THE JOINT INSTITUTE FOR NUCLEAR RESEARCH

Opportunities for international collaboration

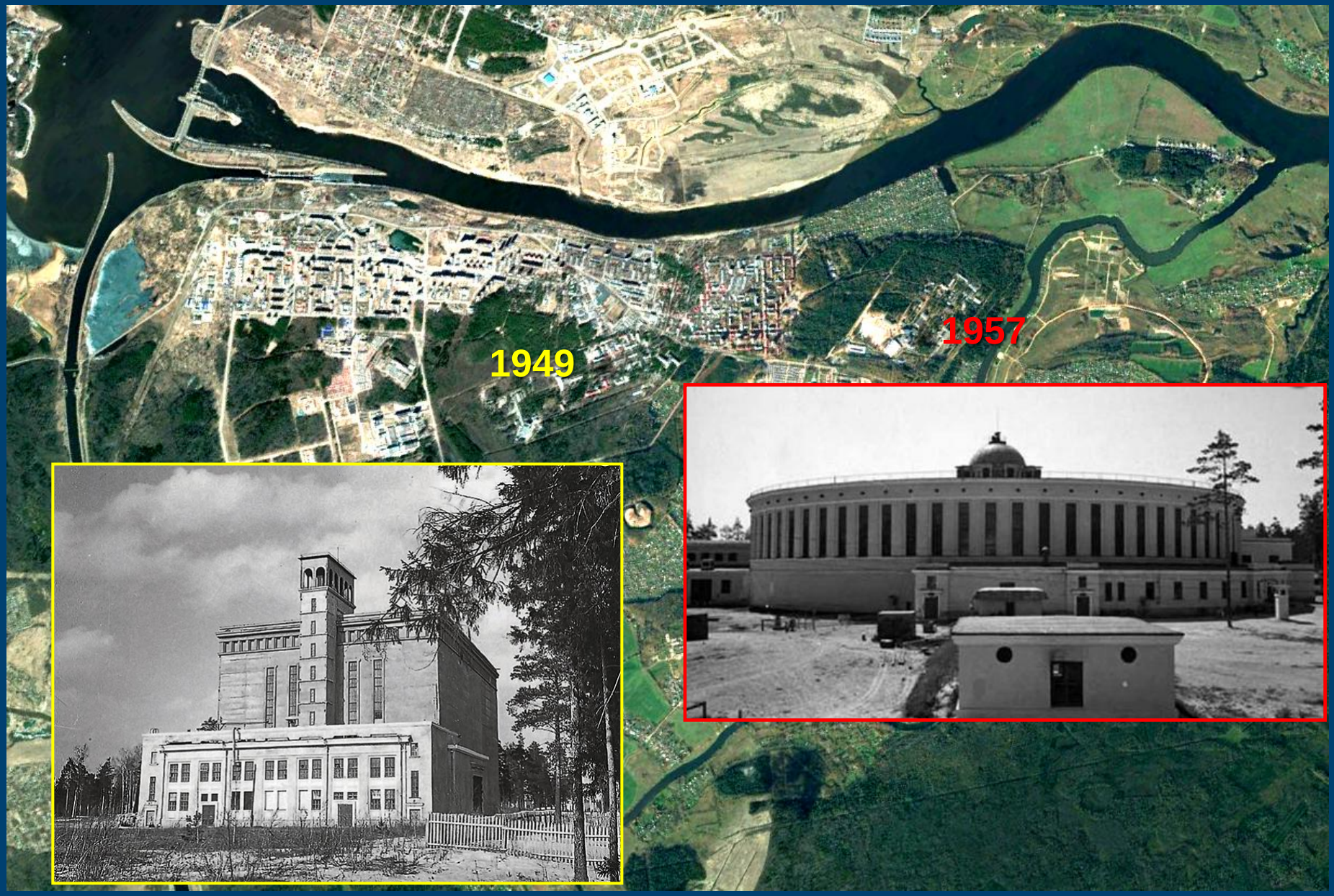
D. Kamanin, JINR

Science diplomacy in the beginning of Atom Era

- **Cold War (formally started 5 March 1946)** is the period when the foundations of scientific diplomacy were laid.
- During the **World War II** for the first time in history science became a factor of foreign policy.
- World War II demonstrated massive use of scientists and engineers in the preparation of military operations.
- Both letter by Albert Einstein to US president Roosevelt in 1939 and letter by Georgy Flyorov to Soviet leader Stalin in 1942 marked the **beginning of a new era when science was no longer far from politics**.
- Scientific achievements became the **symbol** of superpower and improved a lot the images of the countries like USSR and USA.
- The atomic issue became central in questions relating to science and foreign policy – "**Atomic diplomacy**".

- 12 April 1943 – Laboratory №2 was founded, I.V. Kurchatov was nominated to its director

Dubna – Island of Stability



International background during the period of JINR foundation

- 1949 – foundation of **Council of Europe** to promote human rights, democracy and rule of law in Europe
- 1951 – foundation of **European Coal and Steel community.** The goal - - to regulate their industrial production under a centralized authority. Formal integration which led to the European Union started
- **1954, 29 September - European Organization for Nuclear Research (CERN) was founded** as a counterbalance to American superiority in the field of nuclear research and because of interest for many countries of Europe
- 1955, April – Bandung Conference (Indonesia) the most important step toward Non-Aligned Movement
- 1955, August - International Conference on the Peaceful Uses of Atomic Energy in Geneva
- 1956, February – 20th Congress of the CPSU: the principle of peaceful coexistence became the basis for the foreign policy of the Soviet Union
- **1956, 26 March – JINR was founded**
- **1957, 29 July - The IAEA was created** in response to the deep fears and expectations generated by the discoveries and diverse uses of nuclear technology.
- 1957, July – **Pugwash Conference**(Canada) united scientists from East and West joined together to discuss global issues.

Establishment of the Joint Institute for Nuclear Research

The Joint Institute for Nuclear Research (JINR) is an international intergovernmental scientific research organization established through the Convention signed on 26 March 1956 in Moscow to unite scientific and material potential of its member states in order to study fundamental properties of matter

The results of research carried out at the Institute can be used solely for peaceful purposes for the benefit of mankind.

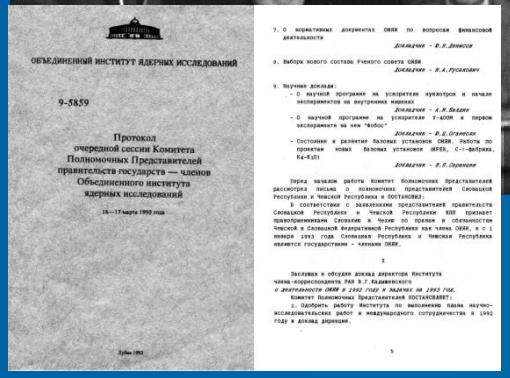
JINR as an exhibition of Soviet science achievements

- 1957 – visits of UN general secretary Doug Hammershield, Prime Minister of Great Britain Harold McMillan, President of Egypt Gamal Abdel Nasser, Nobel Prize Laureate P. Joliot-Curie




1993–2018: 25 years of the New Era of the Joint Institute for Nuclear Research

Session of the JINR Committee of Plenipotentiaries, Dubna, 17 March 1993



ОБЪЕДИНЕННЫЙ ИНСТИТУТ ЯДЕРНЫХ ИССЛЕДОВАНИЙ

9-5859

Протокол
очередной сессии Комитета
Полномочных Представителей
правительств государств — членов
Объединенного института
ядерных исследований

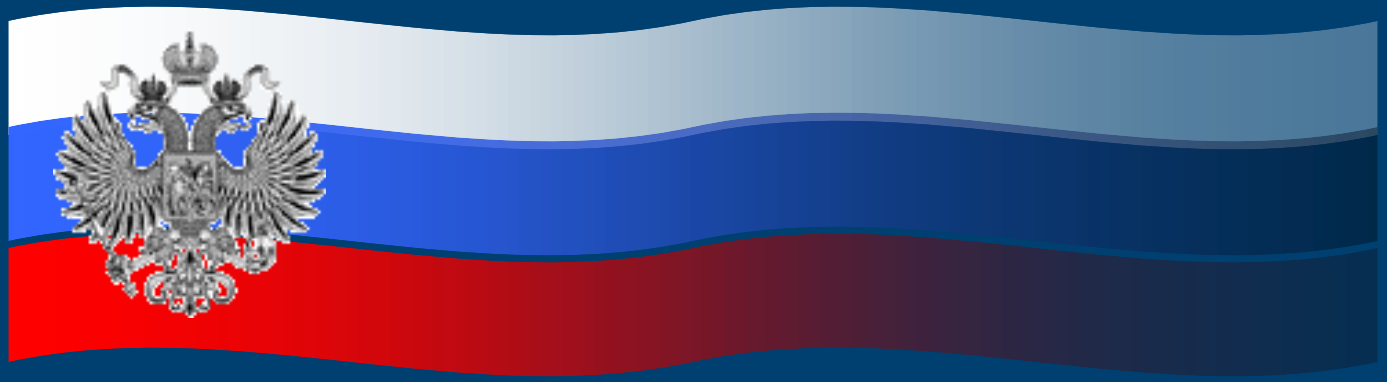
16—17 марта 1993 года

- Membership of Belarus, Russia, and Ukraine was approved at CP session in December 1991;
- Armenia, Azerbaijan, Georgia, Kazakhstan, and Moldova – March 1992;
- Uzbekistan – June 1992;
- Czech and Slovak Republics – March 1993;
- Associate members: Germany (July 1991) and Hungary (February 1993).

