V. Ovcharenko, V.I. Palichik, A.M. Raportirenko,
 V.N. Shigaeve, N.Yu. Shirikova, L.A. Siurakshina,
 A.G. Soloviev, A.N. Sosnin, V.V. Uzhinsky,
 N.N. Voitishin, O.O. Voskresenskaya, A.V. Yakovlev,
 V.B. Zlokazov

3. Numerical methods, algorithms and software computationally adapted to multicore and hybrid architectures

LIT T.O. Ablyazimov, P.G. Akishin, E.I. Aleksandrov,
 A.S. Ayriyan, E.A. Ayrjan, O. Chuluunbaatar,
 O.Yu. Derenovskaya, V.P. Gerdt, A.A. Gusev,
 V.V. Ivanov, A.I. Kazymov, A.M. Khvedelidze,
 P.I. Kisel, Gh.E. Kozlov, A.A. Lebedev, S.A. Lebedev,
 Yu.G. Palii, D.V. Podgainy, A.A. Sapozhnikov,
 T.F. Sapozhnikova, O.I. Strelets, O.I. Yuldashev,
 M.B. Yuldasheva, E.V. Zemlyanaya, M.I. Zuev

4. Methods, algorithms and software of computer algebra

LIT A.A. Bogolubskaya, S.A. Evlakhov, A.A. Gusev,
 A.M. Khvedelidze, V.V. Korniyak, Yu.G. Palii,
 A.M. Raportirenko, I.A. Rogozhin, O.V. Tarasov,
 D.A. Yanovich

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU IIAP NAS RA RAU Foundation ANSL
Australia	Ashtarak	IPR NAS RA
Belarus	Sydney	Univ.
Belgium	Minsk	IM NASB BSU
Brazil	Brussels	ULB
Bulgaria	Liege	ULg
	Sao Carlos, SP	IFSC USP
	Sofia	IMI BAS INRNE BAS
Canada	Plovdiv	SU PU
	Edmonton	U of A

CERN	Toronto	IBM Lab
Czech Republic	Geneva	CERN
Egypt	Řež	NPI ASCR
France	Cairo	TIMS
	Metz	UPV-M
	Nantes	SUBATECH
Georgia	Tbilisi	UG
		RMI TSU
		TSU
		GTU
		ISU
Germany	Bonn	UniBonn
	Darmstadt	GSI
	Dresden	IFW
	Frankfurt/Main	Univ.
	Giessen	JLU
	Heidelberg	Univ.
	Jülich	FZJ
	Kassel	Uni Kassel
	Marburg	Univ.
	Munich	LMU
	Potsdam	IASS
	Regensburg	UR
	Tübingen	Univ.
Greece	Thessaloniki	AUTH
India	Pune	IUCAA
Italy	Turin	INFN
	Bari	UniBa
Japan	Osaka	Kansai Univ.
Kazakhstan	Almaty	INP
		IPPT
Moldova	Chișinău	IAP ASM
Mongolia	Ulaanbaatar	NUM
		MUST
Poland	Krakow	AGH-UST
	Lublin	UMCS
	Otwock-Swierk	NCBJ
	Wroclaw	UW
Portugal	Coimbra	UC
Romania	Bucharest	IFA
		IFIN-HH
		ISS
		UB
	Cluj-Napoca	INCDTIM
Russia	Moscow	ICS RAS

	ITEP
	NNRU "MEPhI"
	KIAM RAS
	MSU
	PFUR
	SINP MSU
	VIGG RAS
	GPI RAS
	BelSU
	Dubna Univ.
	BINP SB RAS
	PSNRU
	IHEP
	IMPB RAS
	ITEB RAS
	IPR RAS
	SSU
	FIP
	NIEFA
	TSU
	TvSU
Slovakia	IEP SAS
	TUKE
	PJSU
	PU
South Africa	UCT
	UP
Switzerland	ETH
Taiwan	AS
Tajikistan	TNU
	PHTI ASRT
	KSU
Ukraine	BITP NASU
	IERT NASU
	KFTI
USA	ANL
Vietnam	VNU

05-8-1037-2001/2019

Priority:

1

Status:

In-progress

Analytical and Methodological Work to Assess the Prospects of Scientific Research and Cooperation in the Main Directions of JINR's Development. Organization of International Cooperation

Leader: N.A. Russakovich

Participating Countries and International Organizations:

Member States of JINR, non-Member States participating in JINR activities on the basis of bilateral agreements, and international organizations.

Scientific Programme

Preparation by the JINR Science Organization Department of analytical materials on the prospects of scientific research. Preparation of research plans. Preparation of scientific-organizational and methodological materials concerning project-topical and special-purpose financing of research programmes and projects. Application of data base systems for the analysis of results of theoretical and experimental research activities. Organization of international cooperation with the Member States of JINR, non-Member States participating in JINR activities on the basis of bilateral agreements, and with scientific research institutions with which JINR has collaboration agreements.

Expected main results in 2016:

- Analysis of the results of JINR's activities in the main directions of research. Preparation for publication of the JINR Topical Plan for Research and International Cooperation for 2017.
- Information and technical preparation of the JINR Web site. Further development of the data base information search system for JINR research themes and projects. Information support of the electronic system of protocols for scientific and technical collaboration.
- Development and application of software for automation of scientific and financial planning. Analysis of the use of budgetary resources by fields of research, themes, and research groups.
- Maintenance of interaction on issues of scientific research work with representatives of the Member States of JINR and non-Member States participating in JINR activities on the basis of bilateral agreements. Organization and holding of meetings on cooperation with international organizations.

List of activities:

Activity or experiment	Leaders
Laboratory or other	Main researchers
Division of JINR	
1. Preparation for publication of the JINR Topical Plan for Research and International Cooperation for 2017	N.A. Russakovich
SOD	N.A. Boklagova, L.K. Ivanova, N.I. Sissakian

2. JINR internet-site activities maintenance

SOD

N.A. Russakovich

N.A. Boklagova, L.K. Ivanova, L.I. Kalinina,
T.B. Ivashkevich, O.K. Kronshtadtov, K.P. Moisenz,
A.G. Nanev, N.I. Sissakian

AMISD

V.F. Borisovskiy

Editorial office, weekly newspaper
“Dubna: Science, Cooperation,
Progress”

E.M. Molchanov

LIT

K.V. Lukyanov, A.V. Prikhodko

3. Automation of scientific planning

AMISD

N.A. Russakovich

V.F. Borisovskiy

LIT

M.V. Bashashin, I.A. Filozova, S.V. Kunyaev,
G.G. Musulmanbekov, M.S. Plyashkevich, P.V. Ustenko

4. International cooperation

IRD

N.A. Russakovich

D.V. Kamanin

Educational Programme (06)

06-0-1120-2014/2018

Priority:

1

Status:

In-progress

Organization, Support and Development of the JINR Educational Programme

Leaders:

V.A. Matveev
S.Z. Pakuliak

Participating Countries and International Organizations:

Armenia, Azerbaijan, Belarus, Bulgaria, CERN, Czech Republic, Egypt, Kazakhstan, Moldova, Poland, Romania, Russia, Serbia, Slovakia, South Africa, Ukraine, USA, Vietnam.

Scientific Programme

Support and development of the JINR Educational Programme in general (training of physicists, engineers and engineering physicists in JINR fields of research and in the interests of the Member States). Professional development, training and retraining of JINR engineering and technical staff. Promotion of physics research and of the Institute activities among the youth of the Member States including high-school students.

Expected main results in 2016:

- Support and maintenance of the educational process at the UC. Preparation and publication - as tutorials - of lectures given to the UC students and postgraduates. Support of the system of assigning young researchers to JINR laboratories for preparation of PhD theses without mastering the academic programmes of PhD courses.
- Organization and holding of Summer Student Practices in JINR fields of research for students of higher-education institutions of JINR Member States. Participation in the organization and holding of international schools on nuclear physics and particle physics for young scientists. Expansion of the research projects of the Summer Student Programme at JINR and number of participants of this programme.
- Completion of creation of the educational facilities and complexes for practical work in the framework of a UC-based scientific and engineering group for implementation of educational programmes for training engineering physicists for the needs of JINR and scientific centres of the Member States.
- Cooperation with international foundations in organizing student and postgraduate exchange between the UC and foreign research centres regulated by special agreements.
- Development of the computer infrastructure for organizing and conducting training programmes for data analysis in high-energy physics experiments.
- Improvement of the training laboratory and school elective courses for the organization of lecture courses and practical classes in physics for high-school students from Dubna and the Member States. Organization of scientific schools for teachers of physics from the Member States at CERN and JINR.
- Organization of real and virtual excursions to JINR and video-conferences for high-school students and teachers from the Member States. Development of the system of teaching Russian, English, French and German to JINR staff.
- Development of training and educational programmes in relativistic nuclear physics and particle physics. Dissemination of information on the Virtual Laboratory of Nuclear Fission in the Member States.

List of projects:

Project	Leader	Priority (period of realization)
1. Development of modern education programmes	Y.A. Panebratsev	1 (2014 – 2016)

List of activities:

Activity or experiment	Leaders
Laboratory or other	Main researchers
Division of JINR Responsible person 1. Organization of the Educational Process at JINR DLNP V.A. Bednyakov D.V. Naumov BLTP V.V. Voronov A.P. Isaev A.B. Arbuzov FLNP V.N. Shvetsov E.V. Lychagin O.A. Culikov VBLHEP R. Lednický V.D. Kekelidze FLNR S.N. Dmitriev LIT V.V. Korenkov LRB E.A. Krasavin Directorate G.V. Trubnikov G.D. Shirkov SOICO D.V. Kamanin	V.A. Matveev S.Z. Pakuliak G.A. Chelkov, A.G. Olshevskiy, V.V. Glagolev D.I. Kazakov, A.V. Gladyshev, V.A. Osipov, S.N. Nedelko B.N. Savenko, A.M. Balagurov, Yu.N. Kopach, A.V. Belushkin I.A. Golutvin, S.V. Shmatov, M.G. Sapozhnikov, N.N. Agapov, S.S. Shimansky, Zimin N.I. A.V. Eremin V.I. Zagrebaev, A.G. Popeko, A.S. Denikin T.A. Strizh, N.A. Kutovskiy, S.D. Belov, V.P. Gerdt O.V. Belov, I.V. Koshlan A.V. Dudarev, E.D. Uglov W. Chmielowski, M.G. Loschilov
Y.A. Panebratsev 2. Developing of modern educational projects	

Collaboration

Country or International Organization	City	Institute or Laboratory
Armenia	Yerevan	YSU
Azerbaijan	Baku	IP ANAS
Belarus	Minsk	BSU
		NC PHEP BSU
		ME RB
Bulgaria	Gomel	GSU
	Sofia	INRNE BAS
		SU
	Blagoevgrad	SWU

CERN	Geneva	CERN
Czech Republic	Prague	CU
	Řež	CTU
Egypt	Cairo	NPI ASCR
Kazakhstan	Almaty	ASRT
Moldova	Chișinău	KazNU
Poland	Krakow	ASM
	Lodz	JU
	Poznan	UL
Romania	Bucharest	AMU
Russia	Moscow	UB
	Dolgoprudny	MIREA
	Dubna	NNRU "MEPhI"
		SINP MSU
	Kostroma	MIPT
	Tver	Dubna Univ.
	Tula	BSINP MSU
Slovakia	Bratislava	KSU
	Košice	TvSU
South Africa	Pretoria	TSU
Ukraine	Kiev	CU
		PJSU
USA	Upton, NY	Necsa
Vietnam	Hanoi	BITP NASU
		NUK
		BNL
		VNU

Alphabetic List of Collaborators

Albania

Tirana

UT (University of Tirana |
<http://www.unitir.edu.al/>), 122

Argentina

Bariloche

CAB CNEA (Centro Atomico Bariliche
National Atomic Energy Commission |
<http://www.cab.cnea.gov.ar/>), 132

Armenia

Ashtarak

IPR NAS RA (Institute for Physical Research
of the National Academy of Sciences of the
Republic of Armenia |
<http://www.ipr.sci.am/>), 169

Yerevan

ANSSP (Armenian National Survey for
Seismic Protection | <http://www.nssp-gov.am/about-NSSP-eng.htm>),
77

Foundation ANSL (Alikhanian National
Science Laboratory (Yerevan Physics
Institute) Foundation |
<http://www.yerphi.am/>), 11, 21, 37, 55, 61,
85, 89, 92, 111, 163, 169

IIAP NAS RA (Institute for Informatics and
Automation Problems of the National
Academy of Sciences of the Republic of
Armenia), 21, 163, 169

Inst. Physiology NAS RA (L.A.Orbeli
Institute of Physiology of the National
Academy of Sciences of the Republic of
Armenia | <http://www.physiol.sci.am/>), 142

RAU (Russian-Armenian (Slavonic) University
| <http://www.rau.am/>), 11, 17, 169

YSU (Yerevan State University |
<http://ysu.am/>), 21, 26, 73, 85, 96, 111,
149, 163, 169, 177

Australia

Melbourne

Univ. (University of Melbourne |
<http://unimelb.edu.au/>), 21, 122

Sydney

Univ. (University of Sydney |
<http://sydney.edu.au/>), 21, 26, 96, 169

Austria

Innsbruck

Univ. (University of Innsbruck |
<http://www.uibk.ac.at/>), 17, 122

Vienna

HEPHY (Institute of High Energy Physics of
the Austrian Academy of Sciences |
<http://www.hephy.at/>), 55

IAEA (International Atomic Energy Agency |
<http://www.iaea.org/>), 122

TU Vienna (Vienna University of Technology |
<http://www.tuwien.ac.at/>), 26, 30

Univ. (University of Vienna |
<http://www.univie.ac.at/>), 30

Azerbaijan

Baku

IP ANAS (Institute of Physics of the
Azerbaijan National Academy of Sciences |
<http://www.physics.gov.az/>), 11, 37, 73,
132, 163, 177

IRP ANAS (Institute of Radiation Problems
of the Azerbaijan National Academy of
Sciences | <http://www.irp.science.az/>), 89,
137

Belarus

Gomel

BelSUT (Belarusian State University of
Transport | <http://www.belsut.gomel.by/>),
11, 55

GSTU (Sukhoi State Technical University of
Gomel | <http://www.gstu.by/>), 11, 38, 64,
73, 163

GSU (Francisk Skorina Gomel State
University | <http://www.gsu.by/>), 11, 55,
64, 73, 145, 177

IRB NASB (Institute of Radiobiology of the
National Academy of Sciences of Belarus |
<http://irb.basnet.by/>), 149

Minsk

BNTU (Belarusian National Technical
University | <http://www.bntu.by/>), 163

BSTU (Belarusian State Technological
University | [http://www.bstu.unibel/by/](http://www.bstu.unibel.by/)),
21, 145

BSU (Belarusian State University |
<http://www.bsu.by/>), 115, 145, 169, 177

BSUIR (Belarusian State University of
Informatics and Radioelectronics |
<http://www.bsuir.by/>), 64, 73, 77, 142

IAP NASB (State Scientific Institution
“Institute of Applied Physics of the National
Academy of Sciences of Belarus |
<http://iaph.bas-net.by/>), 132

ICE MES RB (Institute for Command
Engineers of the Ministry for Emergency

Situations of the Republic of Belarus | <http://kii.gov.by/>), 22

IM NASB (Institute of Mathematics of the National Academy of Sciences of Belarus | <http://im.bas-net.by/>), 169

