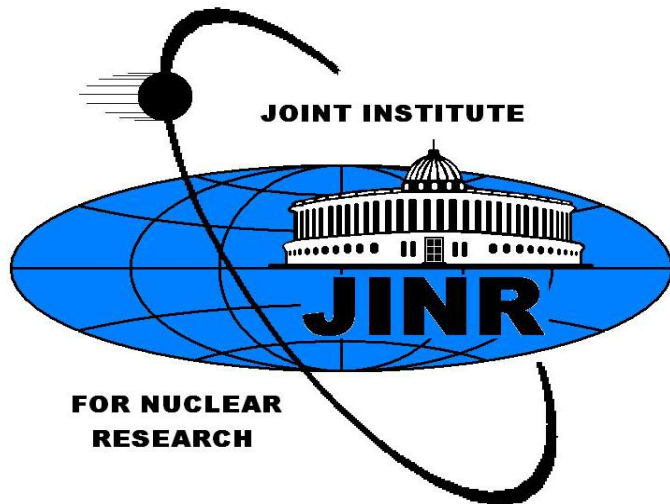


Joint Institute for Nuclear Research International Intergovernmental Organization



The Science Policy of the Joint Institute for Nuclear Research



. issakian
. irector



JOINT INSTITUTE for NUCLEAR RESEARCH

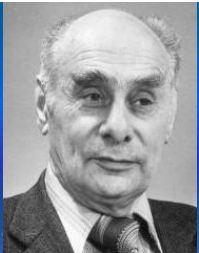


1956



The agreement on the establishment of JINR was signed on 26 March 1956 in Moscow

Founders



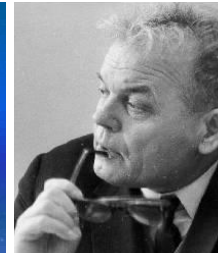
G.Flerov



V.Veksler



I.Frank



M.Meshcheryakov



A.Baldin



N.Bogoliubov,
D.Blokhintsev



B.Pontecorvo



V.Dzhelepov



H.Hulubei



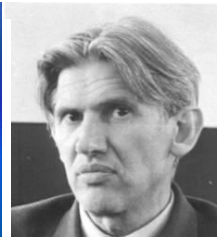
L.Infeld



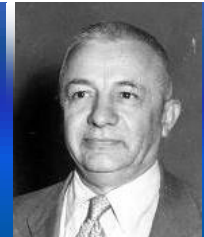
Wang Ganchang



H.Niewodniczanski



L.Janossy

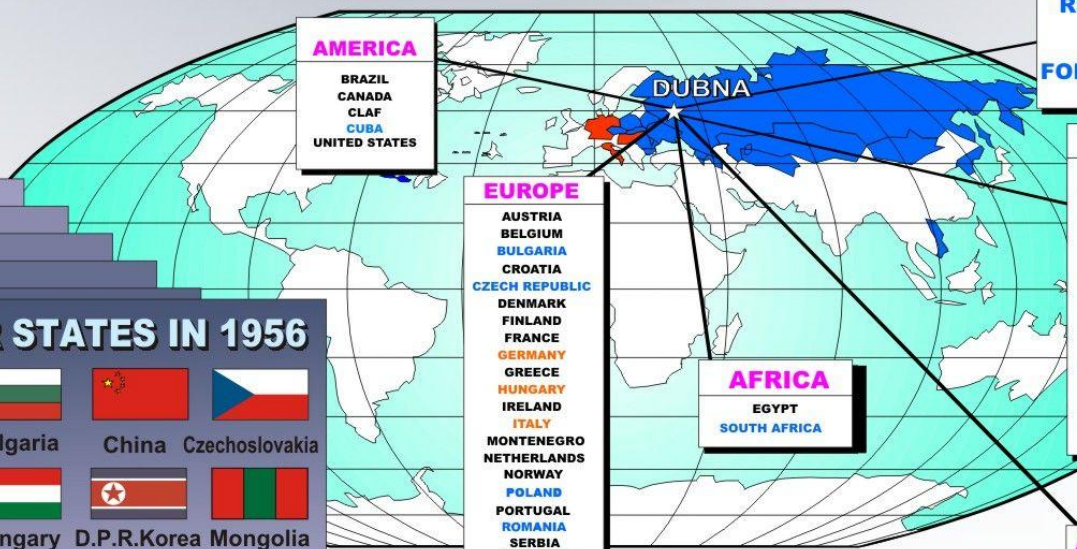


G.Najakov

JINR MEMBER STATES



AGREEMENTS at GOVERNMENTAL LEVEL



AMERICA
 BRAZIL
 CANADA
 CLAF
 CUBA
 UNITED STATES

REPUBLICS OF FORMER USSR

ASIA
 CHINA
 DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA
 INDIA
 ISRAEL
 JAPAN
 MONGOLIA
 SOUTH KOREA
 TURKEY
 VIETNAM

EUROPE
 AUSTRIA
 BELGIUM
 BULGARIA
 CROATIA
 CZECH REPUBLIC
 DENMARK
 FINLAND
 FRANCE
 GERMANY
 GREECE
 HUNGARY
 IRELAND
 ITALY
 MONTENEGRO
 NETHERLANDS
 NORWAY
 POLAND
 PORTUGAL
 ROMANIA
 SERBIA
 SLOVAKIA
 SLOVENIA
 SPAIN
 SWEDEN
 SWITZERLAND
 UNITED KINGDOM
 CERN