Early 1990-ies:

- ✓ Dramatic transformation of European socio-political landscape;
- ✓ Economies in transition in Central/Eastern Europe, Russia: social and economic challenges;
- ✓ New era of cooperation for JINR: new Member States and Associate Members.

JINR – Russia Agreement

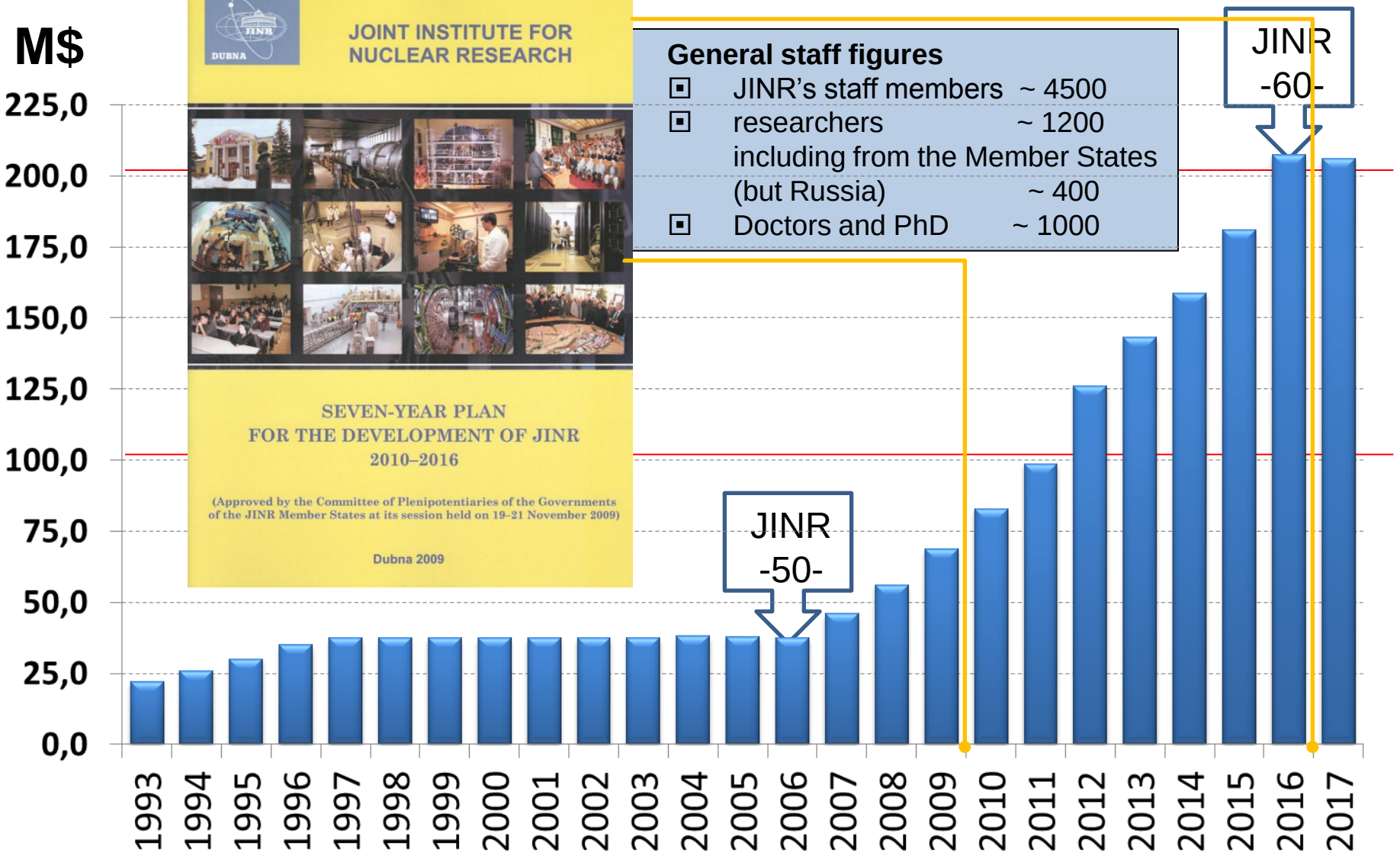


A very important for JINR Russian Federal law was signed by President V.Putin in 2000. This is ***"The Agreement between the Government of the Russian Federation and JINR on the Location and Terms of Activity of JINR in the Russian Federation".*** This Agreement grants privileges and immunities in accordance with established practice for international intergovernmental organizations.

JINR budget since 1993: 25 years

General staff figures

- JINR's staff members ~ 4500
- researchers ~ 1200
  including from the Member States
  (but Russia) ~ 400
- Doctors and PhD ~ 1000



60 years: Mission of JINR

Science Bringing Nations Together

5 Major Pillars:

- Research
  Basic studies at the frontiers of knowledge
- International cooperation
  Combining world intellect and material resources
- Innovation
  Multi-disciplinary studies
  New instruments and technologies
- Education
  Training students, young scientists and engineers
- Outreach
  Promoting science in society worldwide

JINR has at present 18 Member States

Armenia
Azerbaijan
Belarus
Bulgaria
Cuba
Czech Republic
Georgia
Kazakhstan
D. P. Republic of Korea
Moldova
Mongolia
Poland
Romania
Russian Federation
Slovakia
Ukraine
Uzbekistan
Vietnam

Participation of Egypt, Germany, Hungary, Italy, Republic of South Africa, Serbia in JINR activities is based on bilateral agreements signed on the governmental level.
International partner network ~800 partner organizaion in ~62 countries

TOP 10 of JINR International Cooperation

Short-Term visits 2018

to JINR

1.	Belarus	145
2.	Poland	85
3.	Germany	85
4.	Czech	79
5.	France	69
6.	Bulgaria	54
7.	Slovakia	52
8.	Ukraine	52
9.	Kazakhstan	34
10.	Egypt	26
Total:		921*

from JINR

	CERN	514
1.	German	363
2.	Czech	310
3.	Poland	208
4.	Italy	182
5.	China	173
6.	France	172
7.	Belarus	158
8.	Bulgaria	120
9.	Romania	110
Total:		2114

Short-Term visits 2017

to JINR

1.	Belarus	164
2.	Poland	117
3.	Germany	106
4.	Bulgaria	79
5.	France	64
6.	Czech	56
7.	Ukraine	55
8.	Kazakhstan	52
9.	South Africa	49
10.	Slovakia	43
Total:		1072

JINR participants in conf.

1.	Italy	121
2.	Germany	119
3.	China	92
4.	Bulgaria	91
5.	Czech Republic	89
6.	France	72
7.	Romania	61
8.	Poland	60
9.	Montenegro	56
10.	Belarus	38
Total:		1163

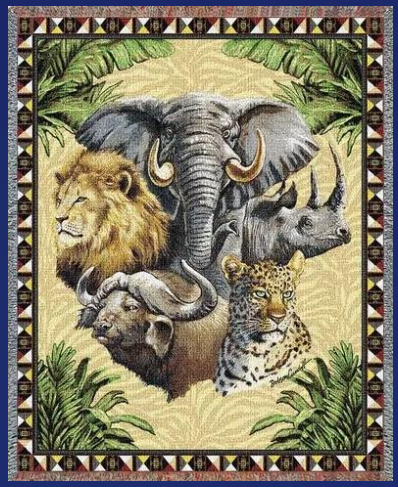
Collaboration with research centers and universities (2019)

	Russia	190
1.	USA	78
2.	Germany	65
3.	France	39
4.	Romania	38
5.	Italy	37
6.	Poland	31
7.	Japan	29
8.	Ukraine	24
9.	Great Britain	22
10.	Czech Republic	21
11.	Bulgaria	20

European Union (EU) **361**

BRICS (without Russia) **62**

New agreements 37



2018 Employees from JINR member states

1.	Kazakhstan	79
2.	Bulgaria	36
3.	Ukraine	36
4.	Czech	32
5.	Poland	31
6.	Belarus	28
7.	Slovakia	23
8.	Azerbaijan	20
9.	Romania	19
10.	Uzbekistan	18
Total :		389