INP BSU (Research Institute for Nuclear Problems of the Belarusian State University | <http://www.inp.bsu.by/>), 11, 55, 78, 81, 96, 115, 122, 132

IOMR (N.N.Alexandrov National Cancer Centre of Belarus | <http://omr.by/>), 145

IP NASB (B.I.Stepanov Institute of Physics of the National Academy of Sciences of Belarus | <http://ifanbel.basnet.by/>), 17, 22, 26, 37, 115

JIMB NASB (Joint Institute of Machine Building of the National Academy of Sciences of Belarus | <http://www.oim.by/>), 22

JIPNR-Sosny NASB (Joint Institute for Power and Nuclear Research - Sosny of the National Academy of Sciences of Belarus | <http://sosny.bas-net.by/>), 11, 22, 38, 61, 73, 96, 157, 163

ME RB (Ministry of Education of the Republic of Belarus | <http://edu.gov.by/>), 177

NC PHEP BSU (National Scientific and Educational Centre of Particle and High Energy Physics of the Belarusian State University | <http://www.hep.by/>), 11, 37, 40, 45, 52, 55, 61, 64, 73, 85, 96, 115, 132, 145, 157, 163, 177

PTI NASB (Physical Technical Institute of the National Academy of Sciences of Belarus | <http://www.phti.belhost.by/>), 78

RI PCP BSU (Research Institute for Physical Chemical Problems of the Belarusian State University | <http://www.fhp.bsu.by/>), 132

RIAPP BSU (Research Institute of Applied Physical Problems of the Belarusian State University | <http://www.niipfp.bsu.by/>), 145

SOL instruments (SOL instruments | <http://www.solinstruments.com/>), 142

SPMRC NASB (Scientific-Practical Materials Research Centre of the National Academy of Sciences of Belarus | <http://www.physics.by/>), 78, 96, 122, 132

“INTEGRAL” (“INTEGRAN” JSC | <http://www.integral.by/>), 40

“Planar” (Planar Corporation | <http://www.planar.by/>), 73

Belgium

Antwerp

UA (University of Antwerp | <http://www.uantwerpen.be/>), 55

Brussels

ULB (Free University of Brussels | <http://www.ulb.ac.be/>), 55, 106, 169

VUB (Vrije University Brussels | <http://www.vub.ac.be/>), 17, 55

Geel

IRMM (Institute for Reference Materials and Measurements of the Joint Research Centre of the European Commission | <http://irmm.jrc.ec.europa.eu/>), 122

Leuven

KU Leuven (Catholic University of Leuven | <http://www.kuleuven.ac.be/>), 102, 106, 111

Liege

ULg (University of Liège | <http://www.ulg.ac.be/>), 169

Louvain-la-Neuve

IBA (Ion Beam Applications | <http://iba-worldwide.com/>), 102, 118

UCL (Catholic University of Louvain | <http://www.uclouvain.be/>), 17, 22, 52, 55

Mons

UMONS (University of Mons | <http://portail.umons.ac.be/>), 55

Brazil

Brasilia, DF

UnB (University of Brasilia | <http://www.unb.br/>), 22

Florianopolis, SC

UFSC (Federal University of Santa Catarina | <http://ufsc.br/>), 17

Natal, RN

IIP UFRN (International Institute of Physics of the Federal University of Rio Grande do Norte | <http://www.iip.ufrn.br/>), 22

Niteroi, RJ

UFF (Federal Fluminense University | <http://www.uff.br/>), 17

Rio de Janeiro, RJ

CBPF (Brazilian Center for Physics Research | <http://portal.cbpf.br/>), 55

UERJ (Rio de Janeiro State University | <http://www.uerj.br/>), 55

UFRJ (Federal University of Rio de Janeiro | <http://www.ufpj.br/>), 55

Sao Carlos, SP

IFSC USP (Institute of Physics of São Carlos of the University of São Paulo | <http://www.ifsc.usp.br/>), 169

Sao Jose dos Campos, SP

ITA (Instituto Tecnológico de Aeronáutica |
<http://www.ufcar.br/>), 17

Sao Paulo, SP

UEP (Unidade de Ensino Profissionalizante da
Santa Casa de São Paulo |
<http://www.santacasasp.org.br/>), 17

USP (University of São Paulo |
<http://www5.usp.br/>), 22, 26, 30

Unesp (São Paulo State University |
<http://www.unesp.br/>), 55

Bulgaria

Blagoevgrad

SWU (South-West University “Neofit Rilski” |
<http://www.swu.bg/>), 52, 73, 163, 177

Plovdiv

PU (Plovdiv University “Paisii Hilendarski” |
<http://www.uni-plovdiv.bg/>), 52, 73, 111,
122, 145, 169

UFT (University of Food Technologies |
<http://uft-plovdiv.bg/>), 122

Sofia

IE BAS (Academician Emil Djakov Institute
of Electronics of the Bulgarian Academy of
Sciences | <http://ie-bas.dir.bg/>), 132, 149

IEES BAS (Institute of Electrochemistry and
Energy Systems of the Bulgarian Academy
of Sciences | <http://www.bas.bg/cleps/>),
132

IMI BAS (Institute of Mathematics and
Informatics of the Bulgarian Academy of
Sciences | <http://math.bas.bg/>), 169

IMS BAS (Institute of Metal Science,
Equipment end Technologies
“Acad. A.Balevsci” with Hydroaerodynamics
Centre of the Bulgarian Academy of
Sciences | <http://ims.bas.bg/>), 132

IMech BAS (Institute of Mechanics of the
Bulgarian Academy of Sciences |
<http://www.imbm.bas.bg/>), 22

INRNE BAS (Institute for Nuclear Research
and Nuclear Energy of the Bulgarian
Academy of Sciences |
<http://www.inrne.bas.bg/>), 11, 17, 22, 26,
30, 50, 55, 61, 73, 78, 85, 96, 102, 106, 111,
122, 132, 140, 149, 163, 169, 177

ISSP BAS (Georgi Nadjakov Institute of Solid
State Physics of the Bulgarian Academy of
Sciences | <http://www.issp.bas.bg/>), 22, 73,
132

LTD BAS (Laboratory for Technical
Development of the Bulgarian Academy of
Sciences | <http://www.pronto.phys.bas.bg/>),
73, 102

NCRRP (National Centre of Radiobiology and
Radiation Protection | <http://ncrrp.org/>),
149

SU (Sofia University “St.Kliment Ohridski” |
<http://www.uni-sofia.bg/>), 11, 22, 26, 30,
40, 52, 55, 61, 92, 115, 163, 169, 177

TU-Sofia (Technical University of Sofia |
<http://www.tu-sofia.bg/>), 73

UCTM (University of Chemical Technology
and Metallurgy | <http://www.uctm.edu/>),
81

Canada

Edmonton

U of A (University of Alberta; Theoretical
Physics Institute; Avadh Bhatia Physics
Laboratory | <http://www.ualberta.ca/>), 26,
30, 169

Hamilton

McMaster (McMaster University |
<http://www.mcmaster.ca/>), 17

Kingston

Queen’s (Queen’s University |
<http://www.queensu.ca/>), 22

London

Western (University of Western - Canada |
<http://www.uwo.ca/>), 22

Montreal

Concordia (Concordia University Montreal |
<http://www.concordia.ca/>), 22

McGill (McGill University |
<http://www.mcgill.ca/>), 11, 26

UdeM (University of Montreal |
<http://www.umontreal.ca/>), 11, 26, 30, 38

Quebec

UL (Laval University |
<http://www.ulaval.ca/>), 22

Saskatoon

U of S (University of Saskatchewan |
<http://www.usask.ca/>), 17

Toronto

IBM Lab (IBM Toronto Software Lab |
<http://www.ibm.com/>), 170

U of T (University of Toronto |
<http://www.utoronto.ca/>), 11

Vancouver

TRIUMF (Canada’s National Laboratory for
Particle and Nuclear Physics |
<http://www.triumf.ca/>), 38, 115

China

Beijing

Beijing Fert Co (Beijing Fert Medical
Instruments Technology Co., Ltd. |
<http://www.china-fert.com/>), 145

- CIAE** (China Institute of Atomic Energy | <http://www.ciae.ac.cn/>), 17, 86, 92, 106
- IHEP CAS** (Institute of High Energy Physics of the Chinese Academy of Sciences | <http://www.ihep.ac.cn/>), 35, 43, 55, 86, 122
- ITP CAS** (Institute of Theoretical Physics of the Chinese Academy of Sciences | <http://english.itp.cas.cn/>), 17
- PKU** (Peking University | <http://www.pku.edu.cn/>), 17, 55, 106
- “**Tsinghua**” (Tsinghua University | <http://www.tsinghua.edu.cn/>), 73
- Hefei*
- IPP CAS** (Institute of Plasma Physics of the Chinese Academy of Sciences | <http://english.ipp.cas.cn/>), 118
- USTC** (University of Science and Technology of China | <http://www.ustc.edu.cn/>), 55
- Lanzhou*
- IMP CAS** (Institute of Modern Physics of the Chinese Academy of Sciences | <http://www.impcas.cn/>), 102, 106
- Wuhan*
- CCNU** (Central China Normal University; Institute of Particle Physics | <http://www.ccnu.edu.cn/>), 86, 92
- WIPM CAS** (Wuhan Institute of Physics and Mathematics of the Chinese Academy of Sciences | <http://english.wipm.cas.cn/>), 11
- Croatia**
- Split*
- Univ. (University of Split | <http://www.unist.hr/>), 55
- Zagreb*
- Oikon IAE (Oikon Ltd. Institute for Applied Ecology | <http://www.oikon.hr/>), 122
- RBI (Rudjer Boskovic Institute | <http://www.irb.hr/>), 92, 115, 122
- Cyprus**
- Nicosia*
- UCY (University of Cyprus | <http://www.ucy.ac.cy/>), 55
- Czech Republic**
- Brno*
- BUT (Brno University of Technology | <http://www.vutbr.cz/>), 96
- IBP ASCR (Institute of Biophysics of the Academy of Sciences of the Czech Republic, v.v.i. | <http://www.ibp.cz/>), 149
- ISI ASCR (Institute of Scientific Instruments of the Academy of Sciences of the Czech Republic, v.v.i. | <http://www.isibrno.cz/>), 81
- Liberec*
- TUL (Technical University of Liberec | <http://www.tul.cz/>), 73, 81
- Ostrava*
- UO (University of Ostrava | <http://www.osu.eu/>), 123
- VSB-TUO (Technical University of Ostrava | <http://www.vsb.cz/>), 122
- Prague*
- CEI (Czech Environmental Institute | <http://www.ceu.cz/>), 122
- CTU (Czech Technical University in Prague | <http://www.cvut.cz/>), 11, 26, 30, 64, 78, 81, 96, 106, 111, 122, 132, 149, 157, 178
- CU (Charles University in Prague | <http://www.cuni.cz/>), 11, 17, 26, 38, 43, 45, 47, 52, 55, 61, 73, 81, 89, 102, 115, 178
- IG ASCR (Institute of Geology of the Academy of Sciences of the Czech Republic, v.v.i. | <http://www.gli.cas.cz/>), 132
- IMC ASCR (Institute of Macromolecular Chemistry of the Academy of Sciences of the Czech Republic, v.v.i. | <http://www.imc.cas.cz/>), 86, 132
- IP ASCR (Institute of Physics of the Academy of Sciences of the Czech Republic, v.v.i. | <http://www.fzu.cz/>), 11, 30, 92, 132, 163
- PTC (Proton Therapy Center ‘zech s.r.o | <http://www.ptc.cz/>), 155
- VP (Vacuum PRAGUE | <http://www.vakuum.cz/>), 102, 106
- Řež*
- NPI ASCR (Nuclear Physics Institute of the Academy of Sciences of the Czech Republic, v.v.i. | <http://www.ujf.cas.cz/>), 11, 17, 22, 26, 30, 64, 81, 86, 90, 102, 106, 111, 115, 132, 140, 145, 149, 170, 178
- UJV (“ÚJV Řež, a.s.” | <http://www.ujv.cz/>), 64, 89, 92, 96, 149, 155
- Democratic People’s Republic of Korea**
- Yonbyon*
- IFR SCNR (Institute of Fundamental Research of the Yongbyon Nuclear Scientific Research Centre), 102
- Denmark**
- Copenhagen*
- NBI (Niles Bohr Institute of the University of Copenhagen | <http://www.nbi.ku.dk/>), 92
- Egypt**
- Alexandria*
- Univ. (Alexandria University | <http://www.alexu.edu.eg/>), 123

- Cairo*
- AASTMT (Arab Academy for Science and Technology and Maritime Transport | <http://www.aast.edu/>), 102
 - ASRT (Academy of Scientific Research and Technology | <http://www.asrt.sci.eg/>), 178
 - CU (Cairo University | <http://cu.edu.eg/>), 102, 132
 - EAEA (Egyptian Atomic Energy Authority | <http://www.eaea.org.eg/>), 17, 123, 132
 - ECTP (Egyptian Center for Theoretical Physics | <http://www.mti.edu.eg/ECTP>), 73
 - TIMS (Tabbin Institute for Metallurgical Studies | <http://www.tins.gov.eg/>), 170
- Giza*
- CU (Cairo University | <http://cuportal.cu.edu.eg/>), 17, 106, 149, 163
- Shibin al Kawm*
- MU (Menoufia University | <http://mu.menoufia.edu.eg/>), 102, 106, 123
- Estonia**
- Tallinn*
- NICPB (National Institute of Chemical Physics and Biophysics | <http://www.kbfi.ee/>), 55
- Finland**
- Helsinki*
- HIP (Helsinki Institute of Physics | <http://www.hip.fi/>), 55
 - UH (University of Helsinki | <http://www.helsinki.fi/university>), 11, 55
- Jyväskylä*
- UJ (University of Jyväskylä | <http://www.jyu.fi/>), 55, 107, 111, 123
- Oulu*
- UO (University of Oulu; Microelectronics Instrumentation Laboratory | <http://www.oulu.fi/>), 55, 123
- Tampere*
- TUT (Tampere University of Technology; Digital and Computer Systems Laboratory | <http://www.tut.fi/>), 55
- France**
- Annecy-le-Vieux*
- LAPP (Laboratory of Annecy-la-Vieux for Particles Physics of the National Institute for Nuclear Physics and Particles Physics of the National Centre for Scientific Research | <http://lappweb.in2p3.fr/>), 27, 30, 55
 - LAPTh (Laboratory of Theoretical Physics of Annecy-la-Vieux of the National Institute for Nuclear Physics and Particles Physics of the National Centre for Scientific Research | <http://lappweb.in2p3.fr/lapth-2005>), 27
- Bordeaux*
- CENBG (Centre of Nuclear Studies of Bordeaux-Gradignan | <http://www.cenbg.in2p3.fr/>), 111
 - UB (University of Bordeaux | <http://www.univ-bordeaux.fr/>), 17
- Cadarache*
- CC CEA (Centre de Recherche du Commissariat à l'Energie Atomique et aux Energies Alternatives Cadarache | <http://www-cadarache.cea.fr/>), 123
- Caen*
- GANIL (Grand National Heavy Ion Accelerator | <http://www.ganil-spiral2.eu/>), 17, 102, 107
 - UNICAEN (University of Caen Normandy | <http://www.unicaen.fr/>), 111
- Clermont-Ferrand*
- LPC (Corpuscular Physics Laboratory Clermont-Ferrand of the Blaise Pascal University | <http://clrwww.in2p3.fr/>), 38, 92
- Dijon*
- UB (University of Bourgundy | <http://www.u-bourgogne.fr/>), 27, 30
- Grenoble*
- IBS (Institute of Structural Biology | <http://www.ibs.fr/>), 132, 143
 - ILL (Institute Laue-Langevin | <http://www.ill.eu/>), 123, 140
 - LPSC (Laboratoire de Physique Subatomique et de Cosmologie | <http://lpscwww.in2p3.fr/>), 102, 123
- Lyon*
- ENS Lyon (Ecole Normale Supérieure de Lyon; Physics Laboratory | <http://www.ens-lyon.eu/>), 27, 30
 - IPNL (Institute of Nuclear Physics of Lyon | <http://www.ipnl.in2p3.fr/>), 55
 - UCBL (Claude Bernard University Lyon 1 | <http://www.univ-lyon1.fr/>), 11, 92
- Marseille*
- CPPM (Centre de Physique des Particules de Marseille | <http://marwww.in2p3.fr/>), 163
 - CPT (Centre of Theoretical Physics | <http://www.cpt.univ-mrs.fr/>), 27, 30
 - UPC (University Paul Cézanne - Aix-Marseille III | <http://www.univ-cezanne.fr/>), 22
- Metz*
- UPV-M (Paul-Verlaine University of Metz | <http://www.univ-metz.fr/>), 11, 170