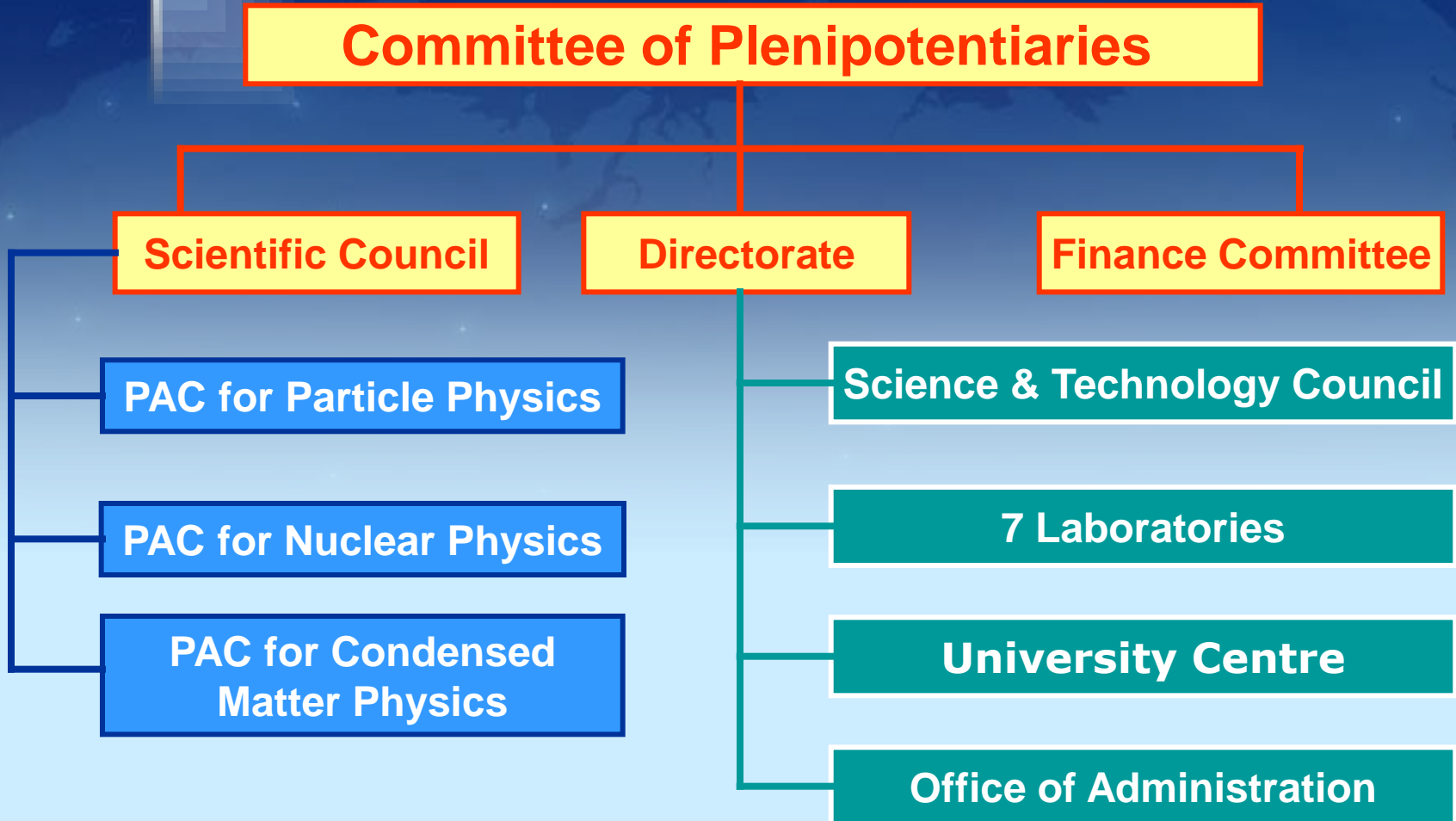
AFRICA
 EGYPT
 SOUTH AFRICA

AUSTRALIA AND OCEANIA
 AUSTRALIA

MEMBER STATES IN 1956



Governing Bodies & Structure



JINR in figures

JINR's staff members ~ 5500
researchers ~ 1300
including from the Member States ~ 500
(but Russia)

Doctors and PhD ~ 1000

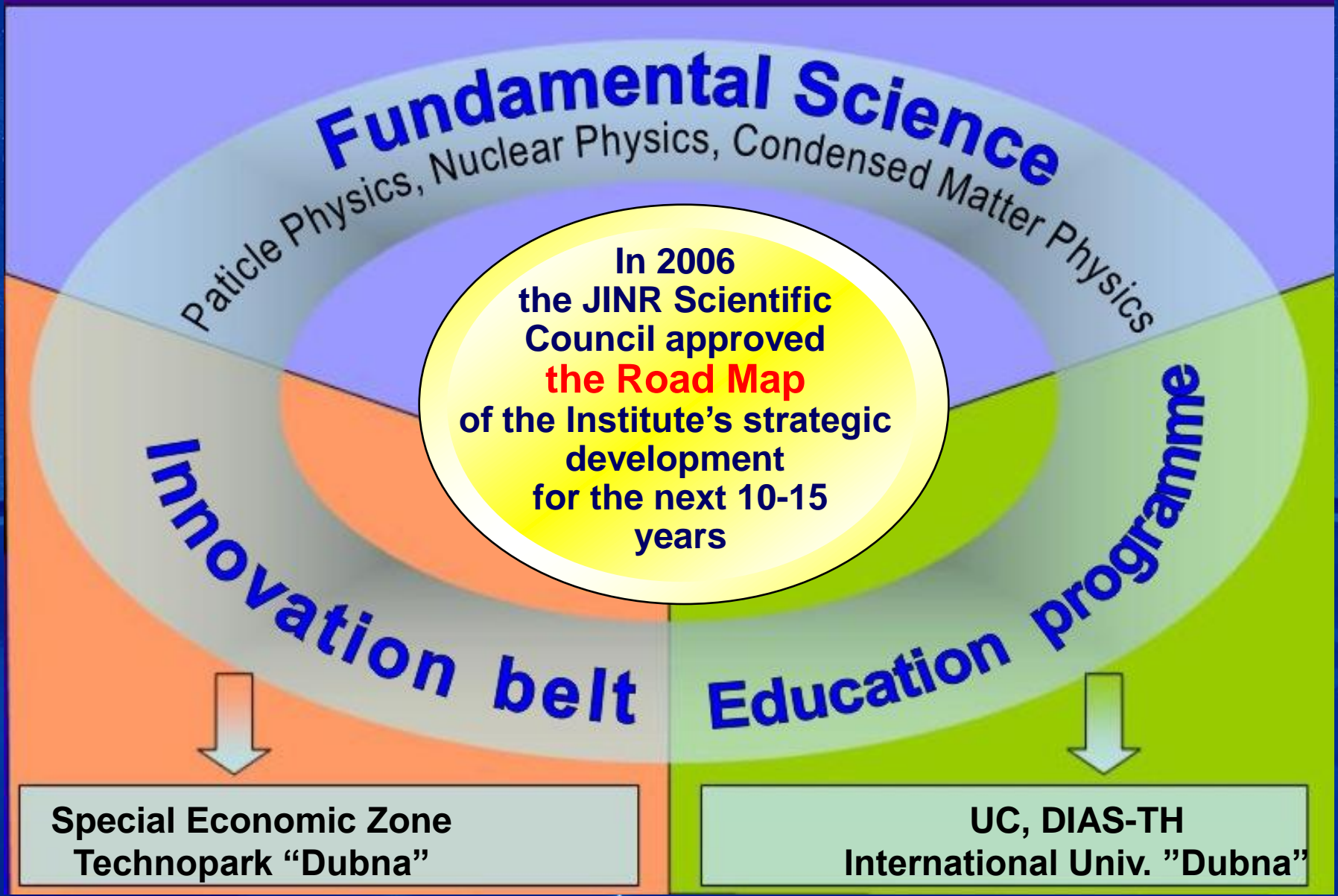
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II. Scientific & Innovative Activities