Non-RUS employees	419
Inc. EU employees	151
Total states	33

*not counting visits for participation in JINR conferences, meetings

Joint publications with JINR authors and authors from different countries (2018)

JINR Member States	Number of Publications
ARMENIA	313
AZERBAIJAN	169
BELARUS	321
BULGARIA	251
CUBA	33
CZECH REPUBLIC	398
GEORGIA	265
KAZAKHSTAN	36
MOLDOVA	17
MONGOLIA	55
POLAND	**446**
ROMANIA	233
SLOVAKIA	219
UKRAINE	254
UZBEKISTAN	32
VIETNAM	19

JINR Associate Members	Number of Publications
EGYPT	**162**
GERMANY	**584**
HUNGARY	295
ITALY	**447**
SERBIA	271
SOUTH AFRICA	160

Other States	Number of Publications
USA	**486**
FRANCE	**418**
CHINA	**407**
SWITZERLAND	364
ENGLAND	347
TURKEY	328
BRAZIL	**324**
SPAIN	314
GREECE	303
AUSTRIA	297
TAIWAN	291
PORTUGAL	286
SOUTH KOREA	264
COLOMBIA	262
INDIA	**253**
JAPAN	238
MALAYSIA	234
SWEDEN	216
PAKISTAN	212
AUSTRALIA	210
MEXICO	198
CROATIA	197
NETHERLANDS	196
FINLAND	195
BELGIUM	179
THAILAND	178
CYPRUS	162
NORWAY	156
IRAN	153
IRELAND	152
CANADA	150
ECUADOR	149

DENMARK	147
LITHUANIA	147
NEW ZEALAND	147
ESTONIA	145
LATVIA	145
QATAR	142
SCOTLAND	140
CHILE	136
ISRAEL	133
SRI LANKA	118
ARGENTINA	115
SLOVENIA	114
MOROCCO	110
SAUDI ARABIA	83
PALESTINE	56
UAE	42
INDONESIA	31
PERU	31
TAJIKISTAN	7
JORDAN	5
ALGERIA	3
WALES	3
ALBANIA	2
BOTSWANA	2
MACEDONIA	2
MONTENEGRO	2
COSTA RICA	1
LUXEMBOURG	1
NIGERIA	1
UGANDA	1
URUGUAY	1
VENEZUELA	1

Cooperation with CERN

CERN is JINR's main partner in Particle Physics over more than 50 years.
Dubna physicists are widely involved in more than
20 CERN projects, including 3 LHC experiments & LHC itself

1963, JINR, Dubna
CERN Director-General
Prof. V.Weisskopf,
Prof. V.Dzhelepov and
Prof. B.Pontecorvo

2004, JINR Dubna
CERN Director-General Dr R.Aymar
meeting with
JINR director acad. V. Kadyshevsky

1971, Dubna
CERN Director-General Prof. W.Jentschke
and JINR Director Prof. N.Bogoliubov

2010: CERN – JINR mutual participation in their projects
2014: CERN – JINR reciprocal Observer status

JINR vs CERN @ Web of Science®

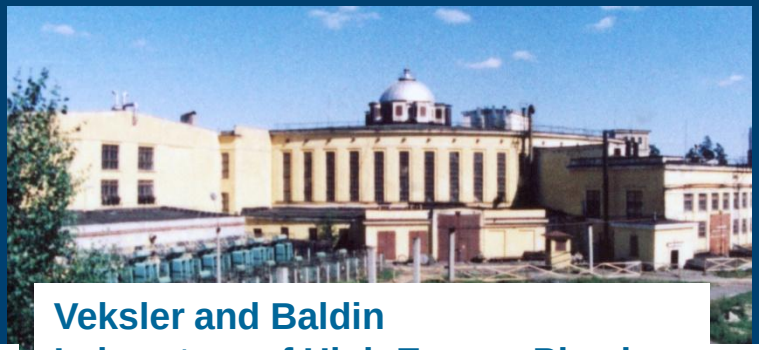
JINR publication statistics		in comparison with CERN
2011 – 2017	2017	CERN 2017
Total number of publications: 8 178 Total number of citations: 97 711 Excluding self-citations: 77 861 Average citations per article: 11,95 h-index: 106	Total number of publications: 1 260 Total number of citations: 1 202 Excluding self-citations: 837 Average citations per article: 0,95 h-index: 14	Total number of puications: 1 287 Total number of citations: 1 694 Excluding self-citations: 1 226 Average citations per article: 1,32 h-index: 15

April 2017
*Working group for adoption NICA/**MPD***
*as the **CERN recognized experiment***

Publication Years	JINR	CERN
2007	937	899
2008	927	785
2009	932	778
2010	949	986
2011	1024	997
2012	1149	1354
2013	994	1283
2014	1054	1438
2015	1292	1468
2016	1468	1421

JINR comprises 7 Laboratories, each being comparable with a large institute in the scale and scope of investigations performed