- Montpellier*
 UM2 (University of Montpellier 2 |
<http://www.univ-montp2.fr/>), 11
- Nantes*
 SUBATECH (Subatomic Physics Laboratory and Associated Technologies;
 UMR/EMN/IN2P3/CNRS/University of Nantes | <http://www-subatech.in2p3.fr/>), 27, 30, 73, 90, 92, 170
- Nice*
 UN (University Nice Sophia Antipolis |
<http://unice.fr/>), 22
- Orsay*
 CSNSM (Center for Nuclear and Mass Spectrometry- IN2P3/CNRS |
<http://www-csnsm.in2p3.fr/>), 17, 107, 111
 IPN Orsay (Institute of Nuclear Physics Orsay - IN2P3/CNRS | <http://ipnweb.in2p3.fr/>), 17, 81, 86, 92, 102, 107
 LAL (Linear Accelerator Laboratory of the University of Paris-Sid 11 - IN2P3/CNRS | <http://www.lal.in2p3.fr/>), 38, 111
- Palaiseau*
 Polytech (Ecole Polytechnique |
<http://www.polytechnique.fr/>), 27
- Paris*
 ENS (École Normale Supérieure Paris |
<http://www.ens.fr/>), 27, 30
 LPTHE (Laboratory of Theoretical Physics and High Energy of the Pierre et Marie Curie - IN2P3/CNRS |
<http://parthe.lpthe.jussieu.fr/>), 27, 30
 UPMC (Pierre et Marie Curie University Henri Poincaré Institute Paris 6 |
<http://www.upmc.fr/>), 22, 30
- Saclay*
 IRFU (Institute of Research into the Fundamental Laws of the Universe |
<http://irfu.cea.fr/>), 11, 55, 61, 81, 92, 115
 LLB (Léon Brillouin Laboratory CEA-CNRS |
<http://www-lb.cea.fr/>), 123, 132, 140
 SPhN CEA DAPNIA (Nuclear Physics Division of the Commissariat for Atomic Energy | <http://irtu.cea.fr/Sphn>), 11, 107
- Strasbourg*
 CRN (Centre of Nuclear Research - IN2P3/CNRS | <http://ireswww.in2p3.fr/>), 43, 92, 107
 IPHC (Hubert Curien Multidisciplinary Institute of the University of Strasburg - IN2P3/CNRS | <http://www.iphc.cnrs.fr/>), 55, 102, 107, 123
- Valenciennes*
 UVHC (University of Valenciennes and Hainaut-Combrésis |
<http://www.univ-valenciennes.fr/>), 22, 27, 30
- Vannes*
 SigmaPhi (Company SigmaPhi Accelerator Technologies | <http://www.sigmaphi.fr/>), 102
- Georgia**
- Tbilisi*
 AIP TSU (Elevter Andronikashvili Institute of Physics of the Ivane Javakhishvili Tbilisi State University | <http://aiphysics.ge/>), 55, 73, 123
 GRENA (Georgian Research and Educational Networking Association | <http://grenae.ge/>), 163
 GTU (Georgia Technical University |
<http://www.gtu.ge/>), 163, 170
 HEPI-TSU (High Energy Physics Institute of Ivane Javakhishvili Tbilisi State University |
<http://www.hepi.edu.ge/>), 38, 40, 55, 78, 115
 ISU (Ilia State University |
<http://iliauni.edu.ge/>), 170
 RMI TSU (Andrea Razmadze Mathematical Institute of the Ivane Javakhishvili Tbilisi State University | <http://www.rmi.ge/>), 11, 170
 TSU (Ivane Javakhishvili Tbilisi State University | <http://www.tsu.ge/>), 123, 163, 170
 UG (University of Georgia |
<http://www.ug.edu.ge/>), 163, 170
- Germany**
- Aachen*
 RWTH (Aachen University |
<http://www.rwth-aachen.de/>), 12, 43, 55, 115
- Bayreuth*
 Univ. (University of Bayreuth |
<http://www.uni-bayreuth.de/>), 132
- Berlin*
 BAM (Federal Institute for Materials Research and Testing |
<http://www.bam.de/>), 132
 FU Berlin (Free University of Berlin |
<http://www.fu-berlin.de/>), 11, 27
 HUB (Humboldt University of Berlin |
<http://www.hu-berlin.de/>), 12, 27, 30, 55
 HZB (Helmholtz Centre Berlin of the Helmholtz Association |
<http://www.helmholtz-berlin.de/>), 107, 132, 140

- Bielefeld*
 Univ. (University of Bielefeld |
<http://www.uni-bielefeld.de/>), 12, 27, 61
- Bochum*
 RUB (Ruhr University of Bochum |
<http://www.ruhr-uni-bochum.de/>), 12, 61,
 82, 132
- Bonn*
 UniBonn (University of Bonn |
<http://www3.uni-bonn.de/>), 12, 17, 22, 27,
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- Braunschweig*
 TU (Technical University Carolo-Wilhelmina
 at Braunschweig |
<http://www.tu-braunschweig.de/>), 22
- Bremen*
 Univ. (University of Bremen |
<http://www.uni-bremen.de/>), 22
- Cologne*
 Univ. (University of Cologne |
<http://www.uni-koeln.de/>), 17, 115
- Darmstadt*
 GSI (Helmholtz-Centre for Heavy Ion
 Research of the Helmholtz Association |
<http://www.gsi.de/>), 17, 22, 45, 50, 73, 78,
 86, 92, 102, 107, 145, 163, 170
- IKP (Institute of Nuclear Physics of the
 Darmstadt University of Technology |
<http://www.physik.tu-darmstadt.de/>), 17
- TU Darmstadt (Technical University of
 Darmstadt | <http://www.tu-darmstadt.de/>),
 17, 86, 96, 123, 132
- Dortmund*
 TU Dortmund (Technical University of
 Dortmund | <http://www.uni-dortmund.de/>),
 12, 22, 27, 132
- Dresden*
 HZDR (Dresden-Rossendorf Helmholtz Centre
 | <http://www.hzdr.de/>), 17, 50, 86, 115, 123
- IFW (Leibniz Institute for Solid State and
 Materials Research Dresden |
<http://www.ifw-dresden.de/>), 22, 170
- ILK (Institute of Air Handling and
 Refrigeration | <http://www.ilkdresden.de/>),
 73
- MPI PkS (Max Planck Institute for the
 Physics of Complex Systems |
<http://www.mppiks-dresden.mpg.de/>), 22
- TU Dresden (Technical University of Dresden
 | <http://tu-dresden.de/>), 22, 82, 132
- Duisburg*
 UDE (University of Duisburg-Essen |
<http://www.uni-due.de/>), 22
- Erlangen*
 FAU (Friedrich Alexander University of
 Erlangen-Nuremberg |
<http://www.uni-erlangen.org/>), 12, 17, 61,
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- Frankfurt/Main*
 FIAS (Frankfurt Institute for Advanced
 Studies | <http://fias.uni-frankfurt.de/>), 73
- Univ. (Goethe University of Frankfurt on
 Main | <http://www.uni-frankfurt.de/>), 17,
 30, 50, 64, 73, 86, 92, 107, 163, 170
- Freiberg*
 IMF TUBAF (Institute for Metal Forming
 Technical University Bergakademie of
 Freiberg | <http://www.imf.tu-freiberg.de/>),
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- TUBAF (Technical University Bergakademie
 of Freiberg | <http://tu-freiberg.de/>), 132
- Freiburg*
 Univ. (Albert-Ludwigs University of Freiburg |
<http://www.uni-freiburg.de/>), 61
- Göttingen*
 Univ. (University of Göttingen |
<http://www.uni-goettingen.de/>), 132
- Geesthacht*
 GKSS (Research Center in Geesthacht of the
 Helmholtz Association |
<http://www.hzg.de/>), 132
- Giessen*
 JLU (Justus Liebig University Giessen |
<http://www.uni-giessen.de/>), 17, 73, 86, 170
- Halle*
 MLU (Martin-Luther University of
 Halle-Wittenberg |
<http://www.uni-halle.de/>), 132
- Hamburg*
 DESY (Deutsches Elektronen-Synchrotron A
 Research Centre of the Helmholtz
 Association | <http://www.desy.de/>), 12, 30,
 61, 78, 132, 157, 163
- Univ. (University of Hamburg |
<http://www.uni-hamburg.de/>), 17, 43, 47
- Hannover*
 LUH (Leibniz University of Hannover |
<http://www.uni-hannover.de/>), 27, 31
- Heidelberg*
 MPIK (Max Planck Institute for Nuclear
 Physics | <http://www.mpi-hd.mpg.de/>), 61,
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- Univ. (University of Heidelberg |
<http://www.uni-heidelberg.de/>), 12, 50, 86,
 90, 92, 115, 140, 170
- Jülich*
 FZJ (Research Centre Jülich of the Helmholtz
 Association | <http://www.fz-juelich.de/>),

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- Jena*
 Univ. (Friedrich-Schiller University of Jena |
<http://www.uni-jena.de/>), 12, 27, 31
- Kaiserslautern*
 TU (Technical University of Kaiserslautern |
<http://www.uni-kl.de/>), 12
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 KIT (Karlsruhe Institute of Technology |
<http://www.kit.edu/>), 12, 55, 132, 140, 163
- Kassel*
 Uni Kassel (University of Kassel |
<http://www.uni-kassel.de/>), 170
- Kiel*
 CAU (Christian Albrecht Kiel University |
<http://www.uni-kiel.de/>), 132
- IFM-GEOMAR (Leibniz Institute for Marine
 Science of the Kiel University |
<http://www.geomar.de/>), 132
- Leipzig*
 UoC (University of Leipzig |
<http://www.zv.uni-leipzig.de/>), 17, 22, 27,
 31, 132
- Münster*
 Univ. (University of Münster |
<http://www.uni-muenster.de/>), 92, 115
- Magdeburg*
 OVGU (Otto-von-Guericke University
 Magdeburg | <http://www.avmz.ovgu.de/>),
 22, 140
- Mainz*
 JGU (Johannes Gutenberg University of
 Mainz | <http://www.uni-mainz.de/>), 12, 17,
 52, 61, 73, 107, 111, 115, 123
- Marburg*
 Univ. (Philipps University of Marburg |
<http://www.uni-marburg.de/>), 92, 96, 170
- Munich*
 LMU (Ludwig Maximilians University of
 Munich | <http://www.uni-muenchen.de/>),
 12, 61, 163, 170
- MPI-P (Max Planck Institute for Physics of
 Munich | <http://www.mpp.mpg.de/>), 27,
 31, 38, 47
- TUM (Technical University of Munich |
<http://portal.mytum.de/>), 61, 86, 123, 140
- Potsdam*
 AEI (Max Planck Institute for Gravitational
 Physics (Albert Einstein Institute) |
<http://www.aei-potsdam.mpg.de/>), 27, 31
- GFZ (Helmholtz Centre Potsdam
 GeoForschungsZentrum German Research
 Centre for Geosciences of the Helmholtz
 Association | <http://www.gfz-potsdam.de/>),
 132
- IASS (Institute for Advanced Sustainability
 Studies e.V. |
<http://www.iass-potsdam.de/>), 170
- Quedlinburg*
 IST (Ionen Strahl Technologie GmbH |
<http://www.isttechnologie.de/>), 145
- MiCryon Technik (MiCryon Technik GmbH |
<http://www.micryon.de/>), 145
- Regensburg*
 UR (University of Regensburg |
<http://www.uni-regensburg.de/>), 12, 17, 73,
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- Rostock*
 Univ. (University of Rostock |
<http://www.uni-rostock.de/>), 12, 17, 22, 31,
 132
- Siegen*
 Univ. (University of Siegen |
<http://www.uni-siegen.de/>), 17, 86
- Stuttgart*
 MPI-FKF (Max Planck Institute for Solid
 State Research | <http://www.fkf.mpg.de/>),
 22, 132
- MPI-MF (Max Planck Institute for Metals
 Research | <http://www.mf.mpg.de/>), 115
- Tübingen*
 Univ. (Eberhard Karls University of Tübingen
 | <http://www.uni-tuebingen.de/>), 12, 47,
 107, 123, 170
- Wuppertal*
 UW (University of Wuppertal |
<http://www.uni-wuppertal.de/>), 12, 22
- Zeuthen*
 DESY (Deutsches Elektronen-Synchrotron of
 the Helmholtz Association |
<http://www.desy.de/>), 12, 31, 38, 47, 78,
 140, 163
- Greece**
- Athens*
 INP NCSR “Demokritos” (Institute of Nuclear
 Physics of the National Centre for Scientific
 Research “Demokritos” |
<http://www.inp.demokritos.gr/>), 17, 55
- UoA (National and Kapodistrian University of
 Athens | <http://www.uoa.gr/>), 27, 31, 38,
 55, 78, 92
- Ioannina*
 UI (University of Ioannina |
<http://www.uoi.gr/>), 56
- Thessaloniki*
 AUTH (Aristotle University of Thessaloniki |
<http://www.auth.gr/>), 17, 96, 170

Hungary

Budapest

- ELTE (Eötvös Loránd University | <http://www.elte.hu/>), 12, 145
RKK OU (Rejto Sándor Faculty of Light Industry and Environmental Engineering of the Obuda University | <http://rkk.uni-obuda.hu/>), 123
Wigner RCP (Institute for Particle and Nuclear Physics, Wigner Research Centre for Physics of the Hungarian Academy of Science | <http://wigner.mta.hu/>), 12, 17, 22, 27, 31, 56, 92, 133, 140

Debrecen

- Atomki (Institute of Nuclear Research of the Hungarian Academy of Science | <http://www.atomki.hu/>), 18, 56
UD (University of Debrecen | <http://www.unideb.hu/>), 56
- Szeged*
US (University of Szeged | <http://www.u-szeged.hu/>), 133