JINR's Science Policy Today and Tomorrow



The elaborated Road Map determined three major research directions at JINR:

- high energy physics
- nuclear physics
- condensed matter physics

Main Supporting Activities:

- Theory of PP, NP, CMP
- Networking and computing
- Physics methods
- Training of young staff

JINR's research niche offered by home facilities

■ **Heavy-Ion Physics:**
 - at high energies (up to 5 GeV/n)
 (in future $\sqrt{s_{NN}} = 9$ GeV, NICA facility)

- at low and intermediate energies (5 – 100 MeV/n)

■ **Condensed Matter Physics using nuclear physics methods**



Bogoliubov Laboratory of Theoretical Physics



Veksler-Baldin Laboratory of High Energy Physics



Dzhelepov Laboratory of Nuclear Problems



Flerov Laboratory of Nuclear Reactions



Frank Laboratory of Neutron Physics

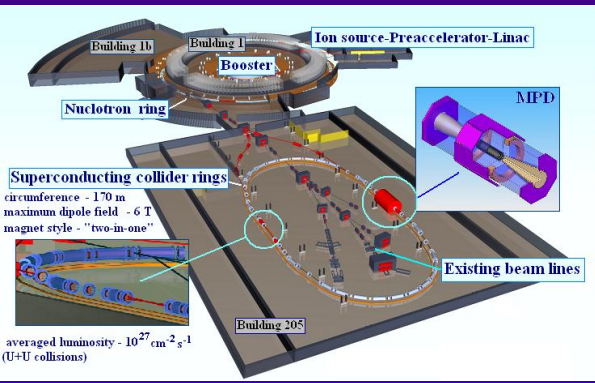


Laboratory of Information Technologies

Laboratory of Radiation Biology

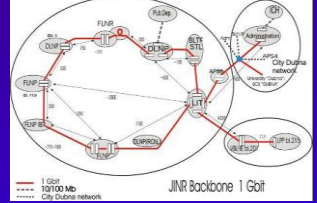


Upgrade of JINR Basic Facilities

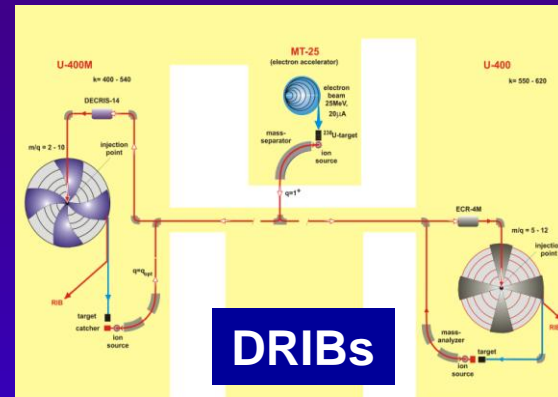


**Upgraded
Nuclotron-M (2009)
+
NICA (2013-2014)**

**Telecommunication channels:
10 Gbps – July 2008,
40 Gbps – 2010,
100 Gbps by the year 2015**

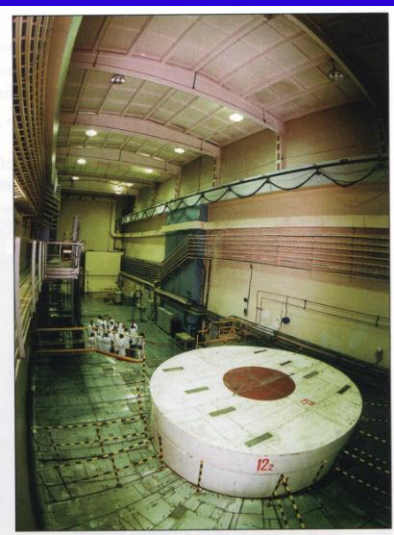


**JINR networks,
including GRID technology**

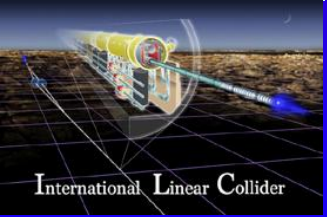
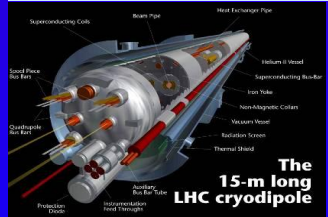


second phase 2009

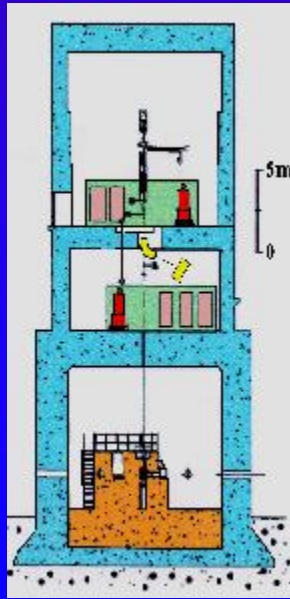
**Participating in LHC, RHIC, TEVATRON...
In future: FAIR, ILC ...**



**New reactor
IBR-2M
2010**



**IREN-I
2008**





“Road Map” in the field of High Energy Physics

Priority tasks:

- **origin of mass: electro-weak symmetry breaking (Higgs mechanism), etc.**
- **properties of strong interactions, including properties of nuclear matter (search of the mixed phase)**
- **neutrino physics and properties of neutrinos, dark matter, dark energy**
- **spin physics**
- **origin of the matter-antimatter asymmetry in the**
- **Universe**
- **unification of particles and forces, including gravity**
- **physics beyond the Standard Model (SUSY, Extra Dim, etc)**

...