Dzhelepov
Laboratory of Nuclear Problems



Veksler and Baldin
Laboratory of High Energy Physics

Bogoliubov
Laboratory of Theoretical Physics

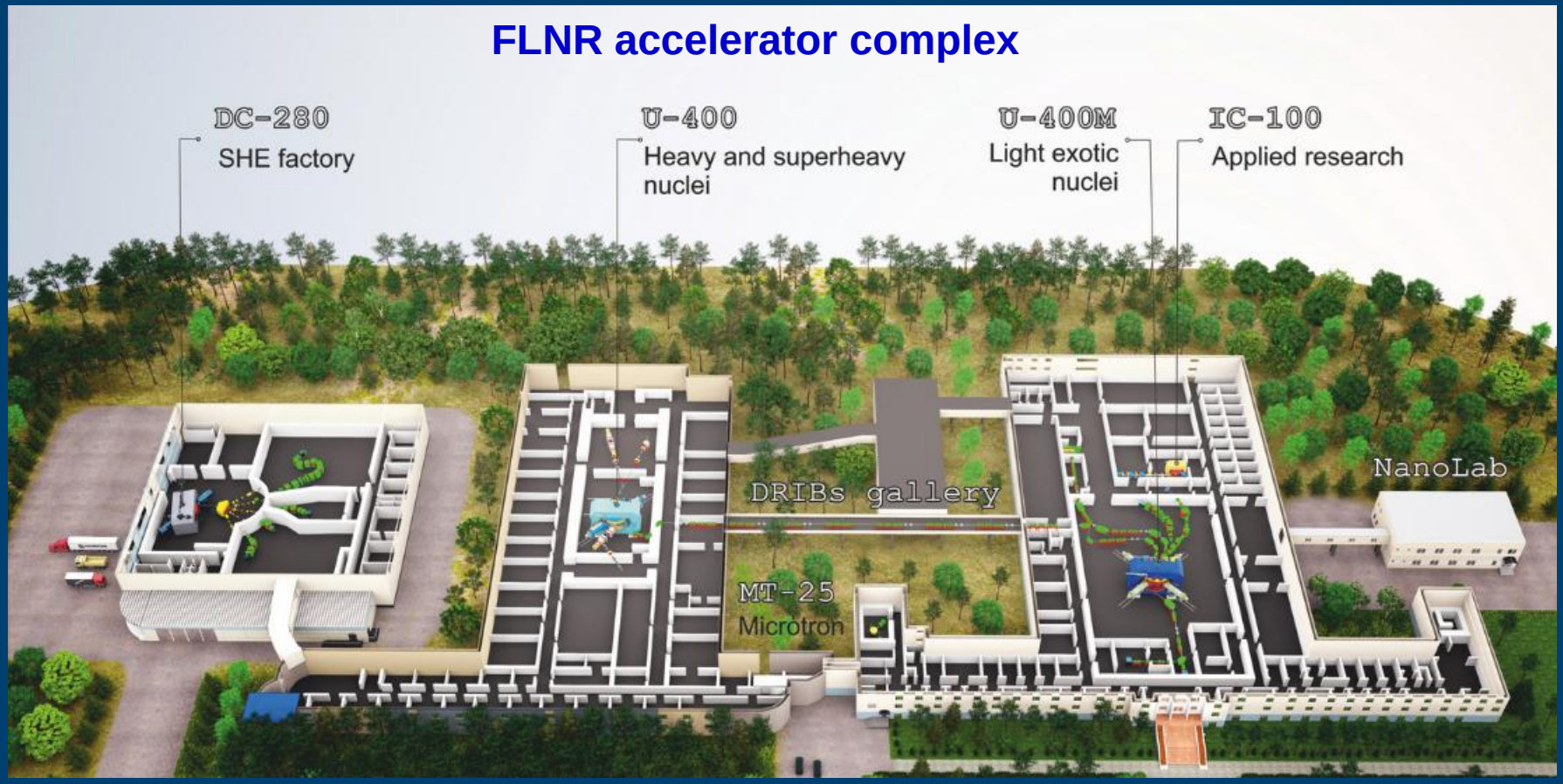
Frank Laboratory of Neutron Physics

Flerov
Laboratory of Nuclear Reactions

Laboratory of Radiation Biology

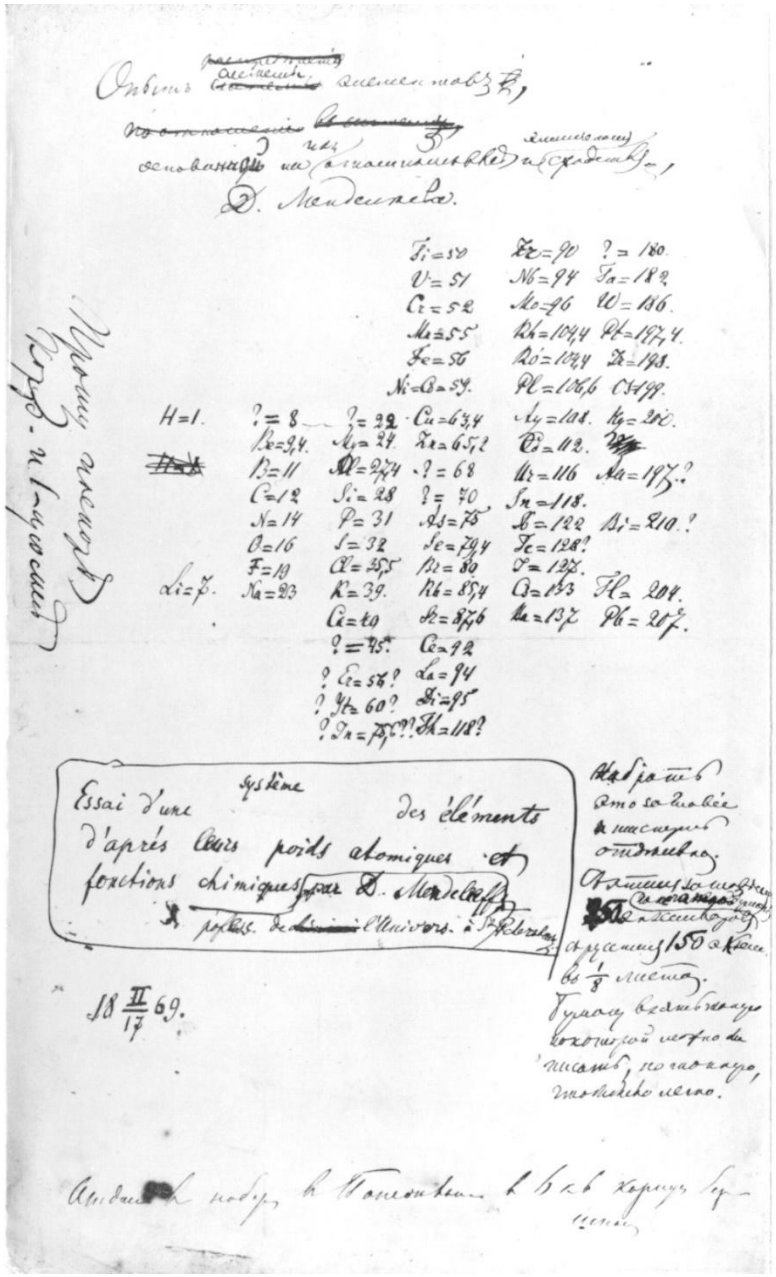
Laboratory of
Information Technologies

FLNR accelerator complex



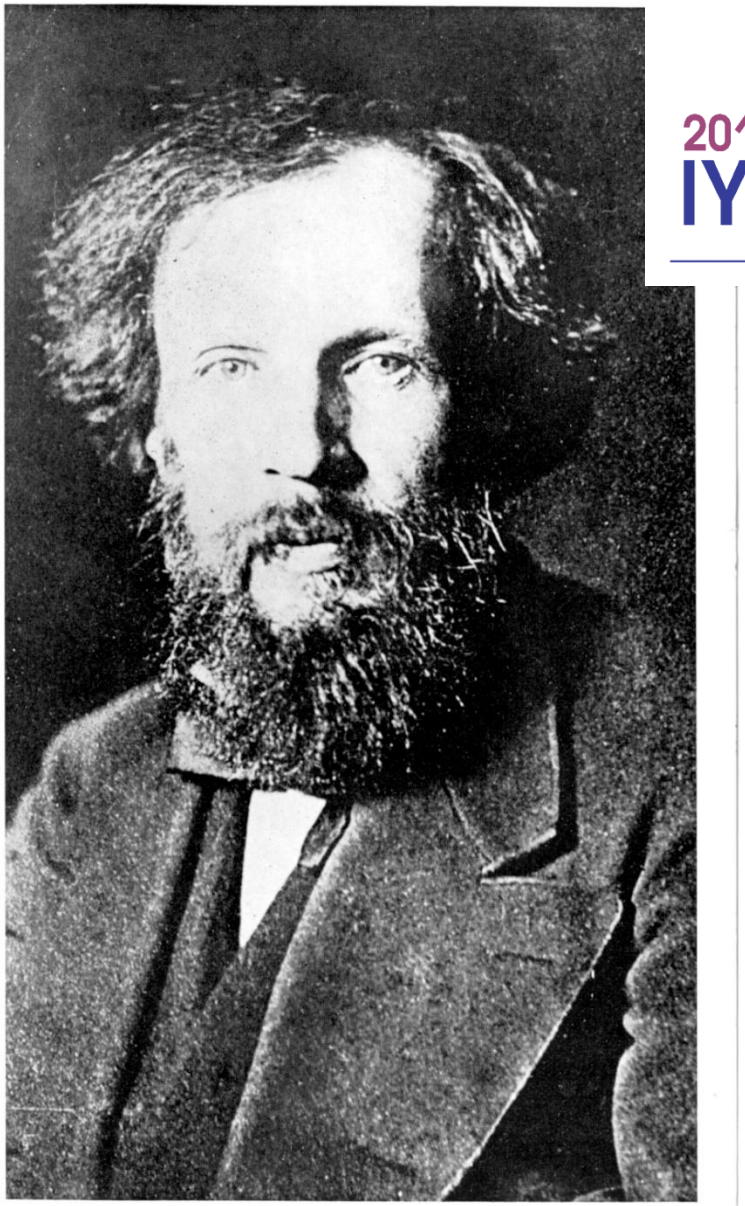
Mendeleev's Table (1869)

International Year
of the Periodic Table of Chemical Elements



Essai d'une système des éléments d'après leurs poids atomiques et fonctions chimiques par D. Mendeleeff

18 II/17 69.



IUPAC

International Union of Pure and Applied Chemistry

May 2012:

Official approval of the name *Flerovium* for element *114*
and the name *Livermorium* for element *116*

30th December 2015:

Approval of the discovery of new elements *113, 115, 117, and 118*

- element 113: RIKEN (Japan)
- elements *115* and *117*: JINR (Dubna) - LLNL (USA) – ORNL (USA) collaboration
- element *118:* JINR (Dubna) – LLNL collaboration.

28th November 2016:

IUPAC formally approved names and symbols of new elements:

Nihonium (Nh) for element 113,
Moscovium (Mc) for element **115**,
Tennessine (Ts) for element **117**, and
Oganesson (Og) for element **118**.

All these elements were synthesized for the first time at the U-400 accelerator complex of the Flerov Laboratory of Nuclear Reactions of JINR.