India

Aligarh

- AMU (Aligarh Muslim University | <http://wwwamu.ac.in/>), 92

Bhubaneswar

- IOP (Institute of Physics of Bhubaneswar | <http://www.iopb.res.in/>), 56, 92

Calcutta

- BNC (S.N.Bose National Centre for Basic Sciences | <http://www.bose.res.in/>), 27, 31
SINP (Saha Institute of Nuclear Physics | <http://www.saha.ernet.in/>), 93
VECC (Variable Energy Cyclotron Centre of the Department of Atomic Energy | <http://www.veccal.ernet.in/>), 92, 107

Chandigarh

- PU (Panjab University | <http://puchd.ac.in/>), 56, 93

Jaipur

- Univ. (University of Rajasthan | <http://www.uniraj.ernet.in/>), 86, 96

Jammu

- Univ. (University of Jammu | <http://www.jammuuniversity.in/>), 93

Manipal

- MU (Manipal University | <http://www.manipal.edu/>), 107

Mumbai

- BARC (Bhabha Atomic Research Centre of the Department of Atomic Energy | <http://wwwbarc.ernet.in/>), 56, 86, 96
TIFR (Tata Institute of Fundamental Research | <http://www.tifr.res.in/>), 22, 56

Pune

- IUCAA (Inter-University Centre for Astronomy and Astrophysics | <http://www.iucaa.ernet.in/>), 170

Iran

Tehran

- IPM (Institute for Studies in Theoretical Physics and Mathematics of the Institute for Research Fundamental Sciences | <http://www.ipm.ac.ir/IPM/>), 56

Ireland

Dublin

- DIAS (Dublin Institute for Advanced Studies | <http://www.dias.ie/>), 22

Israel

Rehovot

- WIS (Weizmann Institute of Science | <http://www.weizmann.ac.il/>), 31, 38

Tel Aviv

- TAU (Tel Aviv University | <http://www.tau.ac.il/>), 61

Italy

Bari

- INFN (National Institute for Nuclear Physics, Section of Bari | <http://www.ba.infn.it/>), 12, 27, 56, 93

- UniBa (University of Bari Aldo Moro | <http://www.uniba.it/>), 170

Bologna

- Centro, ENEA (Bologna Research Centre of the Italian National Agency for New Technologies, Energy and the Environment | <http://www.bologna.enea.it/>), 18

- INFN (National Institute for Nuclear Physics, Section of Bologna | <http://www.bo.infn.it/>), 56, 93

Cagliari

- INFN (National Institute for Nuclear Physics, Section of Cagliari | <http://www.ca.infn.it/>), 93

Catania

- INFN LNS (National Institute for Nuclear Physics, National Laboratory of the South | <http://www.lns.infn.it/>), 18, 56, 102, 107

- UniCT (University of Catania | <http://www.unict.it/>), 22, 93

Ferrara

- INFN (National Institute for Nuclear Physics, Section of Ferrara | <http://www.fe.infn.it/>), 52

- UniFe (University of Ferrara | <http://www.unife.it/>), 115

- Florence*
 INFN (National Institute for Nuclear Physics,
 Section of Florence |
<http://www.fi.infn.it/>), 52, 56
- Frascati*
 INFN LNF (National Institute for Nuclear
 Physics, National Laboratory of Frascati |
<http://www.lnf.infn.it/>), 27, 31, 40, 52, 62,
 78, 115
- Genoa*
 INFN (National Institute for Nuclear Physics,
 Section of Genoa | <http://www.ge.infn.it/>),
 56, 78
- Legnaro*
 INFN LNL (National Institute for Nuclear
 Physics, Legnaro National Laboratories |
<http://www.lnl.infn.it/>), 93, 107
- Messina*
 UniMe (University of Messina |
<http://www.unime.it/>), 18, 107
- Naples*
 INFN (National Institute for Nuclear Physics,
 Section of Naples | <http://www.na.infn.it/>),
 12, 18, 27, 52
 Unina (University of Naples Federico II |
<http://www.unina.it/>), 107
- Padua*
 INFN (National Institute for Nuclear Physics,
 Section of Padua | <http://www.pd.infn.it/>),
 52, 56, 93
 UniPd (University of Padua |
<http://www.unipd.it/>), 12, 27, 31
- Pavia*
 INFN (National Institute for Nuclear Physics,
 Section of Pavia | <http://www.pv.infn.it/>),
 12, 27, 31, 56
- Perugia*
 INFN (National Institute for Nuclear Physics,
 Section of Perugia |
<http://www.pg.infn.it/>), 18, 52, 56
- Pisa*
 INFN (National Institute for Nuclear Physics,
 Section of Pisa | <http://www.pi.infn.it/>),
 12, 27, 31, 38, 52, 56, 78
 UniPi (University of Pisa |
<http://www.unipi.it/>), 40
- Rome*
 ENEA (Italian National Agency for New
 Technologies, Energy and Environment |
<http://www.enea.it/>), 123
 INFN (National Institute for Nuclear Physics,
 Section of Rome |
<http://www.roma1.infn.it/>), 52, 56, 93
 Univ. “La Sapienza” (University of Roma “La
 Sapienza” | <http://www.uniroma1.it/>), 115,
- 152
- Univ. “Tor Vergata” (University of Rome “Tor
 Vergata” | <http://web.uniroma2.it/>), 52
- Salerno*
 INFN (National Institute for Nuclear Physics,
 Section of Naples | <http://www.sa.infn.it/>),
 43, 93
 UNISA (University of Salerno |
<http://web.unisa.it/>), 22, 27, 31
- Trento*
 ECT* (Europen Center Theoretical Studies in
 Nuclear Physic and Related Areas |
<http://www.esttar.eu/>), 18
 UniTn (University of Trento |
<http://www.unitn.it/>), 133
- Trieste*
 INFN (National Institute for Nuclear Physics,
 Section of Trieste | <http://www.ts.infn.it/>),
 62
 SISSA/ISAS (International School for
 Advanced Studies | <http://www.sissa.it/>),
 12, 27, 31
- Turin*
 INFN (National Institute for Nuclear Physics,
 Section of Turin | <http://www.to.infn.it/>),
 27, 31, 45, 52, 56, 62, 73, 93, 115, 170
 UniTo (University of Turin |
<http://www.unito.it/>), 12, 18, 45, 48
- Udine*
 Uniud (University of Udine |
<http://www.uniud.it/>), 149
- Vercelli*
 UPO (Amedeo Avogadro Piemonte Eastern
 University | <http://www.unipmn.it/>), 93
- Viterbo*
 UNITUS (University of Tuscia |
<http://www3.unitus.it/>), 152
- Japan**
- Chiba*
 Toho Univ. (Toho University Foundation |
<http://www.toho-u.ac.jp/>), 62
- Fukuoka*
 Kyushu Univ. (Kyushu University |
<http://www.kyushu-u.ac.jp/>), 27
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 Hiroshima Univ. (Hiroshima University |
<http://www.hiroshima-u.ac.jp/>), 82
- Kobe*
 Kobe Univ. (Kobe University |
<http://www.kobe-u.ac.jp/>), 18
- Kyoto*
 KSU (Kyoto Sangyo University |
<http://www.kyoto-su.ac.jp/>), 27, 31, 123
 Kyoto Univ. (Kyoto University |
<http://www.kyoto-u.ac.jp/>), 12, 116

RIMS (Research Institute for Mathematical Sciences of Kyoto University | <http://www.kurims.kyoto-u.ac.jp/>), 27, 31

YITP (Yukawa Institute for Theoretical Physics of Kyoto University | <http://www.yukawa.kyoto-u.ac.jp/>), 27

Minato

Keio Univ. (Keio University | <http://www.keio.ac.jp/>), 133

Morioka

Iwate Univ. (Iwate University | <http://www.iwate-u.ac.jp/>), 18

Nagano

Shinshu Univ. (Shinshu University | <http://www.shinshu-u.ac.jp/>), 133

Nagoya

Meiji Univ. (Meiji University | <http://www.meiji.ac.jp/cip>), 12

Nagoya Univ. (Nagoya University | <http://www.nagoya-u.ac.jp/>), 12, 62, 73

Osaka

Kansai Univ. (Kansai University | <http://www.kansai-u.ac.jp/>), 170

OCU (Osaka City University | <http://www.osaka-cu.ac.jp/>), 62

Osaka Univ. (Osaka University | <http://www.osaka-u.ac.jp/>), 18, 116

RCNP (Research Centre for Nuclear Physics of Osaka University | <http://www.rcnp.osaka-u.ac.jp/>), 18, 64, 82, 86

Sendai

Tohoku Univ. (Tohoku University | <http://www.tohoku.ac.jp/>), 62

Tokai

JAEA (Japan Atomic Energy Agency | <http://www.jaea.go.jp/>), 107

Tokyo

Toho Univ. (Toho University | <http://www.toho-u.ac.jp/>), 43

UT (University of Tokyo; Centre for Nuclear Study (CNS); Institute for Cosmic Ray Research; Institute Centre for Elementary Particle Physics (ICEPP) | <http://www.u-tokyo.ac.jp/>), 12, 82, 86

Tsukuba

KEK (High Energy Accelerator Research Organization | <http://legacy.kek.jp/>), 12, 27, 31, 62, 78, 116, 123

Univ. (University of Tsukuba | <http://www.tsukuba.ac.jp/>), 86

Wako

RIKEN (RIKEN Wako Institute; Institute of Physical and Chemical Research | <http://www.riken.go.jp/>), 47, 107

Yamagata

Yamagata Univ. (Yamagata University | <http://www.yamagata-u.ac.jp/>), 62

Kazakhstan

Almaty

APHI (Fesenkov Astrophysical Institute of the National Centre of Space Researches and Technologies | <http://aphi.kz/>), 12

INP (Institute of Nuclear Physics of Ministry of Energy of the Republic of Kazakhstan | <http://www.inp.kz/>), 12, 18, 102, 107, 111, 123, 146, 170

IFT (“Institute of Physics and Technology”

LLC “National Scientific-Technology Holding “Parasat” Joint Stock Company of the Ministry of Education and Sciences of the Republic of Kazakhstan | <http://www.sci.kz/>), 86, 170

KazNU (Al-Farabi Kazakh National University | <http://www.kaznu.kz/>), 18, 178

Astana

BA INP (Branch of the Astana Institute of Nuclear Physics of Ministry of Energy of the Republic of Kazakhstan | <http://www.inp.kz/>), 12, 102, 146

ENU (L.N.Gumilyov Eurasian National University | <http://www.enu.kz/>), 107, 123, 146

NU (Nazarbayev University | <http://nu.edu.kz/>), 146

Rudny

RII (Rudny Industrial Institute | <http://rii.kz/>), 133

Ust-Kamenogorsk

TRCE (Training and Research Centre of Ecology of the Sarsen Amanzholov East Kazakhstan State University | <http://www.vkgu.kz/>), 123

Latvia

Riga

IPE (Institute of Physical Energetics | <http://www.innovation.lv/fei/>), 133

ISSP UL (Institute of Solid State Physics of the University of Latvia | <http://www.cfi.lu.lv/>), 133, 142

Macedonia

Skopje

UKiM (Ss. Cyril and Methodius University-Skopje | <http://www.ukim.edu.mk/>), 123

Mexico

Cuernavaca

UNAM (National Autonomous University of Mexico | <http://www.unam.mx/>), 12

Leon

UG (University of Guanajuato | <http://www.ugto.mx/>), 31

Mexico

Cinvestav (Centre for Advanced Investigations and Studies of the National Polytechnical Institute | <http://www.cinvestav.mx/>), 56

Puebla

BUAP (Autonomous University of Puebla | <http://www.buap.mx/>), 48

San Luis Potosí

UASLP (Autonomous University of San Luis Potosí | <http://www.uaslp.mx/>), 52

Moldova

Chișinău

ASM (Academy of Sciences of Moldova | <http://www.asm.md/>), 163, 178

IAP ASM (Institute of Applied Physics of the Academy of Sciences of Moldova | <http://www.phys.asm.md/>), 18, 23, 73, 96, 146, 163, 170

IC ASM (Institute of Chemistry of the Academy of Sciences of Moldova | <http://chem.asm.md/>), 123, 133

IEEN ASM (Chitu Institute of the Electronic Engenering and Nanotechnologies of the Academy of Sciences of Moldova | <http://nano.asm.md/>), 142

IMB ASM (Institute of Microbiology and Biotechnology of the Academy of Sciences of Moldova | <http://www.imb.asm.md/>), 123, 133

IMCS ASM (Institute of Mathematics and Computer Science of the Academy of Sciences of Moldova | <http://www.math.md/>), 163

MSU (Moldova State University | <http://usm.md/>), 73

RENAM (Research and Educational Networking Association of Moldova | <http://www.renam.md/>), 163

TUM (Technical University of Moldova | <http://www.utm.md/>), 142

UnASM (University of Academy of Sciences of Moldova | <http://www.edu.asm.md/>), 149

Mongolia

Ulaanbaatar

CGL (Central Geological Laboratory | <http://cengeolab.com/>), 123

II MAS (Institute of Informatics of the Mongolian Academy of Sciences | <http://www.informatic.ac.mn/>), 163

IPT MAS (Institute of Physics and Technology of the Mongolian Academy of Sciences | <http://www.mas.ac.mn/>), 12, 50, 86, 93, 96, 133

MUST (Mongolian University of Science and Technology | <http://www.must.edu.mn/>), 133, 137, 163, 170

NE^c (Government of Mongolia the Nuclear Energy Commission | <http://nea.gov.mn/>), 86, 111

NRC NUM (Nuclear Research Center of the National University of Mongolia | <http://nrc.num.edu.mn/>), 103, 107, 111, 123, 146

NUM (National University of Mongolia | <http://www.num.edu.mn/>), 12, 23, 149, 163, 170

Netherlands

Amsterdam

NIKHEF (National Institute for Subatomic Physics | <http://www.nikhef.nl/>), 38, 93

Utrecht

UU (University of Utrecht | <http://www.uu.nl/>), 93

New Zealand

Auckland

Univ. (University of Auckland | <http://www.auckland.ac.nz/uoa>), 56

Christchurch

UC (University of Canterbury | <http://www.canterbury.ac.nz/>), 56, 157

Hamilton

Univ. (University of Waikato | <http://www.waikato.ac.nz/>), 12

Norway

Bergen

UiB (University of Bergen | <http://www.uib.no/>), 18, 93

Oslo

UiO (University of Oslo | <http://www.uio.no/>), 18, 93

Trondheim

NGU (Geological Survey of Norway | <http://www.ngu.no/>), 133

NTNU (Norwegian University of Science and Technology | <http://www.ntnu.no/>), 12, 27, 123, 152

Pakistan

Islamabad

QAU (Quaid-i-Azam University |
<http://www.qau.edu.pk/>), 56

Poland

Chorzow

Franko-Term (Franko-Term LTD Company is
a Research and Development |
<http://frankoterm.w.toruniu.pl/sstr/>), 73

Gdansk

GUT (Gdańsk University of Technology |
<http://pg.edu.pl/>), 123

Katowice

US (University of Silesia in Katowice |
<http://www.us.edu.pl/>), 22

Kielce

JKU (Jan Kochanowski University of
Humanities and Science |
<http://www.ujk.edu.pl/>), 12

Krakow

AGH-UST (AGH University of Science and
Technology | <http://www.agh.edu.pl/>), 111,
137, 170

CYFRONET (Academic Computer Centre
CYFRONET of the AGH-University
Science and Technology |
<http://www.cyfronet.krakow.pl/>), 164