High Energy Physics



**Nuclotron is
superconducting
synchrotron for
heavy ions
(has been operating
since 1993).**

**The main home facility (today):
Nuclotron complex of VBLHEP (upgrade till 2009).**

**Future plan: creation of NICA/MPD –
Nuclotron-Based Ion Collider Facility and
Multipurpose Detector (2014).**

NUCLOTRON & accelerator complex:

Stages of the Nuclotron development:

1. upgrade of the Nuclotron to achieve its project parameters ($A \sim 200$, 5 GeV/n for heavy ions, polarized beams)
2. conceptual project: creation of Nuclotron-based Ion Collider Facility (NICA/MPD)

$$\sqrt{s_{NN}} = 9 \text{ GeV}$$

Participation in the external experiments:

CERN – the main partner in PP (participation in more than 20 projects)

Russia: IHEP, INR RAS, BINP SB RAS, ...

Germany: GSI, DESY, ...

USA: FNAL, BNL, LLNL, ...

France: IN2P3/CNRS, ...

Italy: INFN, ...

Japan: KEK, RIKEN...

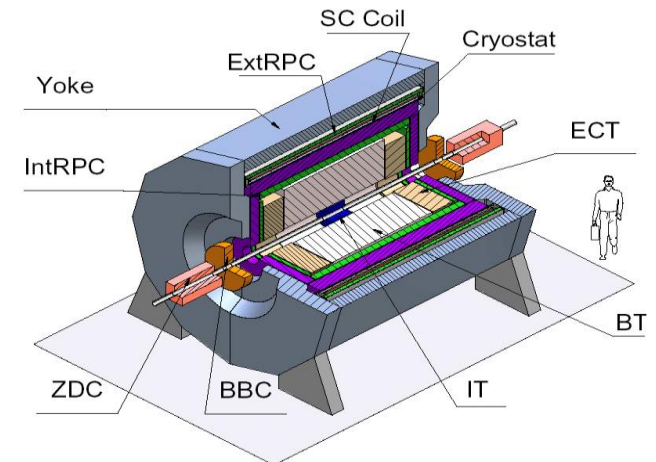
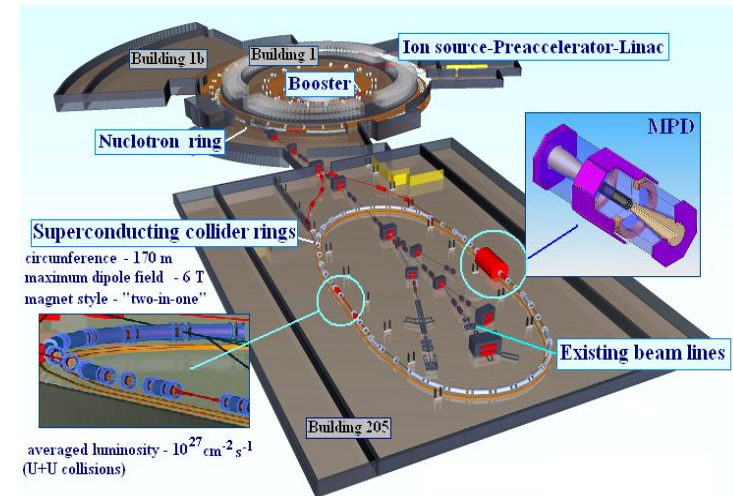
China: IHEP CAS, CIAE, ...

...

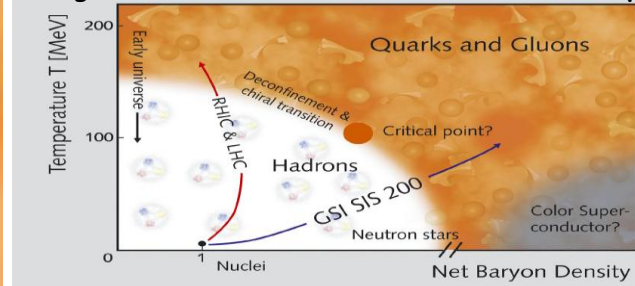
The new flagship of JINR: Nuclotron-based Ion Collider Facility and MultiPurpose Detector (NICA / MPD)



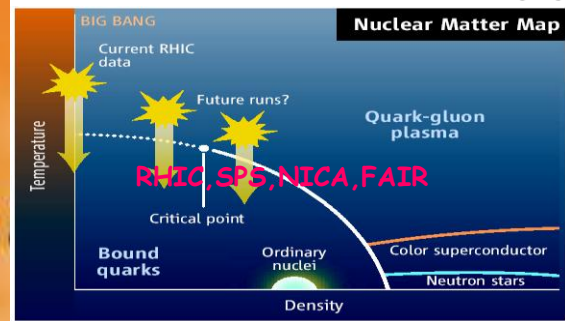
The main goal of the NICA/MPD project is to start in the coming years experimental study of hot and dense strongly interacting QCD matter and search for a possible manifestation of the mixed phase formation and critical endpoint in heavy ion collisions.



Early universe
↓



Quarks and Gluons



Critical point?