Inauguration of the Factory of superheavy elements

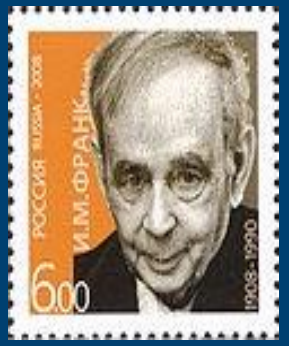
25 March 2019
Flerov Lab
JINR, Dubna

Technology transfer to JINR Member States

CYCLOTRON CENTRE IN ASTANA
(KAZAKHSTAN)
LAUNCHED IN 2006

- **2003:** Government decision on the creation of a cyclotron center in Astana
- **2004–2005:** Designing and manufacturing of equipment of the DC-60 cyclotron
- **2006:** Delivery of equipment to Astana; mounting, tuning and adjustment; first beam generation

IBR-2: Pulsed reactor with fast neutrons

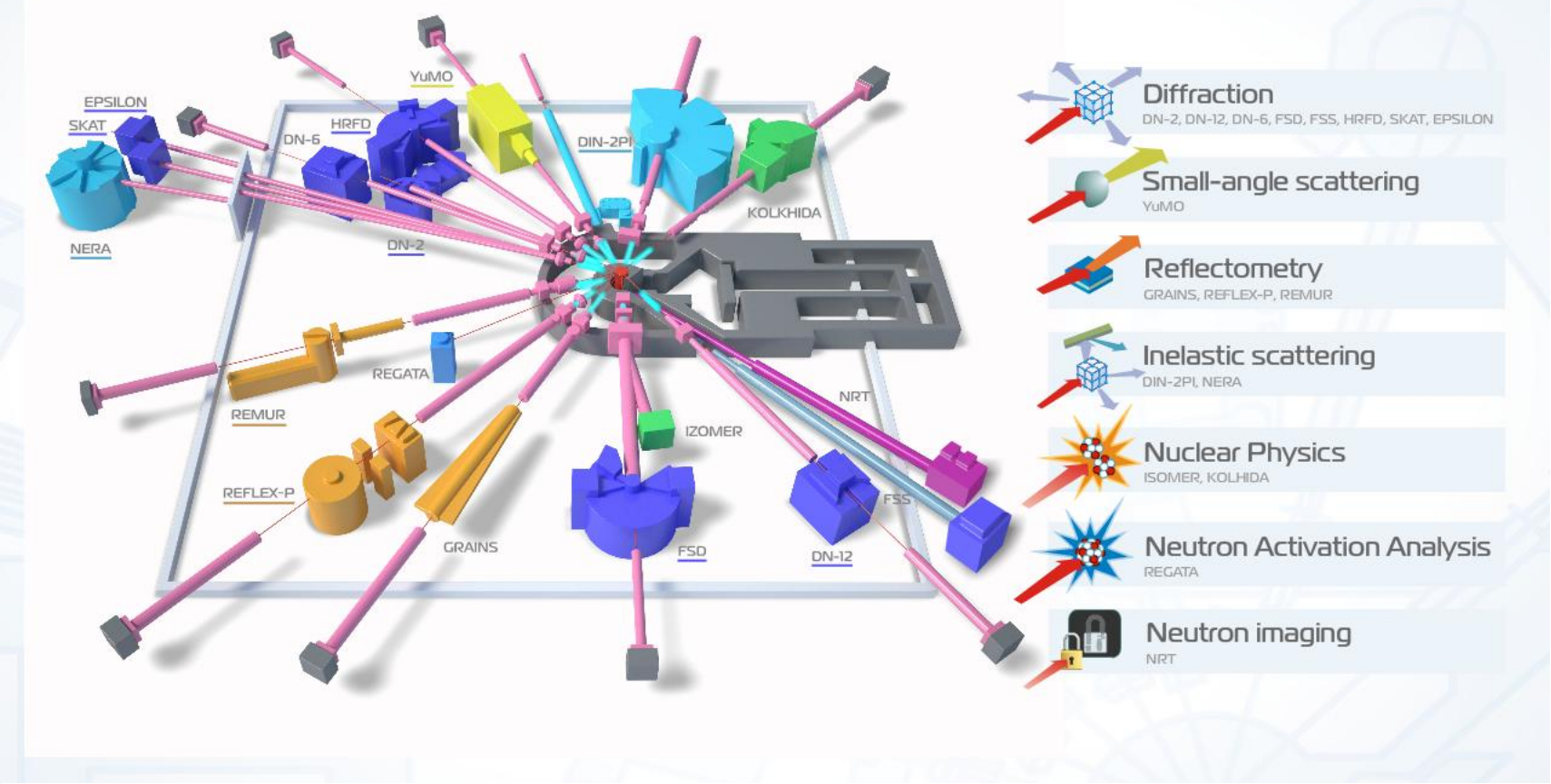


mean power 2 MW
pulse frequency 5 Hz
pulse width for fast neutrons 200 μs
thermal neutrons flux density on the moderator surface: 10^{13} n/cm^2 /s
maximum in pulse: 10^{16} n/cm^2 /s

IBR-2 is included in the 20-year European strategic research program in the field of neutron scattering

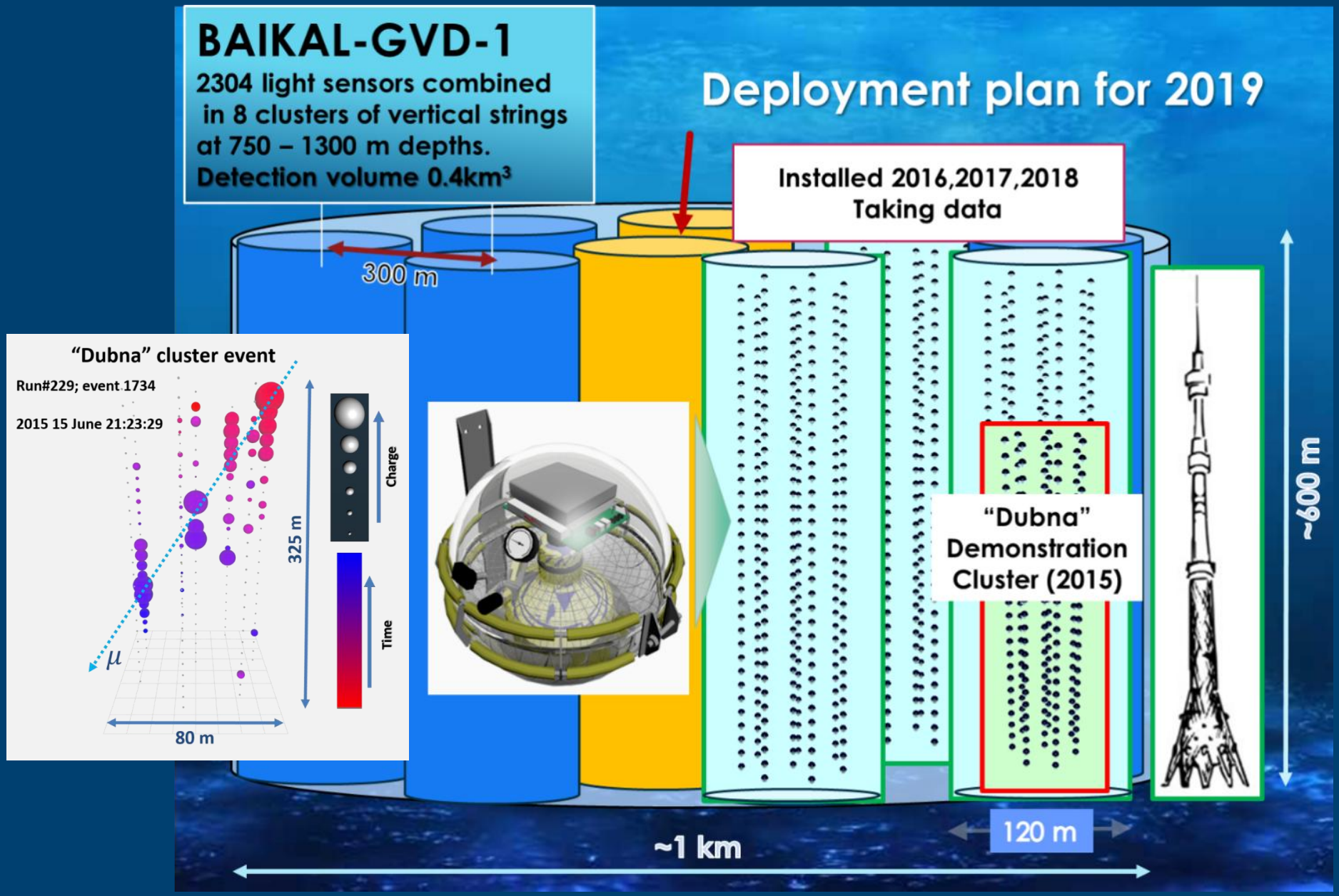
Facilities at IBR-2 reactor

15 instruments are in operation a the Spectrometer Complex of the IBR-2M Reactor



The user policy of the IBR-2 is world friendly.
~200 proposals from ~20 countries are selected annually

Present and future of the BAIKAL-GVD



Baikal. March 2019

Neutrino experiments at Kalinin NPP

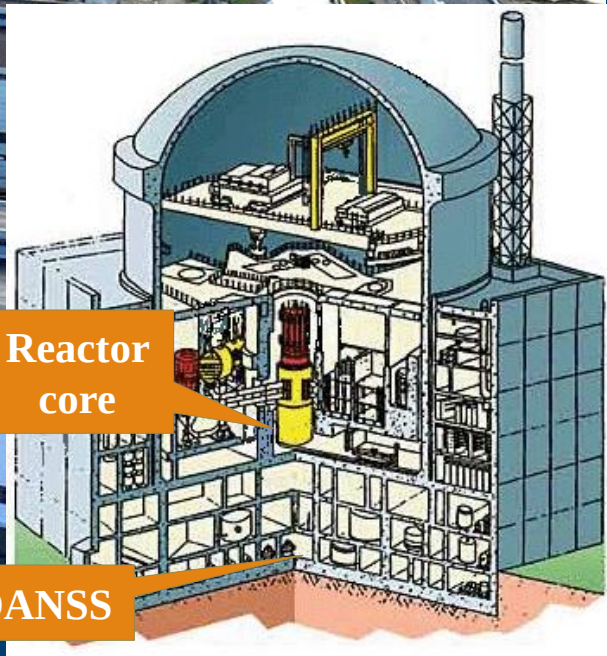
(Tver region, 285 km NW from Dubna)