JU (Jagiellonian University in Kraków |
<http://www.uj.edu.pl/>), 22, 27, 133, 178

NINP PAS (Henryk Niewodniczański Institute
of Nuclear Physics of the Polish Academy of
Sciences | <http://www.ifj.edu.pl/>), 12, 18,
27, 78, 86, 93, 96, 103, 107, 111, 116, 118,
123, 133, 155

Lodz

UL (University of Lódź |
<http://www.uni.lodz.pl/>), 13, 27, 86, 123,
178

Lublin

UMCS (Marie Curie-Sklodowska University in
Lublin | <http://www.umcs.lublin.pl/>), 13,
18, 74, 111, 123, 133, 143, 146, 170

Olsztyn

UWM (University of Warmia and Mazury in
Olsztyn | <http://www.uwm.edu.pl/>), 133

Opole

UO (University of Opole |
<http://www.uni.opole.pl/>), 123

Otwock-Swierk

NCBJ (National Centre for Nuclear Research |
<http://www.ncbj.gov.pl/>), 13, 18, 31, 56, 74,
82, 86, 93, 96, 111, 116, 123, 146, 155, 170

Poznan

AMU (Adam Mickiewicz University in Poznań
| <http://www.guide.amu.edu.pl/>), 23, 107,

123, 133, 152, 164, 178

GPCC (Greater Poland Cancer Center |
<http://www.wco.pl/>), 155

IMP PAS (Institute of Molecular Physics of
the Polish Academy of Sciences |
<http://www.ifmp.ozn.poznan.pl/>), 23

Siedlce

UPH (University of Natural Sciences and
Humanities | <http://www.uph.edu.pl/>), 133

Szczecin

US (University of Szczecin |
<http://www.usz.edu.pl/>), 149

WPUT (West Pomeranian University of
Technology in Szczecin |
<http://www.zut.edu.pl/>), 133

Torun

UMK (Nicolaus Copernicus University |
<http://www.umk.pl/>), 146

Warsaw

HIL WU (Heavy Ion Laboratory of Warsaw
University | <http://www.slcj.uw.edu.pl/>),
103

IEL (Elektrotechnical Institute |
<http://www.iel.waw.pl/>), 74, 93

IEP WU (Institute of Experimental Physics of
Warsaw University |
<http://en.ifd.fuw.edu.pl/>), 103

INCT (Institute of Nuclear Chemistry and
Technology | <http://www.ichtj.waw.pl/>),
133, 146

IPC PAS (Institute of Physical Chemistry of
the Polish Academy of Sciences |
<http://ichf.edu.pl/>), 22

ITR (Tele and Radio Research Institute |
<http://www.itr.org.pl/>), 146

NCAC PAS (Nicolae Copernicus

Astronomical Centre of the Polish Academy
of Sciences | <http://www.camk.edu.pl/>), 27

UW (University of Warsaw |
<http://www.uw.edu.pl/>), 18, 27, 31, 56, 62,
107

WUT (Warsaw University of Technology |
<http://www.pw.edu.pl/>), 18, 22, 74, 86, 90,
93, 96

Wroclaw

ILT&SR PAS (Institute of Low Temperature
and Structure Research of the Polish
Academy of Sciences |
<http://www.int.pan.wroc.pl/>), 74

UW (University of Wrocław |
<http://www.uni.wroc.pl/>), 27, 31, 123, 133,
170

WUT (Wrocław University of Technology |
<http://www.pwr.wroc.pl/>), 133, 164

Portugal

Coimbra

UC (University of Coimbra |
<http://www.uc.pt/>), 170

Republic of Korea

Chongju

CBNU (Chungbuk National University |
<http://www.chungbuk.ac.kr/>), 56

Daejeon

IBS (Institute for Basic Science |
<http://www.ibs.re.kr/>), 18
NFRI (National Fusion Research Institute |
<http://www.nfri.re.kr/>), 140

Gangneung

GWNU (Gangneung-Wonju National
University | <http://www.gwnu.ac.kr/>), 93

Kwangju

CNU (Chonnam National University |
<http://www.jnu.ac.kr/>), 56

Naju

DU (Dongshin University; Laboratory for
High Energy Physics |
<http://www.ds.ac.kr/>), 56

Namwon

SU (Seonam University |
<http://www.seonam.ac.kr/>), 56

Pohang

PAL (Pohang Accelerator Laboratory |
<http://pal.postech.ac.kr/>), 123

Seoul

Dawonsys (Company “Dawonsys ‘o., Ltd” |
<http://www.dawonsys.co.kr/>), 123

EWU (Ewha Womans University | <http://www.ewha.ac.kr/>), 48

KU (Korea University |
<http://www.korea.ac.kr/>), 56

Konkuk Univ. (Konkuk University |
<http://www.kku.ac.kr/>), 56

SNU (Seoul National University |
<http://www.snu.ac.kr/>), 13, 18

SNUE (Seoul National University of
Education | <http://www.snue.ac.kr/>), 56

Taejon

KAERI (Korea Atomic Energy Research
Institute | <http://www.kaeri.re.kr:8080/>),
123

Romania

Baia Mare

TUCN-NUCBM (Technical University of
Cluj-Napoca - North University Center of
Baia Mare | <http://www.utcluj.ro/>), 124,
133

Bucharest

IFA (Institute of Atomic Physics |
<http://www.ifa-mg.ro/>), 164, 170

IFIN-HH (Horia Hulubei National Institute of
Physics and Nuclear Engineering |
<http://www.nipne.ro/>), 18, 23, 28, 31, 50,
52, 74, 86, 103, 107, 111, 116, 123, 133, 137,
140, 143, 164, 170

INCDIE ICPE-CA (National Institute of
Research and Development in Electrical
Engineering ICPE-CA |
<http://www.icpe-ca.ro/>), 74, 82, 86, 97, 133,
140

INFLPR (National Institute for Laser, Plasma
and Radiation Physics |
<http://www.inflpr.ro/>), 146

INOE2000 (National Institute for Research
and Development in Optoelectronics |
<http://inoe.inoe.ro/>), 74

ISS (Institute for Space Sciences |
<http://www.spacescience.ro/>), 48, 86, 93,
97, 123, 133, 150, 170

NIMP (National Institute of Materials Physics
| <http://www.infim.ro/>), 133

N&V (<http://www.nuclearvacuum.ro/>), 103

UB (University of Bucharest |
<http://www.unibuc.ro/>), 18, 86, 107, 111,
123, 133, 152, 155, 170, 178

UMF (University of Medicine and Pharmacy
“Carol Davila” - Bucharest’ |
<http://www.umf.ro/>), 97, 133, 149, 155

UPB (University Politehnica of Bucharest |
<http://www.upb.ro/>), 133, 143

UTM (Titu Maiorescu University |
<http://www.utm.ro/>), 133

Cluj-Napoca

INCDTIM (National Institute for Research
and Development of Isotopic and Molecular
Technologies | <http://www.itim-cj.ro/>), 133,
164, 170

RA BC-N (Romanian Academy Cluj-Napoca
Branch | <http://www.acad-cluj.ro/>), 133

UBB (Babeş-Bolyai University |
<http://www.ubbcluj.ro/>), 133

UTC-N (Technical University of Cluj-Napoca |
<http://utcluj.ro/>), 23

Constanţa

NIMRD (National Institute for Marine
Research and Development “Grigore
Antipa” | <http://www.rmri.ro/>), 124

UOC (“Ovidius” University of Constanta |
<http://www.univ-ovidius.ro/>), 86, 124, 133

Craiova

UC (University of Craiova |
<http://www.ucv.ro/>), 133

Galați

UG (University of Galați |
<http://www.ugal.ro/>), 124

Iași

IBR (Institute of Biological Research Iași of the National Institute of Research and Development for Biological Sciences |
<http://www.dbioro.eu/>), 150
 NIRDTP (National Institute of Research and Development for Technical Physics |
<http://www.phys-iasi.ro/>), 133
 UAI (University “Apollonia” of Iași |
<http://univapollonia.ro/>), 133
 UAIC (Alexandru Ioan Cuza University of Iași |
<http://www.uaic.ro/>), 97, 124, 133, 150

Oradea

UO (University of Oradea |
<http://www.uoradea.ro/>), 124

Pitești

SCN (Institute for Nuclear Research - Pitești |
<http://www.nuclear.ro/>), 124, 133

Râmnicu Vâlcea

I.C.S.I. (National Research and Development Institute for Cryogenics and Isotopic Technologies |
<http://www.icsi.ro/>), 124

Târgoviște

UVT (VALAHIA University of Târgoviște |
<http://www.valahia.ro/>), 124, 140

Timișoara

CCTFA (Center for Fundamental and Advanced Technical Research of the Romanian Academy, Branch Timișoara Filiala Timișoara |
<http://acad-tim.tn.edu.ro/cctfa>), 116
 LMF CCTFA (Laboratory of Magnetic Fluids of the Center for Fundamental and Advanced Technical Research of the Romanian Academy, Branch Timișoara |
<http://acad-tim.tn.edu.ro/cctfa>), 133
 UPT (Politehnica University of Timișoara |
<http://www.upt.ro/>), 133
 UVT (West University of Timișoara |
<http://www.uvt.ro/>), 23, 133

Russia

Alexandrov

VNIISIMS (Russian Research Institute for the Synthesis of Minerals |
<http://vniisims.ru/>), 116

Astrakhan

ASU (Astrakhan State University |
<http://asu.edu.ru/>), 150

Belgorod

BelSU (Belgorod National Research State University |
<http://www.bsu.edu.ru/>), 13, 23, 74, 134, 171

Borok

IBIW RAS (Federal State Budgetary Institution of Science “I.D.Papanin Institute for the Biology of Inland Waters of the Russian Academy of Sciences” |
<http://ibiw.ru/>), 124

IPE RAS (Federal State Budgetary Institution of Science “Schmidt Institute of the Physics of the Earth of the Russian Academy of Sciences” |
<http://old.ifz.ru/>), 152

Cheboksary

ChSU (I.N.Ulyanov Chuvash State University |
<http://www.chuvsu.ru/>), 107

Cherkessk

NCSHTA (North-Caucasian State Humanitarian Technological Academy |
<http://www.kchgta.ru/>), 164

Chernogolovka

ISMAN RAS (Federal State Budgetary Institution of Science “Institute of Structural Macrokinetics and Materials Science of the Russian Academy of Sciences” |
<http://www.ism.ac.ru/>), 86

ISSP RAS (Federal State Budgetary Institution of Science “Institute of Solid State Physics of the Russian Academy of Sciences” |
<http://issp3.issp.ac.ru/>), 134, 146

LITP RAS (Federal State Budgetary Institution of Science “L.D.Landau Institute for Theoretical Physics of the Russian Academy of Sciences” |
<http://www.itp.ac.ru/>), 13, 28, 31, 164

SCC IPCP RAS (Federal State Budgetary Institution of Science “Supercomputer Centre of the Institute of Problems of Chemical Physics of the Russian Academy of Sciences” |
<http://www.icp.ac.ru/>), 164

Dimitrovgrad

SSC RIAR (Open Joint Stock Company “State Scientific Centre Research Institute of Atomic Reactors” Rosatom State Nuclear Energy Corporation, JSC “Atomenergoprom” |
<http://www.niiar.ru/>), 107

Dolgoprudny

MIPT (Moscow Institute of Physics and Technology (State University) |
<http://mipt.ru/>), 56, 116, 134, 143, 178

Dubna

Adm. of Dubna (Administration of Dubna |
<http://naukograd-dubna.ru/>), 164

BSINP MSU (Branch of the Skobeltsyn Institute of Nuclear Physics of the Lomonosov Moscow State University |

- http://www.msu.dubna.ru/), 45, 96, 164, 178
- Dubna Univ. (Moscow Region State Educational Institution for Higher Education Dubna University | http://www.uni-dubna.ru/), 124, 157, 164, 171, 178
- IAS “Omega” (Institute for Advanced Studies “Omega” | http://dubna-claster.ru/participants/37.htm/), 97
- IINC (Closed Joint Stock Company “International Innovation Nanotechnological Center” | http://dubna-claster.ru/participants/31.htm/), 146
- RDH-9 (Radiological Department of Hospital № 9 | http://ro.ms9.medic.ina.tel.dubna.tel/), 155
- Raduga (Open Joint Stock Company “Raduga” State Machine-Building Design Bureau” | http://abut/structure/458/), 164
- SCC “Dubna” (“Dubna” Satellite Communication Centre, Branch of the Federal State Unitary Enterprise “Russian Satellite Communication Company” | http://www.rscu.ru/), 164
- SEZ “Dubna” (Special Economic Zone in Dubna | http://dubna.oez.ru/), 164
- Tensor (Open Joint Stock Company “Instrumental Plant “Tensor” | http://www.tenzor.յJI/), 164
- Trackpore Technology (Closed Joint Stock Company “Trackpore Technology ” Membrane Technologies and the Future Branch of the Dubna | http://www.trackpore.ru/), 146
- Fryazino*
- ISTOK (Joint Stock Company “Research and Production Corporation “ISTOK” named after Shokin” | http://www.istokmw.ru/), 74
- Gatchina*
- PNPI (Federal State Budgetary Institution “B.P.Konstantinov Petersburg Nuclear Physics Institute” of the National Research Centre “Kurchatov Institute” | http://www.pnpi.spb.ru/), 13, 18, 23, 31, 35, 40, 56, 62, 82, 93, 107, 111, 116, 124, 134, 140, 153, 164
- Irkutsk*
- ISDCT SB RAS (Federal State Budgetary Institution of Science “Matrosov Institute for System Dynamics and Control Theory of the Siberian Branch of the Russian Academy of Sciences” | http://www.idstu.irk.ru/), 13
- ISU (Irkutsk State University | http://isu.su/), 13, 18, 35, 48
- LI SB RAS (Federal State Budgetary Institution of Science “Limnological Institute of the Siberian Branch of the Russian Academy of Sciences” | http://www.lin.irk.ru/), 124
- Ivanovo*
- ISU (Ivanovo State University | http://ivanovo.ac.ru/), 13
- ISUCT (Ivanovo State University of Chemistry and Technology | http://main.isuct.ru/), 124
- Izhevsk*
- UdSU (Udmurtia State University | http://udsu.ru/), 124
- Kaliningrad*
- IKBFU (Immanuel Kant Baltic Federal University | http://www.kantiana.ru/), 146
- Kazan*
- Compressormash (Open Joint Stock Company “Kazancompressormash” | http://compressormash.ru/), 74
- KFU (Kazan (Volga Region) Federal University | http://kpfu.ru/), 13, 23
- KNRTU (Kazan National Research Technological University | http://www.kstu.ru/), 134, 146
- Korolev*
- RSC “Energia” (Open Joint Stock Company “S.P.Korolev Rocket and Space Corporation “Energia” | http://www.energia.ru/), 48
- Kostroma*
- KSU (Kostroma State University | http://ksu.edu.ru/), 178
- Krasnoyarsk*
- SibFU (Siberian Federal University | http://www.sfu-kras.ru/), 134
- Moscow*
- Atomenergomach (Closed Joint Stock Company “Atomenergomach” | http://www.cftp-aem.ru/), 96, 124
- Cryogenmash (Public Joint Stock Company “Cryogenmash” | http://cryogenmash.ru/), 74
- GC RAS (Federal State Budgetary Institution of Science “Geophysical Center of the Russian Academy of Sciences” | http://www.gcras.ru/), 133
- GIN RAS (Federal State Budgetary Institution of Science “Geological Institute of the Russian Academy of Sciences” | http://www.ginras.ru/), 124