Round Table Discussion

Dubna, July 7-9, 2005

<http://theor.jinr.ru/meetings/2005/roundtable/>

Hadrons

RHIC, LHC

Deconfinement and chiral transition
Mixed phase

FAIR SIS 300
NICA

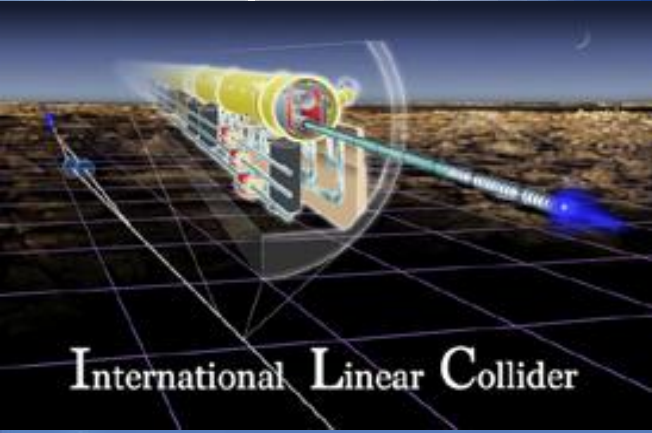
Neutron stars

Color Superconductor?
 N_B

- A.N.Sissakian
- A.S.Sorin
- M.K.Suleymanov
- V.D.Toneev
- G.M.Zinovjev
- nucl-ex/0511018
- nucl-ex/0601034
- nucl-th/0608032



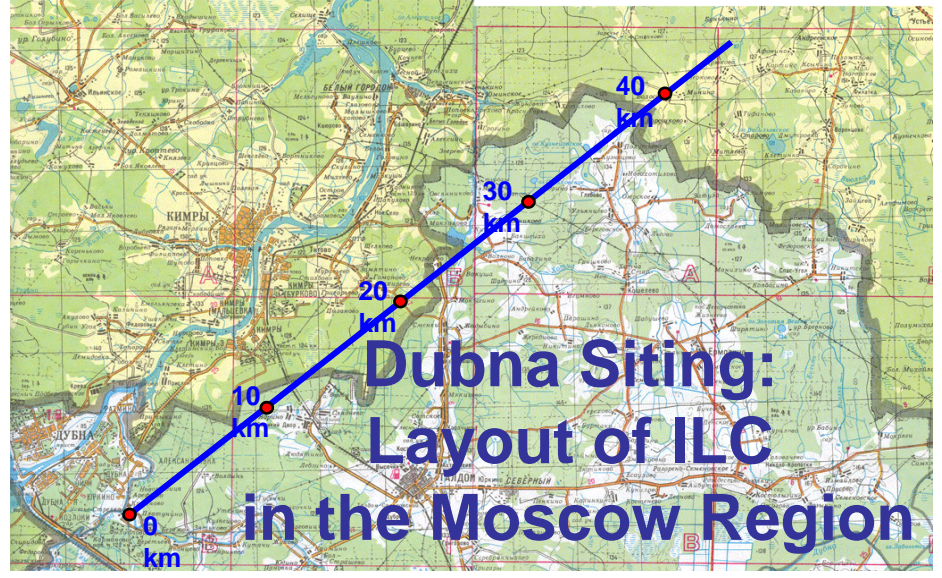
International Linear Collider



The activities at JINR on Physics and Detector for ILC is underway and will be continued in order to provide JINR's visible participation in this ambitious project.

Challenging tasks

- Factory of the Higgs boson
- Supersymmetry
- Dark matter, dark energy
- ...



“Road Map” – in the field of Nuclear Physics:

- Heavy Ion Physics at Low Energies**
- Low and Intermediate Energy Physics**
- Nuclear Physics with Neutrons**

**The main home facilities (today):
Cyclotrons U400MR and U400,
accelerator complex DRIBs-I (Dubna Radioactive
Ion Beams), Phasotron.**

Future plans:

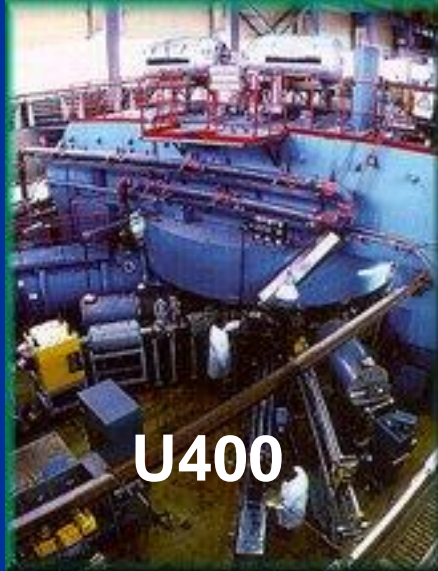
- U400R, accelerator complex DRIBs-II (2009)**
- construction of the IREN-I facility (2008)**

Low Energy Heavy Ion Physics

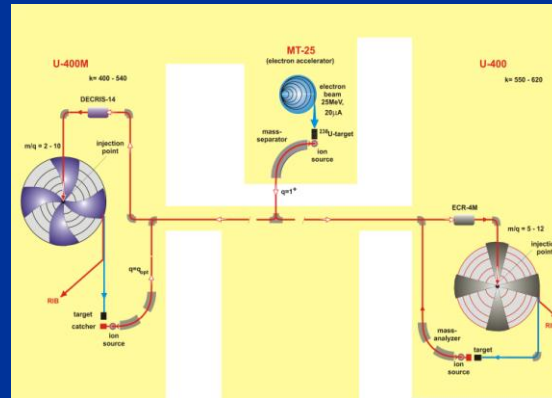
The main home facilities (today):
Cyclotrons U400 and U400MR,
accelerator complex DRIBs-I

Future plans:

- U400R, accelerator complex DRIBs-II



U400



DRIBs –
Dubna Radioactive
Ion Beams



U400M

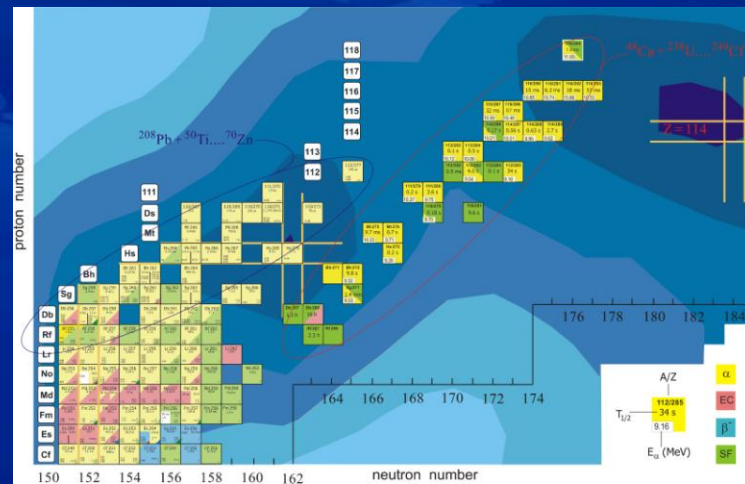
(in operation since 1993)

(in operation since 1979)

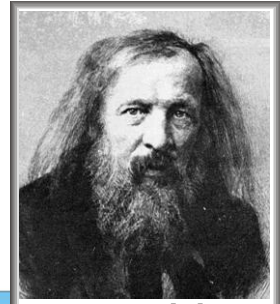
Priorities in Heavy Ion Physics

- Physics and chemistry investigations of the superheavy nuclei with $Z \geq 112$; structure and properties of the neutron-rich light exotic nuclei
- Accelerator technology
- Heavy ion interaction with matter; applied research.

To accomplish these tasks, the FLNR Cyclotron Complex will be upgraded for producing intense beams of accelerated ions of stable (^{48}Ca , ^{58}Fe , ^{64}Ni , ^{86}Kr) and radioactive (^6He , ^8He) isotopes.



период	ряд	группы элементов																						
		a	I	б	a	II	б	a	III	б	a	IV	б	a	V	б	a	VI	б	a	VII	б	a	VIII
1	I	Водород H 1 1s ¹ 1,00794 Hydrogen																						Гелий He 2 1s ² 4,0026 Helium
2	II	Литий Li 3 2s ¹ 6,941 Lithium	Бериллий Be 4 2s ² 9,012182 Beryllium	Бор B 5 2p ¹ 10,811 Boron	Углерод C 6 2p ² 12,011 Carbon	Азот N 7 2p ³ 14,00674 Nitrogen	Кислород O 8 2p ⁴ 15,9994 Oxygen	Фтор F 9 2p ⁵ 18,9984032 Fluorine	Неон Ne 10 2p ⁶ 20,1797 Neon															
3	III	Натрий Na 11 3s ¹ 22,989768 Sodium	Магний Mg 12 3s ² 24,3050 Magnesium	Алюминий Al 13 3p ¹ 26,981539 Aluminum	Кремний Si 14 3p ² 28,0855 Silicon	Фосфор P 15 3p ³ 30,973762 Phosphorus	Сера S 16 3p ⁴ 32,066 Sulfur	Хлор Cl 17 3p ⁵ 35,4527 Chlorine	Аргон Ar 18 3p ⁶ 39,948 Argon															
4	IV	Калий K 19 4s ¹ 39,0983 Potassium	Кальций Ca 20 4s ² 40,078 Calcium	Скандий Sc 21 3d ⁴ 4s ² 44,955910 Scandium	Титан Ti 22 3d ⁴ 4s ² 47,88 Titanium	Ванадий V 23 3d ⁴ 4s ² 50,9415 Vanadium	Хром Cr 24 3d ⁴ 4s ¹ 51,9961 Chromium	Марганец Mn 25 3d ⁵ 4s ² 54,93805 Manganese	Железо Fe 26 3d ⁶ 4s ² 55,847 Iron															
4	V	Медь Cu 29 3d ¹⁰ 4s ¹ 63,546 Copper	Цинк Zn 30 3d ¹⁰ 4s ² 65,39 Zinc	Галлий Ga 31 4p ¹ 69,723 Gallium	Германий Ge 32 4p ² 72,61 Germanium	Мышьяк As 33 4p ³ 74,92159 Arsenic	Селен Se 34 4p ⁴ 78,96 Selenium	Бром Br 35 4p ⁵ 79,904 Bromine	Криптон Kr 36 4p ⁶ 83,80 Krypton															
5	VI	Рубидий Rb 37 5s ¹ 85,4678 Rubidium	Стронций Sr 38 5s ² 87,62 Strontium	Иттрий Y 39 4d ⁵ 5s ² 88,90588 Yttrium	Цирконий Zr 40 4d ⁵ 5s ² 91,224 Zirconium	Нобий Nb 41 4d ⁵ 5s ¹ 92,90638 Niobium	Молибден Mo 42 4d ⁵ 5s ¹ 95,94 Molybdenum	Технеций Tc 43 4d ⁵ 5s ² [98] Technetium	Рутений Ru 44 4d ⁷ 5s ¹ 101,07 Ruthenium	Родий Rh 45 4d ⁸ 5s ¹ 102,90550 Rhodium	Палладий Pd 46 4d ¹⁰ 106,42 Palladium													
5	VII	Серебро Ag 47 4d ¹⁰ 5s ¹ 107,8682 Silver	Кадмий Cd 48 4d ¹⁰ 5s ² 112,418 Cadmium	Индий In 49 5p ¹ 114,818 Indium	Олово Sn 50 5p ² 118,710 Tin	Сурьма Sb 51 5p ³ 121,757 Antimony	Теллур Te 52 5p ⁴ 127,60 Tellurium	Йод I 53 5p ⁵ 126,90447 Iodine	Ксенон Xe 54 5p ⁶ 131,29 Xenon															
6	VIII	Цезий Cs 55 6s ¹ 132,90543 Cesium	Барий Ba 56 6s ² 137,327 Barium	Лантан La 57 5d ¹ 6s ² 138,9055 Lanthanum	Гафний Hf 72 5d ⁴ 6s ² 178,49 Hafnium	Тантал Ta 73 5d ⁴ 6s ² 180,9479 Tantalum	Вольфрам W 74 5d ⁴ 6s ² 183,84 Tungsten	Рений Re 75 5d ⁵ 6s ² 186,207 Rhenium	Осмий Os 76 5d ⁶ 6s ² 190,23 Osmium	Иридий Ir 77 5d ⁷ 6s ² 192,22 Iridium	Платина Pt 78 5d ⁹ 6s ¹ 195,08 Platinum													
6	IX	Золото Au 79 5d ¹⁰ 6s ¹ 196,96654 Gold	Ртуть Hg 80 5d ¹⁰ 6s ² 200,59 Mercury	Таллий Tl 81 6p ¹ 204,3833 Thallium	Свинец Pb 82 6p ² 207,2 Lead	Висмут Bi 83 6p ³ 208,98037 Bismuth	Полоний Po 84 6p ⁴ [209] Polonium	Астат At 85 6p ⁵ [210] Astatine	Радон Rn 86 6p ⁶ [222] Radon															
7	X	Франций Fr 87 7s ¹ [223] Francium	Радий Ra 88 7s ² [226] Radium	Актиний Ac 89 6d ¹ 7s ² [227] Actinium	Резерфордий Rf 104 [261] Rutherfordium	Дубний Db 105 [261] Dubnium	Сибергий Sg 106 [266] Seaborgium	Борий Bh 107 [267] Bohrium	Хасий Hs 108 [269] Hassium	Мейтнерий Mt 109 [268] Meitnerium	Дармштадтий Ds 110 [269] Darmstadtium													
7	XI	111	112	113	114	115	116	117	118															