- Pressurised Water Reactor (ВВЭР-1000)
- Thermal Power: 3 100 MW
- Neutrino Flux: $\sim 6 \times 10^{20}\ \bar{\nu}_e$ / 4π / day
- Campaign: 18 months

DANSS (ongoing)
reactor monitoring and search for sterile neutrino oscillations

GEMMA (completed)
neutrino magnetic moment

νGeN (in preparation)
coherent ν-Ge scattering



NICA Layout

25 March 2016. NICA “corner stone” ceremony at LHEP JINR

Participants of HLC
JINR: 25 year of New Era
25/03/2018

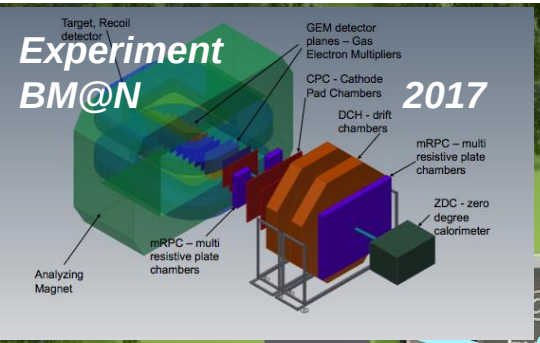
27/05/2017

NICA construction site in the middle 2017

NICA construction site– April 2019

SC magnets fabrication and certification
NICA и SIS-100/FAIR

Readyness of NICA elements



Experiment BM@N 2017

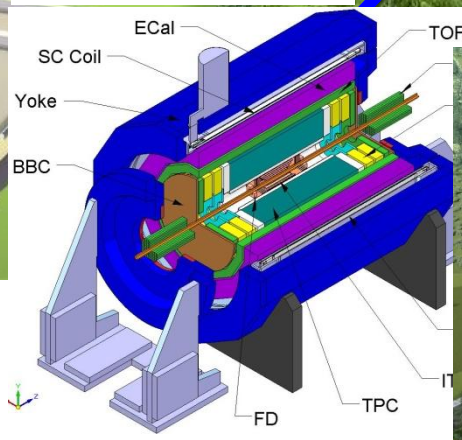
TDR SPD - 2020

Collider - 2021

Applied research - 2020

Booster 2019

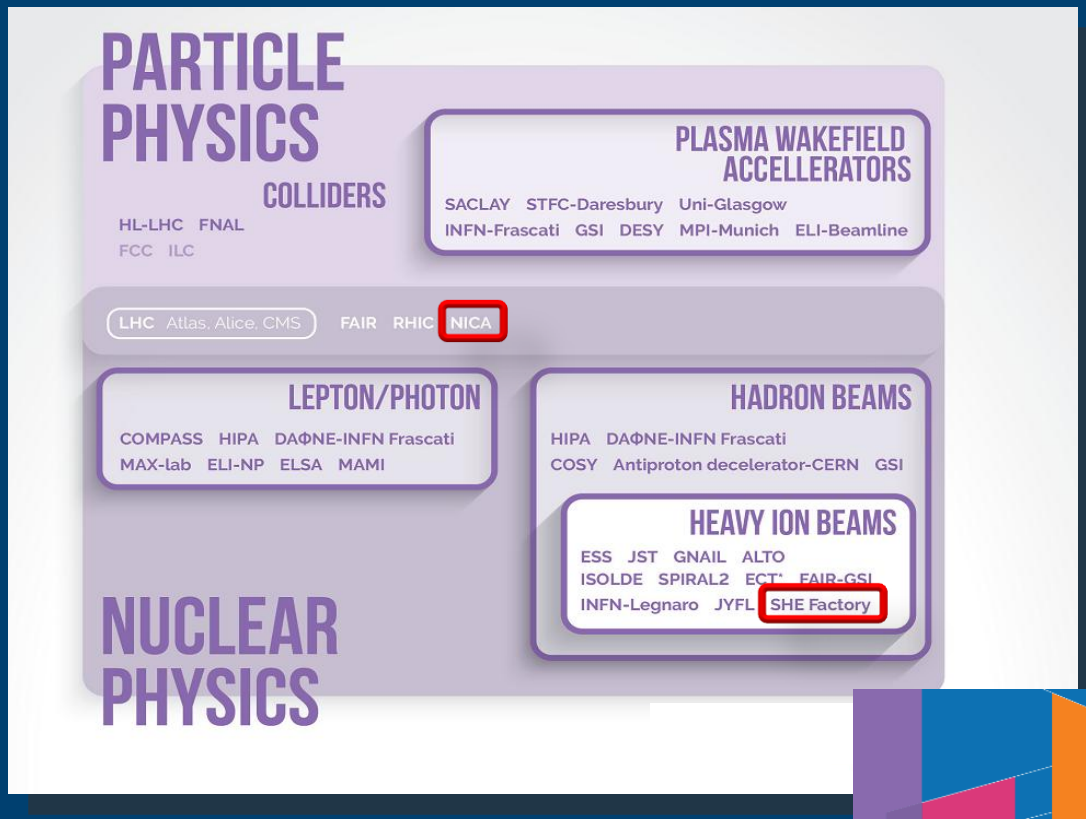
MPD - 2020



Center NICA -2021

V,Kekelidze CP meeting
25 March 2019

JINR facilities in European research programmes



GENERAL

European activity should also be considered as part of a network of global partnerships, both among our nearest neighbours (for example Russia, which has a number of existing and planned facilities available for international users such as the IBR-2 reactor[75] and the support of the Commision through the Cremlin project[76], as well as the middle East with initiatives such as SESAME[77]).

The new ESFRI Roadmap 2018 was officially presented on September 11 in Vienna

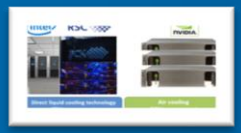
2000: Reorganization of the Laboratory of Computing Techniques and Automation (LCTA) into the Laboratory of Information Technologies (LIT)

Challenges before 2000:

- Transition of the developed countries worldwide to the unified information society
- Transition to distributed computing that ensures participation in the large-scale international research projects (LHC)
- The need to connect to computer networks for science and higher education
- Application of international standards
- Transition to electronic methods of particle detection

MICC main components

GRID



HPC

Cloud

Networking

Power@cooling

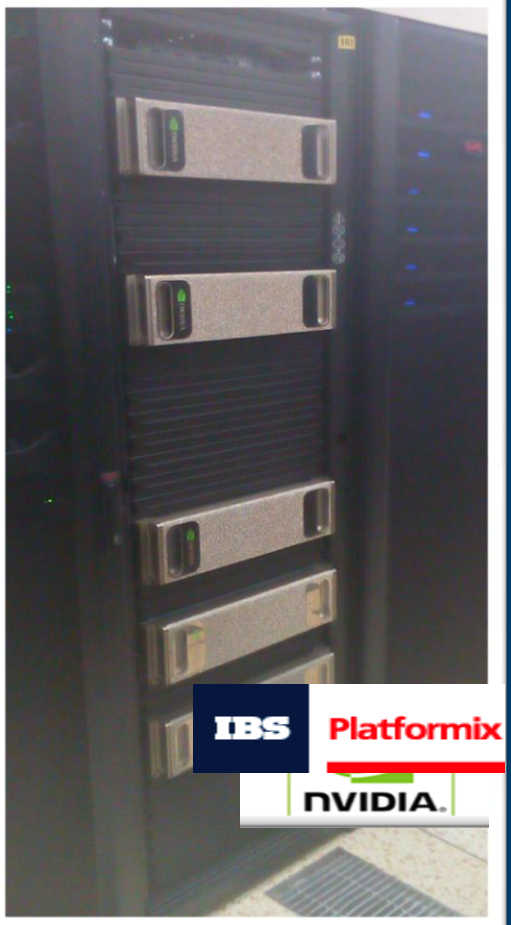
Laboratory today:

LAN	• 10 Gbps
WAN	• 100 Gbps + 2x10 Gbps
Tier-1	• 4160 core, • 5,4 PB disk, 9 PB tape
CICC-Tier-2	• 3640 core, 2PB disk
HPC-HybriLIT	•252 CPU, 77184 GPU cores, 182 PHI-cores, 2.4 TB RAM, 57.6 TB HDD, 142 Tflops
Cloud	• 700 CPU, 2 TB RAM

Now, LIT IT-infrastructure is one of the JINR basic facilities

New facility at JINR supercomputer “GOVORUN” launched on 27.03.18

GOVORUN is highly ranked on 9th position in the latest edition of IO500 List a new industry benchmark for HPC storage systems.