- GPI RAS (Federal State Budgetary Institution of Science "General Physics Institute of the Russian Academy of Sciences" | <http://www.gpi.ru/>), 103, 116, 124, 146, 171
- Gelymash (Open Joint Stock Company "Researching and Production Association of Helium Engineering" | <http://gelymash.ru/>), 74, 137
- IBMC (Federal State Budgetary Institution of Science Institute of Biomedical Chemistry | <http://www.ibmc.msk.ru/>), 134
- IBMP RAS (Federal State Budgetary Institution of Science "State Scientific Centre of the Russian Federation - Institute for Biomedical Problems of the Russian Academy of Sciences" | <http://www.imbp.ru/>), 74, 150, 155
- IC RAS (Federal State Budgetary Institution of Science "A.V.Chubnikov Institute of Crystallography of the Russian Academy of Sciences" | <http://www.crys.ras.ru/>), 134, 146
- ICS RAS (Federal State Budgetary Institute of Science "V.A. Trapeznikov Institute of Control Sciences of the Russian Academy of Sciences" | <http://www.ipu.ru/>), 170
- IEPT RAS (Federal State Budgetary Institution of Science "Institute of Earthquake Prediction Theory and Mathematical Geophysics of the Russian Academy of Sciences" | <http://www.mitp.ru/>), 134
- IGEM RAS (Federal State Budgetary Institution of Science "Institute of Geology of Ore Deposits, Petrography, Mineralogy and Geochemistry of the Russian Academy of Sciences" | <http://www.igem.ru/>), 134, 152
- IGIC RAS (Federal State Budgetary Institution of Science "Kurnakov Institute of General and Inorganic Chemistry of the Russian Academy of Sciences" | <http://www.igic.ras.ru/>), 134
- IHNA Ph RAS (Federal State Budgetary Institution of Science "Institute of Higher Nervous Activity and Neurophysiology of the Russian Academy of Sciences" | <http://www.ihna.ru/>), 150
- IITP RAS (Federal State Budgetary Institute of Science "Institute for Information Transmission Problems (Kharkevich Institute) of the Russian Academy of Sciences" | <http://iitp.ru/>), 164
- IKI RAS (Federal State Budgetary Institution of Science "Space Research Institute of the Russian Academy of Sciences" | <http://www.iki.rssi.ru/>), 124, 152
- IMET RAS (Federal State Budgetary Institution of Science "A.A.Baikov Institute of Metallurgy and Materials Science of the Russian Academy of Sciences" | <http://www.imet.ac.ru/>), 134
- IMM RAS (Federal State Budgetary Institution of Science "Institute for Mathematical Modeling of the Russian Academy of Sciences" | <http://www.imamod.ru/>), 13
- INEUM (Institute of Electronic Control Computers named after I.S.Bruk | <http://www.ineum.ru/>), 137
- INMI RAS (Federal State Budgetary Institution of Science "Winogradsky Institute of Microbiology of the Russian Academy of Sciences" | <http://www.inmi.ru/>), 134
- INTRA (Closed Joint Stock Company "INTRA" | <http://www.intra-zao.ru/>), 111
- IOC RAS (Federal State Budgetary Institution of Science "N.D.Zelinsky Institute of Organic Chemistry of the Russian Academy of Sciences" | <http://zioc.ac.ru/>), 164
- IPCE RAS (Federal State Budgetary Institution of Science "A.N.Frumkin Institute of Physical Chemistry and Electrochemistry of the Russian Academy of Sciences" | <http://www.phyche.ac.ru/>), 107, 124, 134
- IPE RAS (Federal State Budgetary Institution of Science "Shmidt Institute of Physics of the Earth of the Russian Academy of Sciences" | <http://www.ifz.ru/>), 134
- IPI RAN (Federal State Budgetary Institution of Science "Institute of Informatics Problems of the Russian Academy of Sciences" | <http://www.ipiran.ru/>), 164
- ISP RAS (Federal State Budgetary Institution of Science "Institute for System Programming of the Russian Academy of Sciences" | <http://www.ispras.ru/>), 164
- ISPM RAS (Federal State Budgetary Institution of Science "Enikolopov Institute of Synthetic Polymeric Materials of the Russian Academy of Sciences" | <http://www.ispm.ru/>), 134, 146
- ITEP (Federal State Budgetary Institution "Russian Federation State Scientific Centre - Alikhanov Institute for Theoretical and Experimental Physics" of the National Research Centre "Kurchatov Institute" | <http://www.itep.ru/>), 13, 18, 28, 31, 38, 50,

- 56, 74, 86, 90, 93, 103, 111, 116, 124, 134, 146, 150, 157, 164, 171
- JSCC RAS** (Federal State Budgetary Institution of Science “Joint Supercomputer Centre of the Russian Academy of Sciences” | <http://www.jscs.ru/>), 164
- KIAM RAS** (Federal State Budgetary Institution of Science “Keldysh Institute of Applied Mathematics of the Russian Academy of Sciences” | <http://www.keldysh.ru/>), 164, 171
- LPI RAS** (Federal State Budgetary Institution of Science “P.N.Lebedev Physical Institute of the Russian Academy of Sciences” | <http://www.lebedev.ru/>), 13, 28, 31, 38, 56, 62, 74, 82, 86, 146
- MATI** (Russian State Technological University | <http://www.mati.ru/>), 146
- MI RAS** (Federal State Budgetary Institution of Science “Steklov Mathematical Institute of the Russian Academy of Sciences” | <http://www.mi.ras.ru/>), 13, 23, 28, 31
- MIET** (National Research University of Electronic Technology | <http://www.miet.ru/>), 134
- MIREA** (Moscow State University Information Technology, Radioengineering and Electronics | <http://www.mirea.ru/>), 23, 178
- MITHT** (Lomonosov Moscow University of Fine Chemical Technology | <http://www.mitht.ru/>), 134
- MPEI** (National Research University “Moscow Power Engineering Institute” | <http://mpei.ru/>), 164
- MSU** (Lomonosov Moscow State University | <http://www.msu.ru/>), 13, 18, 23, 28, 31, 38, 74, 107, 124, 134, 150, 152, 157, 164, 171
- MUCTR** (Mendeleev University of Chemical Technology of Russia | <http://www.muctr.ru/>), 107
- NIKIET** (Joint Stock Company “A.N.Dollezhal Research and Development Institute of Power Engineering” | <http://www.nikiet.ru/>), 56, 134, 137
- NNRU “MEPhI”** (National Nuclear Research University “MEPhI” | <http://www.mephi.ru/>), 18, 23, 48, 50, 56, 78, 90, 93, 107, 111, 134, 140, 171, 178
- NRC KI** (National Research Centre “Kurchatov Institute” | <http://www.nrcki.ru/>), 18, 23, 74, 82, 93, 107, 111, 116, 124, 134, 140, 164
- NRU HSE** (National Research University “Higher School of Economics” | <http://www.hse.ru/>), 28
- PFUR** (Peoples’ Friendship University of Russia | <http://www.rudn.ru/>), 23, 143, 171
- PIN RAS** (Paleontological Institute of the Russian Academy of Sciences | <http://www.paleo.ru/>), 152
- RADON** (Federal State Unitary Enterprise - United Ecological, Scientific and Research Centre of Decontamination of Radioactive Waste and Environmental Protection “RADON” | <http://www.radon.ru/>), 111
- RCC MSU** (Research Computer Centre of the M.V.Lomonosov Moscow State University | <http://www.srcc.msu.ru/>), 164
- RCRC RAMS** (N.M.Blochin Russian Cancer Research Centre of the Russian Academy of Medical Sciences | <http://www.ronc.ru/>), 155
- RIPN** (Russian Institute for Public Networks | <http://www.ripn.net/>), 164
- RMAPE** (Russian Medical Academy of Postgraduate Education | <http://www.rmapo.ru/>), 155
- RSCC** (Federal State Unitary Enterprise “Russian Satellite Communications Company” | <http://www.rscc.ru/>), 164
- SAI MSU** (Sternberg Astronomical Institute of the M.V.Lomonosov Moscow State University | <http://www.sai.msu.ru/>), 152
- SC “VNIINM”** (Stock Company “A.A.Bochvar High-Technology Research Institute of Inorganic Materials” | <http://www.bochvar.ru/>), 111, 134
- SCC RAS** (Scientific Council for Cybernetics of the Russian Academy of Sciences | <http://www.ras.ru/>), 13, 31
- SF IPh** (Federal State Budgetary Institution of Science “State Foundation Institute of Pharmacology” | <http://www.academpharm.ru/>), 150
- SINP MSU** (Skobeltsyn Institute of Nuclear Physics of the M.V.Lomonosov Moscow State University | <http://www.sinp.msu.ru/>), 13, 18, 23, 31, 48, 50, 56, 62, 65, 86, 93, 107, 111, 116, 124, 134, 146, 164, 171, 178
- SRI “Voskhod”** (Scientific Research Institute “Voskhod” | <http://www.voskhod.ru/>), 164
- SSDI** (Joint Stock Company “State Specialized Design Institute” | <http://oaogspi.ru/>), 78, 137
- SYSTEMATOM** (Closed Joint Stock Company “Nuclear and Radiation Safety Systems” | <http://www.systematom.ru/>), 137

- TIPS RAS (Federal State Budgetary
 Institution of Science “A.V.Topchiev
 Institute of Petrochemical Synthesis of the
 Russian Academy of Sciences” |
<http://www.ips.ac.ru/>), 146
- VIGG RAS (Federal State Budgetary
 Institution of Science “Vavilov Institute of
 General Genetics of the Russian Academy of
 Sciences” | <http://www.vigg.ru/>), 155, 171
- VNIIMS (Federal Agency of Technical
 Regulating and Metrology National
 Metrology Institute All-Russian Research
 Institute of Metrological Service |
<http://www.vniims.ru/>), 28, 31
- Moscow, Troitsk*
- HPPI RAS (Federal State Budgetary
 Institution of Science “Institute for High
 Pressure Physics of the Russian Academy of
 Sciences” | <http://www.hppi.troitsk.ru/>),
 23, 134
- INR RAS (Federal State Budgetary
 Institution of Science “Institute for Nuclear
 Research of the Russian Academy of
 Sciences” | <http://www.inr.ac.ru/>), 13, 18,
 23, 28, 31, 40, 48, 50, 52, 56, 62, 74, 78, 82,
 86, 93, 107, 111, 116, 124, 134, 140, 157, 164
- ISAN (Federal State Budgetary Institution of
 Science “Institute of Spectroscopy of the
 Russian Academy of Sciences” |
<http://isan.troitsk.ru/>), 134
- Moscow, Zelenograd*
- NT-MDT Co. (Closed Joint Stock Company
 “NT-MDT Co.” | <http://www.ntmdt.ru/>),
 143
- RIMST (Closed Joint Stock Company
 “Research Institute of Material Science and
 Technology” | <http://www.niimv.ru/>), 107
- Nizhny Novgorod*
- IAP RAS (Federal State Budgetary
 Institution of Science “Institute of Applied
 Physics of the Russian Academy of
 Sciences” | <http://www.iapras.ru/>), 78, 103
- IPM RAS (Federal State Budgetary
 Institution of Science “Institute for Physics
 of Microstructures of the Russian Academy
 of Sciences” | <http://ipmras.ru/>), 134, 140
- UNN (N.I.Lobachevsky State University of
 Nizhny Novgorod (National Research
 University) | <http://www.unn.ru/>), 134, 164
- Novosibirsk*
- BIC SB RAS (Federal State Budgetary
 Institution of Science “Boreskov Institute of
 Catalysis of the Siberian Branch of the
 Russian Academy of Sciences” |
<http://www.catalysis.ru/>), 153
- BINP SB RAS (Federal State Budgetary
 Institution of Science “Budker Institute of
 Nuclear Physics of the Siberian Branch of
 the Russian Academy of Sciences” |
<http://www.inp.nsk.su/>), 13, 35, 74, 78, 93,
 103, 164, 171
- IM SB RAS (Federal State Budgetary
 Institution of Science “Sobolev Institute of
 Mathematics of the Siberian Branch of the
 Russian Academy of Sciences” |
<http://math.nsc.ru/>), 13
- ISP SB RAS (Federal State Budgetary
 Institution of Science “A.V.Rzhanov
 Institute of Semiconductor Physics of the
 Siberian Branch of the Russian Academy of
 Sciences” | <http://www.isp.nsc.ru/>), 146
- NSU (Novosibirsk State University |
<http://www.nsu.ru/>), 56
- Obninsk*
- IPPE (Joint Stock Company “State Scientific
 Centre of the Russian Federation - Institute
 of Physics and Power Engineering’ |
<http://www.ippe.ru/>), 18, 97, 124, 134
- MRRC (A.Tsyb Medical Radiological
 Research Centre - Branch of the National
 Medical Radiological Centr of the Health of
 the Russian Federation |
<http://mrrc.obninsk.ru/>), 97, 155
- Omsk*
- OB IM SB RAS (Federal State Budgetary
 Institution of Science “Institute of
 Mathematics of the Siberian Branch of the
 Russian Academy of Sciences” |
<http://ofim.oscsbras.ru/>), 45
- OMSU (F.V. Dostoevsky Omsk State
 University | <http://www.omsu.ru/>), 18
- Pereslavl-Zaleskiy*
- PSI RAS (Federal State Budgetary Institution
 of Science “Program Systems Institute of
 the Russian Academy of Sciences” |
<http://www.botik.ru/PSI>), 164
- Perm*
- ICMM UrB RAS (Federal State Budgetary
 Institution of Science “Institute of
 Continuous Media Mechanics of the Russian
 Academy of Sciences Ural Branch” |
<http://www.icmm.ru/>), 134
- ITCh UrB RAS (Federal State Budgetary
 Institution of Science “Institute of Technical
 Chemistry of the Russian Academy of
 Sciences Ural Branch” |
<http://www.itch.perm.ru/>), 134
- PSNRU (Perm State National Research
 University | <http://www.psu.ru/>), 13, 171

Petrozavodsk

IG KRS RAS (Federal State Budgetary Institution of Science “Institute of Geology Karelian Research Center of the Russian Academy of Sciences” | <http://ig.krc.karelia.ru/>), 134
PetrSU (Petrozavodsk State University | <http://petrsu.karelia.ru/>), 31

Podolsk

GIDROPRESS (Open Joint Stock Company “Experimental & Design Organization “GIDROPRESS” | <http://www.gidropress.podolsk.ru/>), 134

Protvino

IHEP (Federal State Budgetary Institution “Russian Federation State Scientific Centre - Institute for High Energy Physics” of the National Research Centre “Kurchatov Institute” | <http://www.ihep.ru/>), 13, 23, 28, 31, 38, 45, 50, 52, 56, 62, 65, 74, 90, 93, 164, 171

Puschino

IMPB RAS (Federal State Budgetary Institution of Science “Institute of Mathematical Problems of Biology of the Russian Academy of Sciences” | <http://www.impb.ru/>), 164, 171

IPR RAS (Federal State Budgetary Institution of Science “Institute of Protein Research of the Russian Academy of Sciences” | <http://www.protres.ru/>), 171