**D.I. Mendeleev
1834 - 1907**

- s-элементы
- p-элементы
- d-элементы
- f-элементы

Лантаноиды Lanthanides													
Церий Ce 4f ¹ 5d ¹ 140,115 Cerium	Прозеций Pr 4f ³ 140,90765 Praseodymium	Неодим Nd 4f ⁴ 144,24 Neodymium	Прометий Pm [145] Promethium	Самарий Sm 4f ⁶ 150,36 Samarium	Европий Eu 4f ⁷ 151,9654 Europium	Гадолиний Gd 4f ⁷ 5d ¹ 157,25 Gadolinium	Тербий Tb 4f ⁹ 158,92534 Terbium	Диспрозий Dy 4f ¹⁰ 162,50 Dysprosium	Гольмий Ho 4f ¹¹ 164,93032 Holmium	Эрбий Er 4f ¹² 167,26 Erbium	Тулий Tm 4f ¹³ 168,93421 Thulium	Иттербий Yb 4f ¹⁴ 173,0547 Ytterbium	Лютеций Lu 4f ¹⁴ 5d ¹ 174,967 Lutetium
Актиноиды Actinides													
Торий Th 5f ¹⁴ 6d ² 232,0375 Thorium	Протактиний Pa 5f ¹⁴ 6d ¹ 231,03688 Protactinium	Уран U 5f ¹⁴ 6d ¹ 238,02891 Uranium	Нептуний Np 5f ¹⁴ 6d ¹ [237] Neptunium	Плутоний Pu 5f ¹⁴ [244] Plutonium	Америций Am 5f ¹⁴ [243] Americium	Кюрий Cm 5f ¹⁴ [247] Curium	Калифорний Cf 5f ¹⁴ [251] Californium	Эйнштейний Es 5f ¹⁴ [252] Einsteinium	Фермий Fm 5f ¹⁴ [257] Fermium	Менделевий Md 5f ¹⁴ [258] Mendelevium	Нобелий No 5f ¹⁴ [259] Nobelium	Лоуренсий Lr 5f ¹⁴ 6d ¹ [260] Lawrencium	

112
Chemical
identification
in 2006

113
Discovered
at JINR in
2003

114
Discovered
at JINR in
1999

115
Discovered
at JINR in
2003

116
Discovered
at JINR in
2000

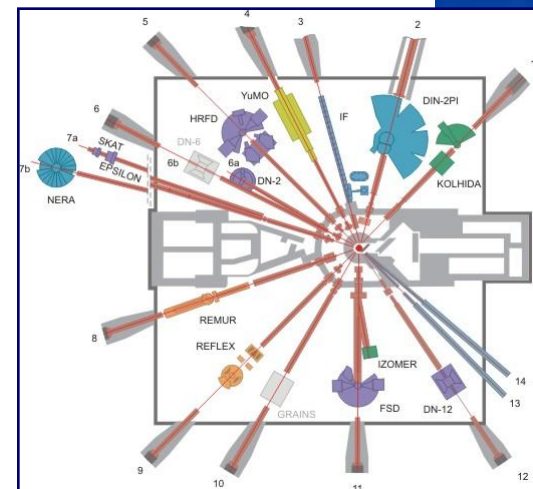
118
Discovered
at JINR in
2001

“Road Map” – in the field of Condensed Matter Physics

The main home facility:
reactor IBR-2 (now under the reconstruction)

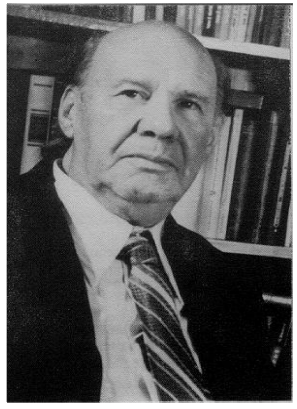
Plans:

- upgraded reactor IBR-2M (2010)
- creation of a complex of modern neutron spectrometers around the modernized reactor (2011-2015)

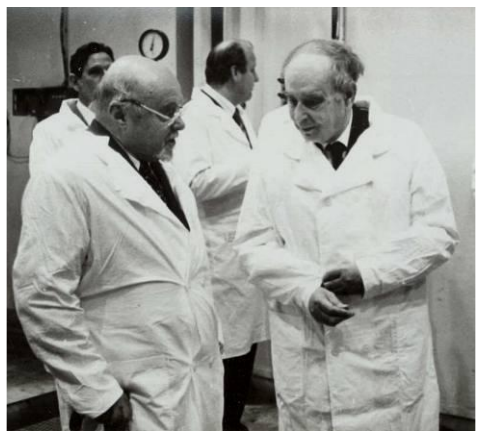


Neutron Reactor IBR-2

The IBR-2 reactor is included in the 20-year European strategic programme of neutron scattering research.