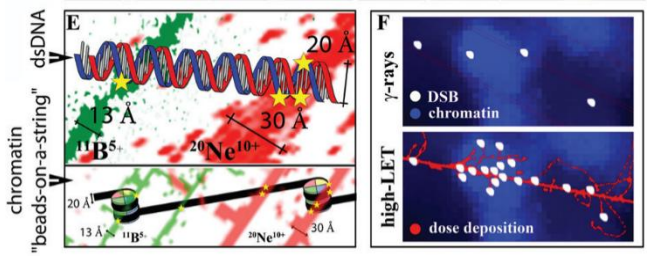
JINR supercomputer ‘Govorun’ – revolutionary ultra-high dense HPC solution

Establishment of a new, seventh laboratory of JINR

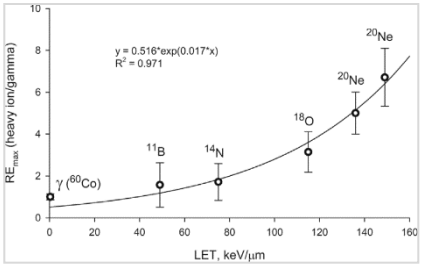
2005: Laboratory of Radiation Biology

Laboratory today:

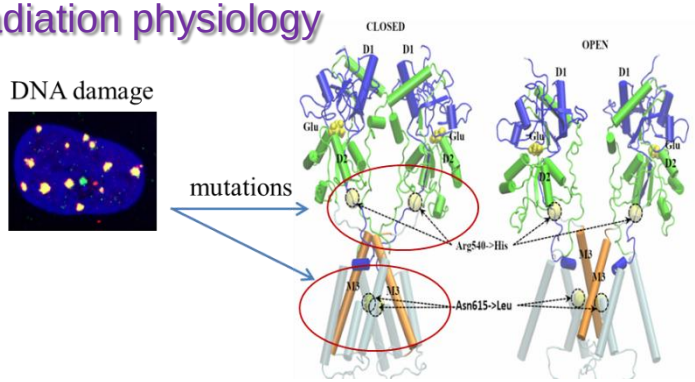
Molecular radiobiology



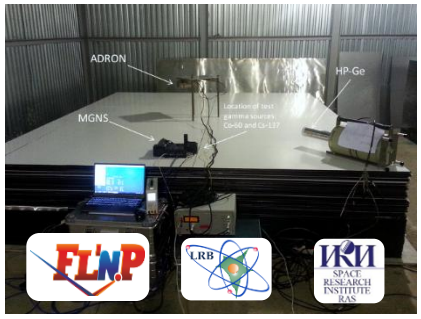
Radiation mutagenesis



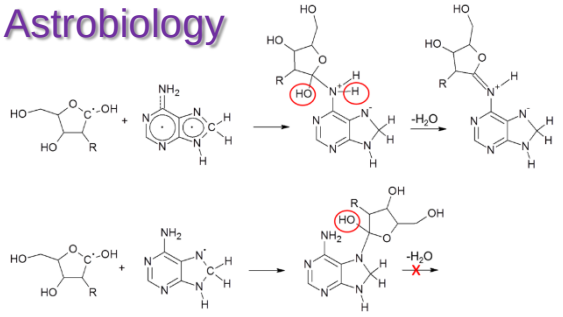
Radiation physiology



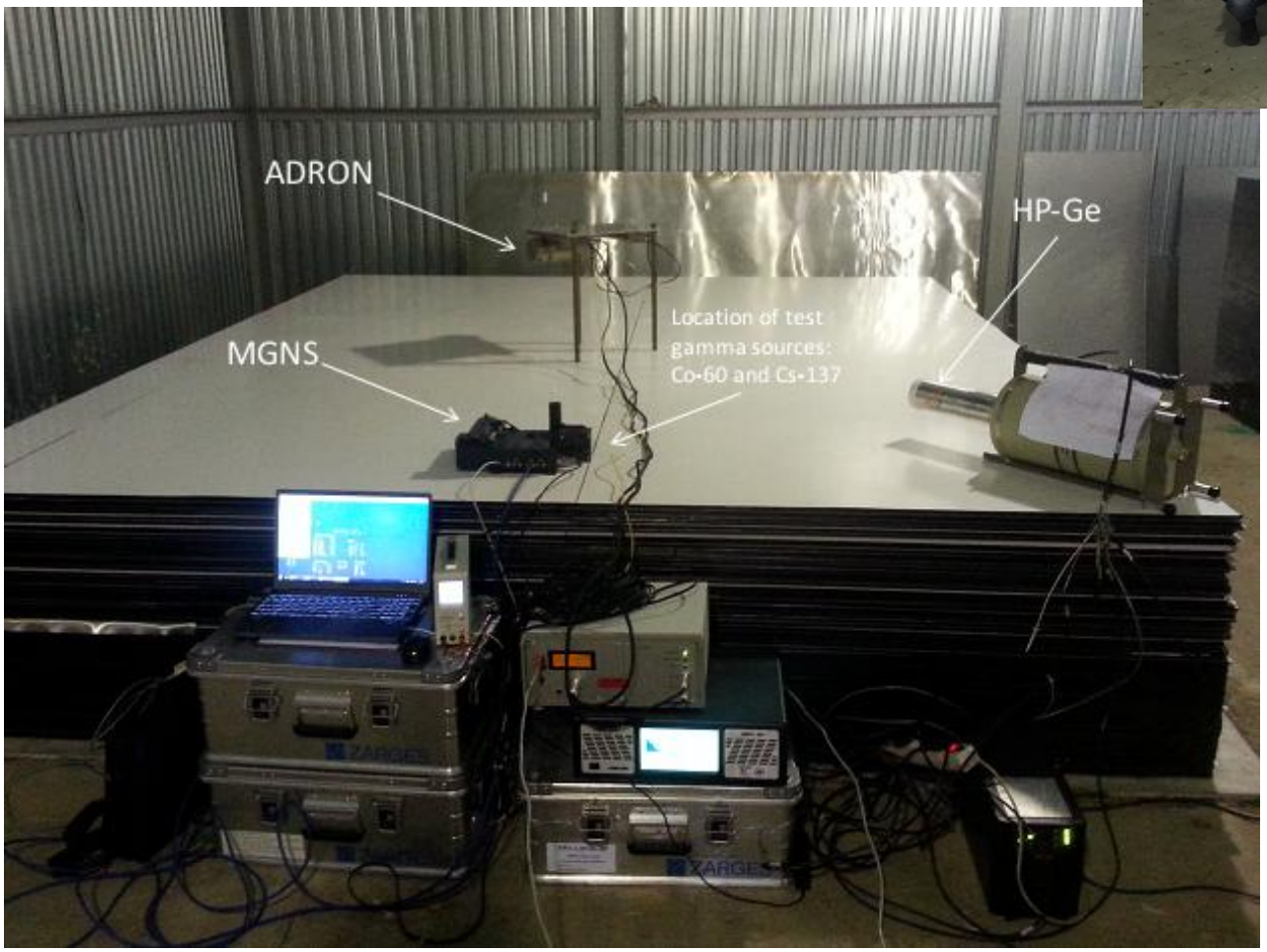
Nuclear planetary science



Astrobiology



Nuclear planetary science



In collaboration between the Space Research Institute (RAS) and FLNP (JINR), a *special facility has been constructed* at the LRB that can *model planetary soil* and allows testing prototypes of active neutron and gamma spectrometers.

The facility can use a neutron generator for soil model exposure. Inside the facility, a silicate glass-based soil model has been assembled.

Bringing people together

The Institute annually organizes up to 10 large conferences and more than 30 international workshops, as well as schools for young scientists, practice courses and schools for teachers – in total more than 100 international events per year, including 10 regular sessions of the JINR governing bodies.