ITEB RAS (Federal State Budgetary Institution of Science “Institute of Theoretical and Experimental Biophysics of the Russian Academy of Sciences” | <http://web.iteb.psn.ru/>), 171

Rostov-on-Don

RIP SFU (Research Institute of Physics of the Southern Federal University | <http://ip.sfedu.ru/>), 134

SFedU (Southern Federal University | <http://www.sfedu.ru/>), 13

Ryazan

RSU (S.A.Esenin Ryazan State University | <http://www.rsu.edu.ru/>), 78

Samara

SSAU (Samara State Aerospace University | <http://www.ssau.ru/>), 13, 164

SSU (Samara State University | <http://samsu.ru/>), 13

Saratov

SSMU (Saratov State Medical University named after V.I.Razumovsky | <http://sgmu.ru/>), 146

SSU (Saratov State University named after N.G.Chernyshevsky | <http://www.sgu.ru/>), 13, 18, 23, 171

Sarov

VNIIEF (Russian Federal Nuclear Centre - All-Russian Research “Institute of Experimental Physics” | <http://www.vniief.ru/>), 13, 78, 86, 93, 103, 107, 111, 116

Sevastopol

IBSS (A.O.Kovalevsky Institute of Biology of the Southern Seas | <http://www.ibss.inf.net/>), 124

Smolensk

SmolGU (Smolensk State University | <http://www.smolgu.ru/>), 86

Snezhinsk

VNIITF (Russian Federal Nuclear Centre - All-Russian Scientific Research Institute of Technical Physics | <http://www.vniitf.ru/>), 56, 124

Sochi

SRI MP (Federal State Budgetary Institution “Scientific Research Institute of Medical Primatology” | <http://www.primatologia.ru/>), 150

St. Petersburg

Botanic garden BIN RAS (Federal State Budgetary Institution of Science “Botanic Garden of the V.L.Komarov Botanic Institute of the Russian Academy of Sciences” | <http://www.binran.ru/>), 124

CC SPbSU (Computer Center of the Saint Petersburg State University | <http://www.cc.spbu.ru/>), 164

ETU (Saint Petersburg State Electrotechnical University “LETT” | <http://www.eltech.ru/>), 23

Electron (Open Joint Stock Company “National Research Institute “Electron” | <http://www.electron.spb.ru/>), 56

FIP (V.F.Fock Institute of Physics of the Saint Petersburg State University | <http://www.niif.spbu.ru/>), 86, 93, 124, 164, 171

Hermitage (State Hermitage Museum | <http://www.hermitagemuseum.org/>), 124

IPTI RAS (Federal State Budgetary Institution of Science “Ioffe Physic 1 Technical Institute of the Russian Academy of Sciences” | <http://www.ioffe.ru/>), 23, 107, 111, 134, 146

ITMO (National Research University of Information Technologies, Mechanics and Optics | <http://www.ifmo.ru/>), 164

- KB "Arsenal" (Federal State Unitary Enterprise "Arsenal" Design Bureau" | <http://kbarsenal.ru/>), 48
- KRI (V.G.Khlopin Radium Institute | <http://www.khlopin.ru/>), 97, 107, 124
- NIIIEFA (D.V.Efremov Scientific Research Institute of Electrophysical Apparatus | <http://www.niiefa.spb.su/>), 103, 171
- NITIOM (Joint Stock Company "Research and Technological Institute of Optical Materials all-Russia Scientific Center "S.I.Vavilov State Optical Institute" | <http://www.goi.ru/>), 143
- Neva-Magnet (Neva-Magnet S&E, Ltd | <http://www.magnet.spb.su/prd2.html/>), 74
- PDMI RAS (Federal State Budgetary Institution of Science "St.Petersburg Department of V.A.Steklov Institute of Mathematics of the Russian Academy of Sciences" | <http://www.pdmi.ras.ru/pdmi/>), 28, 31
- SPSFTU (Saint Petersburg State Forest Technical University | <http://spbftu.ru/>), 124
- SPbSPU (Saint Petersburg Polytechnic University Peter the Great | <http://www.spbstu.ru/>), 13, 157, 164
- SPbSU (Saint Petersburg State University | <http://spbu.ru/>), 13, 18, 23, 28, 90, 111, 134, 164
- Sterlitamak*
- SSPA (Sterlitamak State Pedagogical Academy | <http://www.sspa.edu.ru/>), 134
- Syktyvkar*
- DM Komi SC UrB RAS (Federal State Budgetary Institution of Science "Department of Mathematics Komi Sciences Centre of the Russian Academy of Sciences Ural Branch" | <http://www.komisc.ru/>), 65, 74
- Tomsk*
- IHCE SB RAS (Federal State Budgetary Institution of Science "Institute of High Current Electronics of the Siberian Branch of the Russian Academy of Sciences" | <http://www.hcei.tsc.ru/>), 13, 112
- NPI TPU (Nuclear Physics Institute of the National Research Tomsk Polytechnic University | <http://www.npi.tpu.ru/>), 74, 112, 124, 134
- TPU (National Research Tomsk Polytechnic University | <http://tpu.ru/>), 28, 97
- TSU (National Research Tomsk State University | <http://www.tsu.ru/>), 13, 31, 157, 171
- Tula*
- TSPU (Tula State Pedagogical University | <http://tsput.ru/>), 124
- TSU (Tula State University | <http://tsu.tula.ru/>), 134, 178
- Tver*
- TvSU (Tver State University | <http://university.tversu.ru/>), 13, 171, 178
- Vladimir*
- ELMAG ("ELMAG Ltd" | <http://www2.vtsnet.ru/elmag/about.htm/>), 103
- Vladivostok*
- FEFU (Far Eastern Federal University | <http://dvfu.ru/>), 18, 150
- Voronezh*
- VSU (Voronezh State University | <http://www.vsu.ru/>), 23, 107, 111, 124
- Yekaterinburg*
- IMP UB RAS (Federal State Budgetary Institution of Science "M.N.Mikheev Institute of Metal Physics of Ural Branch of the Russian Academy of Sciences" | <http://www.imp.uran.ru/>), 134, 140
- UrFU (Urals Federal University named after the First President of Russia B.N.Yeltsin | <http://urfu.ru/>), 124, 134
- Yoshkar-Ola*
- VSUT (Volga State University of Technology | <http://www.volgatech.net/>), 13
- Zhukovsky*
- MDB (Open Joint Stock Company "Myasishchev Design Bureau" | <http://www.emz-m.ru/>), 57
- Serbia*
- Belgrade*
- INS "VINČA" ("VINČA" Institute of Nuclear Sciences | <http://www.vin.bg.ac.rs/>), 23, 57, 97, 103, 134, 146
- IPB (Institute of Physics Belgrade of the University of Belgrade | <http://www.phy.bg.ac.rs/>), 18, 28, 31, 124
- Univ. (University of Belgrade | <http://www.bg.ac.rs/>), 13, 28, 31, 124
- Novi Sad*
- UNS (University of Novi Sad | <http://www.uns.ac.rs/>), 124, 134
- Slovakia*
- Bratislava*
- BIONT (Bratislava Ionic Technologies Co. | <http://www.biont.sk/>), 146
- CU (Comenius University in Bratislava | <http://uniba.sk/>), 13, 18, 23, 38, 40, 43, 50, 52, 97, 107, 112, 124, 135, 146, 150, 178

- IEE SAS (Institute of Electrical Engineering of the Slovak Academy of Sciences | <http://www.elu.sav.sk/>), 78, 112, 124, 146
- ILE SAS (Institute of Landscape Ecology of the Slovak Academy of Sciences | <http://uke.sav.sk/>), 124
- IMS SAS (Institute of Measurement Science of the Slovak Academy of Sciences | <http://www.um.sav.sk/>), 74, 140
- IP SAS (Institute of Physics of the Slovak Academy of Sciences | <http://www.fu.sav.sk/>), 13, 18, 38, 40, 45, 50, 82, 86, 90, 97, 103, 108, 124
- SOSMT (Slovak Office of Standards, Metrology and Testing | <http://www.unms.sk/>), 97
- STU (Slovak University of Technology in Bratislava | <http://www.stuba.sk/>), 57, 93
- Košice*
- IEP SAS (Institute of Experimental Physics of the Slovak Academy of Sciences in Košice | <http://uef.saske.sk/>), 13, 23, 82, 135, 164, 171
- PJSU (Pavol Jozef Šafárik University in Košice | <http://www.upjs.sk/>), 74, 82, 86, 90, 93, 171, 178
- TUKE (Technical University of Košice | <http://www.tuke.sk/tuke/university>), 23, 171
- Prešov*
- PU (University of Prešov | <http://www.unipo.sk/>), 171
- Žilina*
- UŽ (University of Žilina | <http://www.uniza.sk/>), 74, 82
- Slovenia**
- Ljubljana*
- GeoSS (Geological Survey of Slovenia | <http://www.geo-zs.si/>), 125
- UL (University of Ljubljana | <http://www.uni-lj.si/>), 23
- South Africa**
- Bellville*
- UWC (University of the Western Cape | <http://www.uwc.ac.za/>), 125, 146
- Cape Town*
- UCT (University of Cape Town | <http://www.uct.ac.za/>), 31, 74, 93, 165, 171
- iThemba LABS (iThemba Laboratory for Accelerator Based Sciences | <http://www.tlabs.ac.za/>), 18, 78, 103, 108
- Johannesburg*
- UJ (University of Johannesburg | <http://www.uj.ac.za/>), 74
- WITS* (University of the Witwatersrand | <http://www.wits.ac.za/>), 74
- Port Elizabeth*
- NMMU (Nelson Mandela Metropolitan University | <http://www.nmmu.ac.za/>), 146
- Pretoria*
- Necsa (South African Nuclear Energy Corporation | <http://www.necsa.co.za/>), 135, 178
- UP (University of Pretoria | <http://web.up.ac.za/>), 146, 171
- Unisa (University of South Africa | <http://www.unisa.ac.za/>), 18, 108, 125
- Stellenbosch*
- SU (Stellenbosch University | <http://www.sun.ac.za/>), 18, 108, 125
- Spain**
- Barcelona*
- IEEC-CSIC (Institute of Space Studies of Catalonia of the Spanish National Research Council | <http://www.ieec.cat/>), 28
- IFAE (Institute for High Energy Physics | <http://www.ifae.es/>), 38
- Bilbao*
- UPV/EHU (University of the Basque Country | <http://www.enu.es/>), 28
- Huelva*
- UHU (University of Huelva | <http://www.uhu.es/>), 108
- Madrid*
- CENIM-CSIC (National Centre for Metallurgical Research of the Spanish National Research Council | <http://www.cenim.csic.es/>), 135
- CIEMAT (Research Centre for Energy, Environment and Technology | <http://www.ciemat.es/>), 57
- CSIC (Spanish National Research Council | <http://www.csic.es/>), 108
- IA-CSIC (Institute of Acoustics of the Spanish National Research Council | <http://www.ia.csic.es/>), 146
- ICMM-CSIC (Materials Science Institute of Madrid of the Spanish National Research Council | <http://www.icmm.csic.es/>), 23
- UAM (Autonoma University of Madrid | <http://www.uam.es/>), 57
- Oviedo*
- UO (University of Oviedo | <http://www.uniovi.es/>), 57
- Palma*
- uib (Illes Baleares University | <http://www.uib.cat/>), 19

Santander

IFCA (Institute of Physics of Cantabria of the University of Cantabria | <http://www.ifca.unican.es/>), 57

Santiago de Compostela

USC (University of Santiago de Compostela | <http://www.usc.es/>), 13

Valencia

IFIC (Institute for Particle Physics of the University of Valencia | <http://ific.uv.es/>), 28

UV (University of Valencia | <http://www.uv.es/>), 13, 146

Sweden

Göteborg

Chalmers (Chalmers University of Technology | <http://www.chalmers.se/>), 19, 108

Lund

LU (Lund University | <http://www.lu.se/>), 13, 19, 86, 93, 165

Stockholm

SU (Stockholm University | <http://www.su.se/>), 74

Uppsala

TSL (Svedberg Laboratory of the Uppsala University | <http://www4.tsl.uu.se/tsl/>), 74, 82

Switzerland

Basel

Uni Basel (University of Basel | <http://www.unibas.ch/>), 57

Bern

Uni Bern (University of Bern | <http://www.unibe.ch/>), 13, 19

Geneva

UniGe (University of Geneva | <http://www.unige.ch/>), 82, 86

Lausanne

EPFL (Ecole Polytechnique Fédérale de Lausanne | <http://www.epfl.ch/>), 93

Villigen

PSI (Paul Scherrer Institute | <http://www.psi.ch/>), 13, 23, 57, 82, 86, 108, 116, 125, 135

Zurich

ETH (Swiss federal Institute of Technology Zurich | <http://www.ethz.ch/>), 23, 57, 86, 135, 171

UZH (University of Zurich | <http://www.uzh.ch/>), 57, 62, 116

Taiwan

Chung-Li

NCU (National Central University | <http://www.ncu.edu.tw/>), 57

Hsinchu

NSRRC (National Synchrotron Radiation Research Center | <http://www.nsrrc.org.tw/>), 135

Taipei

AS (Academia Sinica | <http://www.sinica.edu.tw/>), 171

IP AS (Institute of Physics of the Academia Sinica | <http://www.phys.sinica.edu.tw/>), 23

NTU (National Taiwan University | <http://www.ntu.edu.tw/>), 19, 57

Tajikistan

Dushanbe

IChem ASRT (V.I.Nikitin Institute of Chemistry of the Academy of Sciences of the Republic of Tajikistan | <http://www.phti.tj/>), 135

PHTI ASRT (S.U.Umarov Physical-Technical Institute of the Academy of Sciences of the Republic of Tajikistan | <http://www.phti.tj/>), 87, 171

TNU (Tajik State University | <http://tnu.tj/>), 171

Khujent

KSU (Khujent State University | <http://www.hgu.tj/>), 171

Thailand

Hat Yai

PSU (Prince of Songkla University | <http://www.psu.ac.th/>), 125

Turkey

Adana

CU (Çukurova University | <http://www.cu.edu.tr/>), 57

Ankara

METU (Middle East Technical University | <http://www.metu.edu.tr/>), 43, 57

Istanbul

BU (Boğaziçi University | <http://www.boun.edu.tr/>), 28, 31

Izmir

IZTECH (Izmir Institute of Technology | <http://www.iyte.edu.tr/>), 28

Canakkale

ÇOMU (Çanakkale Onsekiz Mart University | <http://www.comu.edu.tr/>), 125

USA

Ames, IA

ISU (Iowa State University |
<http://www.iastate.edu/>), 57

Ann Arbor, MI

U-M (University of Michigan; Harrison
M. Randall Laboratory |
<http://www.umich.edu/>), 146

Arlington, TX

UTA (University of Texas Arlington |
<http://www.uta.edu/>), 165

Athens, AL

ASU (Athens State University |
<http://www.athens.edu/>), 153

Austin, TX

UT (University of Texas at Austin |
<http://www.utexas.edu/>), 112

Baltimore, MD

JHU (Johns Hopkins University |
<http://www.jhu.edu/>), 28, 32, 57

Batavia, IL

Fermilab (Fermi National Accelerator
Laboratory | <http://www.fnal.gov/>), 40, 43,
57, 74, 78, 165