Geography of JINR meetings in 2016

Science Bringing Nations Together

25Y milestones Egypt – JINR

Milestones

Scientific contacts since late 1960-ies
1993 Protocol on cooperation with Atomic Energy Authority
2009 Cooperation agreement with ARE government signed
2009 First Student Practice
2010 First session of the Joint Coordination Committee
2013 Ministerial visit to JINR
2015 Forum “JINR-Egypt. 5years together”
2015 Ministerial visit to JINR
2017 Road Map for enhancing cooperation endorsed
2018 Approval of the Road Map started

Signing the Cooperation Agreement, Dubna, 3 March 2009
JINR Director and ASRT President

Forum «JINR-Egypt. 5 years together»
6th October City, Egypt, 2-6 March 2015

Strengthening ties with EAEA

ARE in JINR today: 14 Joint Research Projects
Annual contribution to JINR 250 kUSD

WoS Papers / Year	JINR, ARE with others	JINR, ARE with others but without CERN	CERN, ARE with others but without JINR
2007	-	-	-
2008	-	-	1
2009	-	-	-
2010	9	2	1
2011	71	1	2
2012	98	4	1
2013	101	2	5
2014	80	3	11
2015	103	22	6
2016	123	22	10
h / CpI		12 / 7.18	6 / 4/84

At the student practice

Egyptian Ambassador presents diplomas, 2011

8th Session of ARE-JINR Joint Coordination Committee
Signing of the Road Map

ASRT, Cairo, 15 December 2018

ARE-JINR Road Map provides for:

- Recognition of long cooperation history and joint achievements
- Statement of interest in strategic planning of cooperation
- Securing status of Egypt as a key partner with JINR
- New level of responsibility and engagement
- Starting point towards JINR full membership

ARE-JINR Roadmap: «It is expected that ARE-JINR cooperation shall reach remarkable level on ARE scientific landscape and it becomes visible in JINR….. As a result the degree of Egyptian participation in JINR should become sufficient to advance to full membership».

Sharm El Sheikh, December 16, 2018

Meeting
"on the margins "of the 14th Arab Conference on peaceful use of atomic energy with the Directorate
of the Egyptian Atomic Energy Authority resulted in signing of the protocol on
further steps in cooperation

New structure of ASRT-JINR management – the Network of Nuclear Sciences

Nuclear newcomers' visits at the governmental level in 2016-2019

- 03/2016 **Ethiopia**
- 06/2016 **Botswana**
- 01/2017 **Bolivia**
- 06/2018 **Rwanda**
- 02/2017 **Zambia**
- 04/2017 **Paraguay**
- 09/2017 **Shri Lanka**
- 02/2019 **Uganda**

The visits were aimed at studying the opportunities for the use the JINR experience in establishing national expertise in nuclear sciences and applications, participation in JINR education programmes and providing access to modern scientific infrastructure for young talented researches.




atomexpo 2017

Round table in framework of «ATOMEXPO-2017» in JINR / June 2017

90+ experts from **20 countries** discussed the key issues related to JINR experience with efficient operation of Research Infrastructure and User Policy

POCATOM



Meeting of the Group of Senior Officials on Global Research Infrastructures

9-12 October 2017 JINR Dubna, for the first time in Russian Federation

The GSO proactively works to identify opportunities for international collaboration among Research Infrastructures that are proposed by its members: it has identified five Case Studies and has carried out an analysis on their potential as Research Infrastructures for global collaboration.

Feedback from the G7 Meeting of Science Ministers (G.Rossi),
International Cooperation in the Field of Research Infrastructure of RF (G.Trubnikov)
Reports on policy areas: “Open Data management”, “Open Innovation”,
Excellence-driven access“.

Acquaintance
to major JINR infrastructures

Presentations
of mega-projects of Russian Federation

JINR Future:
Long Range Strategy plan for up to 2030-2035

Including upgrade of ongoing project and its further development

- NICA – II and III (SC Nuclotron, HL-NICA)
- DRIBS-III (Dubna Radioactive Beam Complex)

  (Super-heavy Elements and Exotic Nuclei studies)
- Physics with the ultra cold neutrons at IBR-2M
- Baikal –GVD –II Neutrino Telescope (above 1 km*3)
- Hadrons Therapy research complex

  and new large research infrastructures
- DERICA (Dubna Electron Radioactive Ion Collider fAcility)
- Super booster "NEPTUNE"

  (SC proton beam initiated pulsed Np-237 Neutron Reactor)

JINR Expertise for Member States and Partner Countries (JEMS)

10 training international programmes since April 2017 till Februry 2019
116 participants from 27 countries

JEMS Plan 2019

X February, 4-8
XI April, 1-5
XII **June, 3-7**
XIII September. 9-13
XIV December, 2-6

http://www.jinr.ru/JEMS

Generic day-by-day JEMS Programme in Laboratories:

Day 1. Heavy Ion Physics and Accelerator Technologies,
Day 2. Neutron Applications and Nano-World;
Day 3. Theory, Information, Education;
Day 4. Life Sciences on the Earth and Space;
Day 5. Neutrino and particle physics.

Social programme, customized items

Participants 1-10

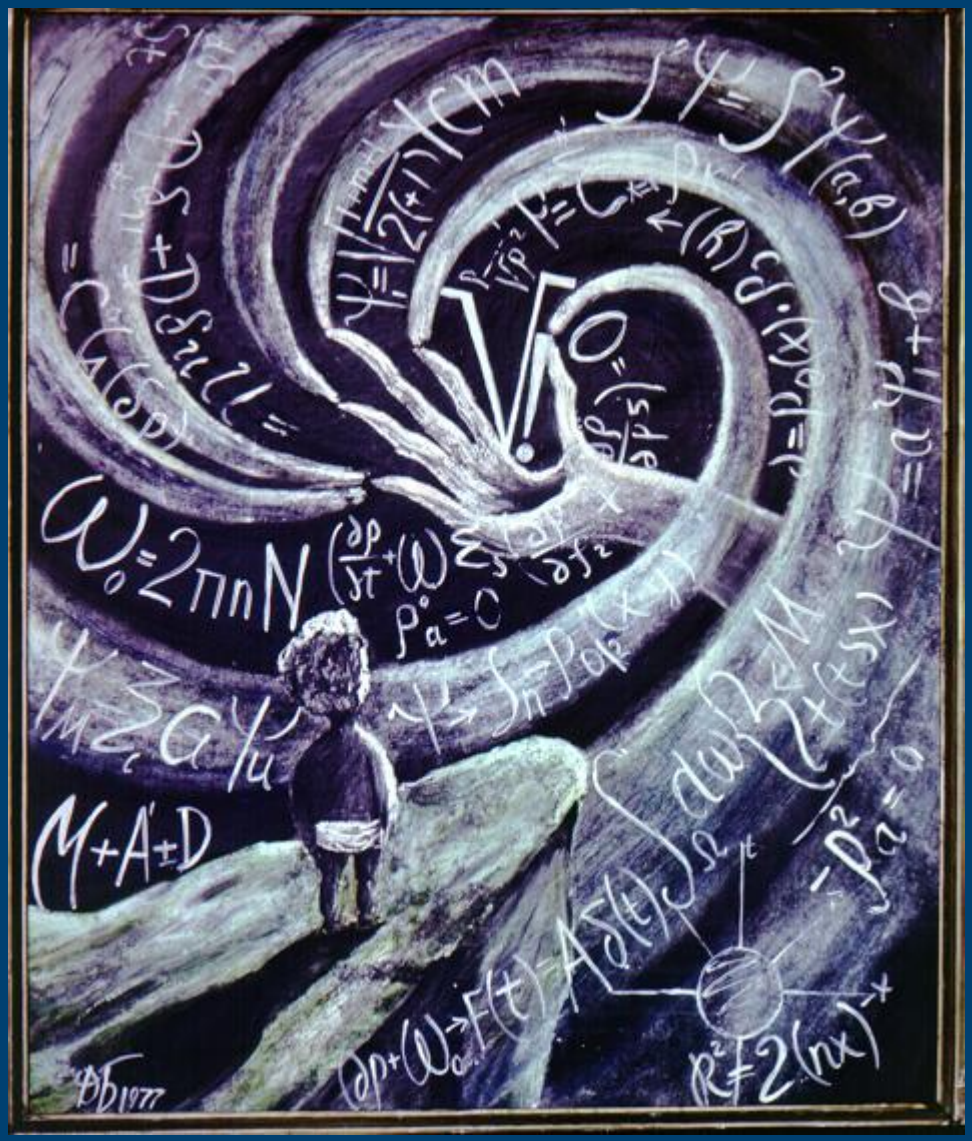
Russia	22
South Africa	16
Vietnam	10
Serbia	9
Egypt	6
Bulgaria	5
Hungary	5
Rwanda	5
Czech Republic	4
China	4
AAEA	3
Cuba	3
Mongolia	3
South Korea	3
Sri Lanka	3
Belarus	2
Botswana	2
Chile	2
Germany	1
Lebanon	1
Moldavia	1
Italy	1
Iraq	1
Oman	1
Poland	1
Romania	1
Zambia	1

MS	52
AM	38

The first JINR director about JINR foundation

Dmitry Ivanovich Blokhintsev

«We go to a completely new area and do not yet know what will come of it, but history teaches that when physicists go to a new area they never come out empty-handed”
D.I. Blokhintsev



Welcome to JINR!
Welcome to Dubna!
Welcome to www.jinr.ru