Berkeley, CA

Berkeley Lab (Lawrence Berkeley National
Laboratory of the University of California |
<http://www.lbl.gov/>), 87, 90

Blacksburg, VA

Virginia Tech (Virginia Polytechnic Institute
and State University; Institute for High
Energy Physics | <http://www.vt.edu/>), 57

Bloomington, IN

IU (Indiana University Bloomington |
<http://www.iub.edu/>), 90

Boston, MA

BU (Boston University |
<http://www.bu.edu/>), 52, 57

NU (Northeastern University |
<http://www.northeastern.edu/>), 57

Cambridge, MA

Harvard Univ. (Harvard University |
<http://www.harvard.edu/>), 43

MIT (Massachusetts Institute of Technology |
<http://web.mit.edu/>), 57

Charlottesville, VA

UVa (University of Virginia |
<http://www.virginia.edu/>), 40, 116

Chicago, IL

UChicago (University of Chicago |
<http://www.uchicago.edu/>), 52, 165

UIC (University of Illinois at Chicago |
<http://www.uic.edu/>), 57

Cincinnati, OH

UC (University of Cincinnati |
<http://www.uc.edu/>), 28, 32

Clemson, SC

Clemson (Clemson University |
<http://www.clemson.edu/>), 28

College Park, MD

UMD (University of Maryland |
<http://www.umd.edu/>), 14, 28, 32, 57

College Station, TX

Texas A&M (Texas A&M University |
<http://www.tamu.edu/>), 103, 108

Columbus, OH

OSU (Ohio State University |
<http://www.osu.edu/>), 57, 93

Coral Gables, FL

UM (University of Miami |
<http://welcome.miami.edu/>), 28, 32

Davis, CA

UCDavis (University of California |
<http://ucdavis.edu/>), 57

Detroit, MI

WSU (Wayne State University |
<http://wayne.edu/>), 90

Durham, NC

Duke (Duke University |
<http://www.duke.edu/>), 125

East Lansing, MI

MSU (Michigan State University |
<http://www.msu.edu/>), 108

Evanston, IL

NU (Northwestern University |
<http://www.northwestern.edu/>), 57

Fairfax, VA

GMU (George Mason University |
<http://www.gmu.edu/>), 52

Gainesville, FL

UF (University of Florida |
<http://www.ufl.edu/>), 57

Gettysburg, PA

GC (Gettysburg College |
<http://www.gettysburg.edu/>), 125

Houston, TX

Rice Univ. (Rice University |
<http://www.rice.edu/>), 57

Indianapolis, IN

IUPUI (Indiana University - Purdue
University Indianapolis |
<http://www.iupui.edu/>), 43, 137

Iowa City, IA

UIowa (University of Iowa |
<http://www.uiowa.edu/>), 57, 87

Irvine, CA

UCI (University of California, Irvine |
<http://www.uci.edu/>), 112

- Kingston, RI*
 URI (University of Rhode Island |
<http://ww2.uri.edu/>), 125
- Knoxville, TN*
 UTK (University of Tennessee of Knoxville |
<http://www.utk.edu/>), 146
- Lemont, IL*
 ANL (Argonne National Laboratory |
<http://www.anl.gov/>), 14, 19, 38, 90, 108,
 171
- Lexington, KY*
 UK (University of Kentucky |
<http://www.uky.edu/>), 40
- Lincoln, NE*
 UNL (University of Nebraska-Lincoln |
<http://www.unl.edu/>), 57
- Livermore, CA*
 LLNL (Lawrence Livermore National
 Laboratory | <http://www.llnl.gov/>), 57, 103,
 108
- Los Alamos, NM*
 LANL (Los Alamos National Laboratory;
 Meson Physics Facility (LAMPF) |
<http://www.lanl.gov/>), 19, 57, 125
- Los Angeles, CA*
 UCLA (University of California, Los Angeles |
<http://www.universityofcalifornia.edu/>), 57,
 90
- Louisville, KY*
 UofL (University of Louisville |
<http://louisville.edu/>), 23
- Lubbock, TX*
 TTU (Texas Tech University |
<http://www.ttu.edu/>), 57
- Madison, WI*
 UW-Madison (University of
 Wisconsin-Madison |
<http://www.wisc.edu/>), 57
- Menlo Park, CA*
 SLAC (SLAC National Accelerator Laboratory
 is Operated by Stanford University |
<http://www6.slac.stanford.edu/>), 52
- Merced, CA*
 UCMerced (University of California, Merced
 Madison | <http://www.ucmerced.edu/>), 52
- Minneapolis, MN*
 U of M (University of Minnesota |
<http://twin-cities.umn.edu/>), 14, 28, 32, 57
- Nashville, TN*
 VU (Vanderbilt University |
<http://www.vanderbilt.edu/>), 103, 108
- New Haven, CT*
 Yale Univ. (Yale University |
<http://www.yale.edu/>), 90
- New York, NY*
 CUNY (City University of New York |
<http://www.cuny.edu/>), 14, 23, 28, 32
- RU (Rockefeller University |
<http://www.rockefeller.edu/>), 14, 28
- SUNY (State University of New York |
<http://www.suny.edu/>), 28, 32
- Newport News, VA*
 JLab (Thomas Jefferson National Accelerator
 Facility; Southeastern Universities Research
 Association (SURA) |
<http://www.jlab.org/>), 14, 32, 82
- Norfolk, VA*
 NSU (Norfolk State University |
<http://www.nsu.edu/>), 82, 87
- Norman, OK*
 OU (University of Oklahoma |
<http://www.ou.edu/>), 14, 28
- Notre Dame, IN*
 ND (University of Notre Dame |
<http://www.nd.edu/>), 19, 57
- Oak Ridge, TN*
 ORNL (Oak Ridge National Laboratory |
<http://www.ornl.gov/>), 93, 103, 108, 125,
 146
- Oxford, MS*
 UM (University of Mississippi |
<http://www.olemiss.edu/>), 57
- Pasadena, CA*
 Caltech (California Institute of Technology |
<http://www.caltech.edu/>), 58, 165
- Philadelphia, PA*
 Penn (University of Pennsylvania |
<http://www.upenn.edu/>), 14, 28, 32
- Piscataway, NJ*
 Rutgers (Rutgers University-State University
 of New Jersey | <http://www.rutgers.edu/>),
 28, 32, 58
- Pittsburgh, PA*
 CMU (Carnegie Mellon University |
<http://www.cmu.edu/>), 58
- Pitt (University of Pittsburgh |
<http://www.pitt.edu/>), 116
- Princeton, NJ*
 PU (Princeton University; Joseph Henry
 Laboratories of Physics |
<http://www.princeton.edu/>), 58
- Riverside, CA*
 UCR (University of California, Riverside |
<http://www.ucr.edu/>), 58
- Rochester, NY*
 UR (University of Rochester |
<http://www.rochester.edu/>), 23, 28, 32, 58

- Salt Lake City, UT*
- U of U (University of Utah | <http://www.utah.edu/>), 32
- Stanford, CA*
- SU (Stanford University | <http://stanford.edu/>), 146
- Stony Brook, NY*
- SUNY (State University of New York at Stony Brook | <http://www.stonybrook.edu/>), 74
- Tallahassee, FL*
- FSU (Florida State University | <http://www.fsu.edu/>), 23, 58
- Tucson, AZ*
- UA (University of Arizona | <http://www.arizona.edu/>), 116
- Tuscaloosa, AA*
- UA (University of Alabama | <http://www.ua.edu/>), 58
- University Park, PA*
- Penn State (Pennsylvania State University | <http://www.psu.edu/>), 14, 19, 90
- Upton, NY*
- BNL (Brookhaven National Laboratory | <http://www.bnl.gov/>), 52, 74, 78, 82, 87, 90, 165, 178
- Urbana, IL*
- I (University of Illinois at Urbana-Champaign), 62
- Williamsburg, VA*
- W&M (College of William & Mary | <http://www.wm.edu/>), 82, 87
- Ukraine**
- Dnepropetrovsk*
- DNU (Dnepropetrovsk National University | <http://www.dnu.dp.ua/>), 14
- Donetsk*
- DonIPE NASU (Donetsk Institute for Physics and Engineering named after O.O.Galkin of the National Academy of Sciences of Ukraine | <http://www.fti.dn.ua/>), 125, 135
- DonNU (Donetsk National University | <http://www.donnu.edu.ua/>), 135
- Kharkov*
- IERT NASU (Institute of Electrophysics and Radiation Technology of the National Academy of Sciences of Ukraine | <http://www.iert.kharkov.ua/>), 78, 135, 146, 171
- ISC NASU (Institute for Single Crystals of the National Academy of Sciences of Ukraine | <http://www.isc.kharkov.ua/>), 57, 112
- ISMA NASU (Institute for Scintillation Materials of the National Academy of Sciences of Ukraine | <http://www.isma.kharkov.ua/>), 40, 62, 125,
- 157
- KFTI (National Science Centre - Kharkov Institute of Physics and Technology | <http://www.kipt.kharkov.ua/>), 14, 23, 28, 32, 57, 74, 82, 93, 97, 125, 135, 165, 171
- KhNU (V.N.Karasin Kharkov National University | <http://www.univer.kharkov.ua/>), 57, 74
- Kiev*
- BITP NASU (M.M.Boholubov Institute for Theoretical Physics of the National Academy of Sciences of Ukraine | <http://www.bitp.kiev.ua/>), 14, 19, 28, 31, 48, 50, 65, 74, 93, 165, 171, 178
- IMP NASU (G.V.Kurdyumov Institute of Metal Physics of the National Academy of Sciences of Ukraine | <http://www.imp.kiev.ua/>), 23
- IPMS NASU (Frantsevich Institute for Problems of Materials Science of the National Academy of Sciences of Ukraine | <http://www.materials.kiev.ua/>), 135
- ISC NASU (Chuiko Institute of Surface Chemistry of the National Academy of Sciences of Ukraine | <http://www.isc.gov.ua/>), 135
- KINR NASU (Kiev Institute for Nuclear Research of the National Academy of Sciences of Ukraine | <http://www.kinr.kiev.ua/>), 19, 103, 108, 112, 125
- NTUU KPI (National Technical University of Ukraine “Kyiv Polytechnic Institute” | <http://kpi.ua/>), 165
- NUK (Taras Shevchenko National University of Kyiv | <http://univ.kiev.ua/>), 23, 125, 135, 178
- PEWI NASU (Paton Electric Welding Institute of Surface Chemistry of the National Academy of Sciences of Ukraine | <http://paton.kiev.ua/>), 78
- L'viv*
- IAPMM NASU (Pidstryhach Institute for Applied Problems of Mechanics and Mathematics of the National Academy of Sciences of Ukraine | <http://www.iapmm.lviv.ua/>), 14
- ICMP NASU (Institute for Condensed Matter Physics of the National Academy of Sciences of Ukraine | <http://www.icmp.lviv.ua/>), 23
- IFNU (Ivan Franko National University in L'viv | <http://lnu.edu.ua/>), 14
- LPNU (National University L'viv Polytechnic | <http://lp.edu.ua/>), 140

Lutsk

VNU (Volyn National University of Lesya Ukrainka | <http://www.vnu.edu.ua/>), 14

Sumy

IAP NASU (Institute of Applied Physics of the National Academy of Sciences of Ukraine | <http://iap.sumy.org/>), 125
SumSU (Sumy State University | <http://sumdu.edu.ua/>), 14

Uzhgorod

IEP NASU (Institute of Electron Physics of the National Academy of Sciences of Ukraine | <http://www.iep.uzhgorod.ua/>), 125
UNU (Uzhgorod National University | <http://www.uzhnu.edu.ua/>), 97

United Kingdom

Birmingham

Univ. (University of Birmingham | <http://www.birmingham.ac.uk/>), 52, 93

Bristol

Univ. (University of Bristol | <http://www.bris.ac.uk/>), 52, 57

Buckingham

UB (University of Buckingham | <http://www.buckingham.ac.uk/>), 153

Cambridge

Univ. (University of Cambridge | <http://www.cam.ac.uk/>), 28, 32

Canterbury

Univ. (University of Kent | <http://www.kent.ac.uk/>), 14

Didcot

RAL (Rutherford Appleton Laboratory; Science and Technology Facilities Council | <http://www.stfc.ac.uk/>), 57, 135, 137, 140

Durham

Univ. (Durham University | <http://www.dur.ac.uk/>), 28, 32

Glasgow

U of G (University of Glasgow | <http://www.gla.ac.uk/>), 82
US (University of Strathclyde of Glasdow | <http://www.strath.ac.uk/>), 52

Liverpool

Univ. (University of Liverpool | <http://www.liv.ac.uk/>), 28, 52, 62

London

Imperial College (Imperial College London | <http://www.imperial.ac.uk/>), 13, 28, 32, 57
NPL (National Physical Laboratory | <http://www.npl.co.uk/>), 146
QM (Queen Mary of the University of London | <http://www.qmul.ac.uk/>), 13

UCL (University College London |

<http://www.ucl.ac.uk/>), 112

Manchester

UoM (University of Manchester | <http://www.manchester.edu/>), 108, 112

Oxford

JAI (John Adams Institute for Accelerator Science | <http://www.adams-institute.ac.uk/>), 78

Southampton

Univ. (University of Southampton | <http://www.soton.ac.uk/>), 28, 32

York

Univ. (University of York | <http://www.york.ac.uk/>), 28, 32

Uzbekistan

Jizakh

JSPI (Jizakh State Pedagogical Institute named after A.Kadri | <http://jspi.uz/>), 50, 87

Samarkand

SSU (Samarkand State University named after Alisher Navoi | <http://www.samdu.uz/>), 38, 50, 87, 103, 112

Tashkent

Assoc.“P.-S.” PTI (Physical Technical Institute Association “Physics-Sun” named after S.A.Azimov of the Academy of Sciences of the Republic of Uzbekistan | <http://uzcinet.uz/>), 19, 23, 82, 87

IAP NUU (Institute of Applied Physics of the National University of Uzbekistan named after Mirzo Ulugbek | <http://nuu.uz/>), 14, 19, 112

IMIT AS RUz (Institute of Mathematics and Information Technology of the Academy of Sciences of the Republic of Uzbekistan | <http://www.mathinst.uzsci.net/>), 165

INP AS RUz (Institute of Nuclear Physics of the Academy of Sciences of the Republic of Uzbekistan | <http://www.inp.uz/>), 19, 58, 82, 112, 118, 135

NUU (National University of Uzbekistan named after Mirzo Ulugbek | <http://nuu.uz/>), 14

Vietnam

Da Nang

DTU (Duy Tan University | <http://daytan.edu.vn/>), 135

Hanoi

IMS VAST (Institute of Material Science of the Vietnam Academy of Science and Technology | <http://ims.vast.ac.vn/>), 23

IOP VAST (Institute of Physics of the Vietnam Academy of Science and Technology | <http://www.iop.vast.ac.vn/>), 14, 32, 125, 135
VNU (Vietnam National University Hanoi | <http://www.vnu.edu.vn/>), 125, 171, 178

CERN

Geneva

CERN (European Organization for Nuclear Research (Switzerland) | <http://public.web.cern.ch/>), 11, 26, 30, 38, 45, 52, 55, 61, 73, 78, 81, 85, 92, 102, 106, 122, 157, 163, 170, 178

ICTP

Trieste

ICTP (Abdus Salam International Centre for Theoretical Physics (Italy) | <http://www.ictp.it/>), 12, 27