D. Blokhintsev



N. Dollezhal and I. Frank



operating since 1984

Parameters of Source

Power: mean 2 MW,
in pulse 1500 MW

Pulse frequency: 5 Hz.

Neutron flux in pulse 5×10^{15}

Neutron pulse width: 320 μ s

Priorities in the field

● Neutron investigations of the structure and dynamics of Condensed Matter

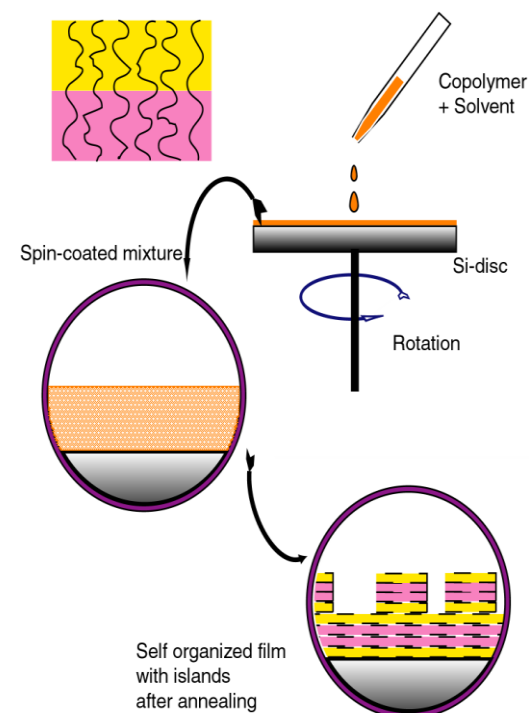
● Development and creation of elements of neutron spectrometers for condensed matter studies

● Radiation and Radiobiological investigations

Spincoating

Symmetric diblock copolymer

d-polystyrene █ --- polybutylmethacrylate █ --- d-PS-PBMA █





III. Education Programme and Innovation activities

A vitally important task is attracting of young people from all the Member States to science

EDUCATIONAL PROGRAMME



JINR UNIVERSITY CENTRE

More than 300 students and postgraduates from Member States are trained at the UC

Chairs:

MSU

MIPT

MEPI

MIREA

others

JINR is a school of excellence for the Member States!

“Dubna” International University



DIAS - TH

Dubna International
Advanced School
on Theoretical Physics



The UC offers graduate programmes in the fields of:

- ◆ Elementary Particle Physics
- ◆ Nuclear Physics
- ◆ Theoretical Physics
- ◆ Condensed Matter Physics
- ◆ Technical Physics
- ◆ Radiobiology

Innovation Activities

Special Economic Zone in DUBNA

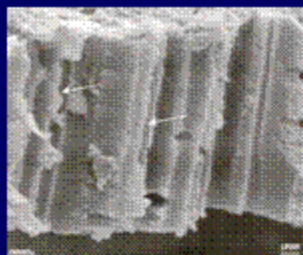
On 21 December 2005,
the Prime Minister of the
Russian Federation
M.Fradkov signed
Resolution № 781 on the
establishment of a
Special Economic Zone in
the territory of the town
Dubna.



First Resident - «Dubna-Systema Inc.»

SEZ main specialization

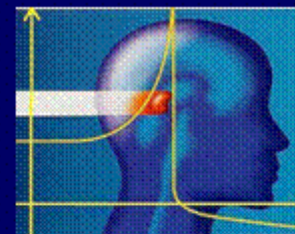
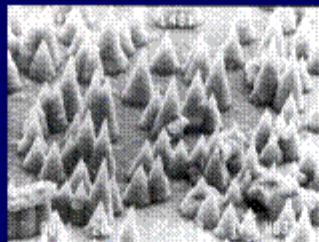
Nanotechnologies



COPPER MICROTUBES

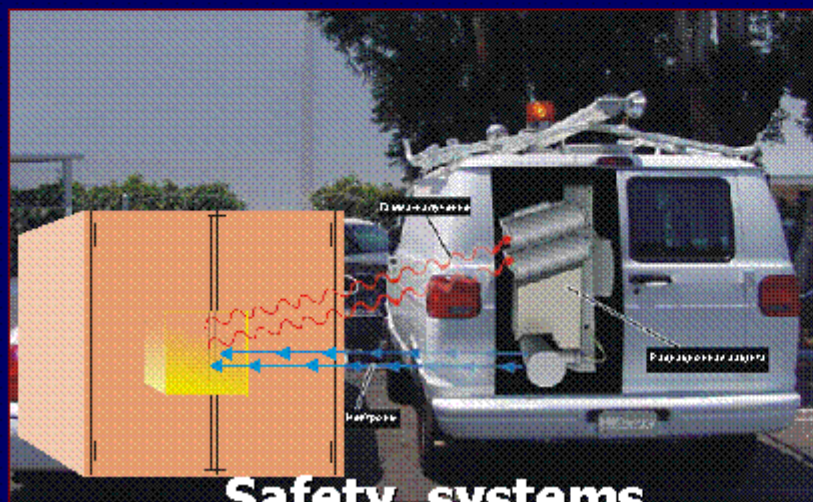


METALLIC NEEDLES



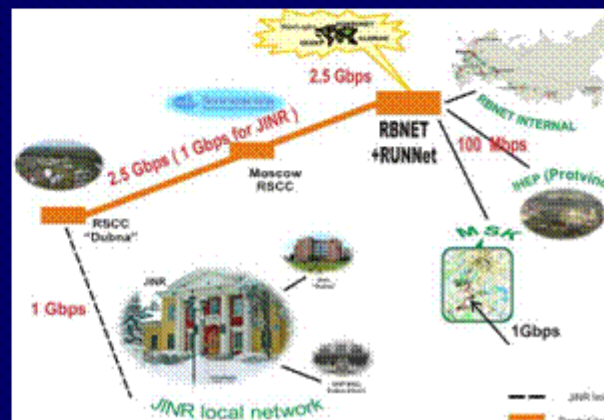
Hadron therapy

Radiation medicine

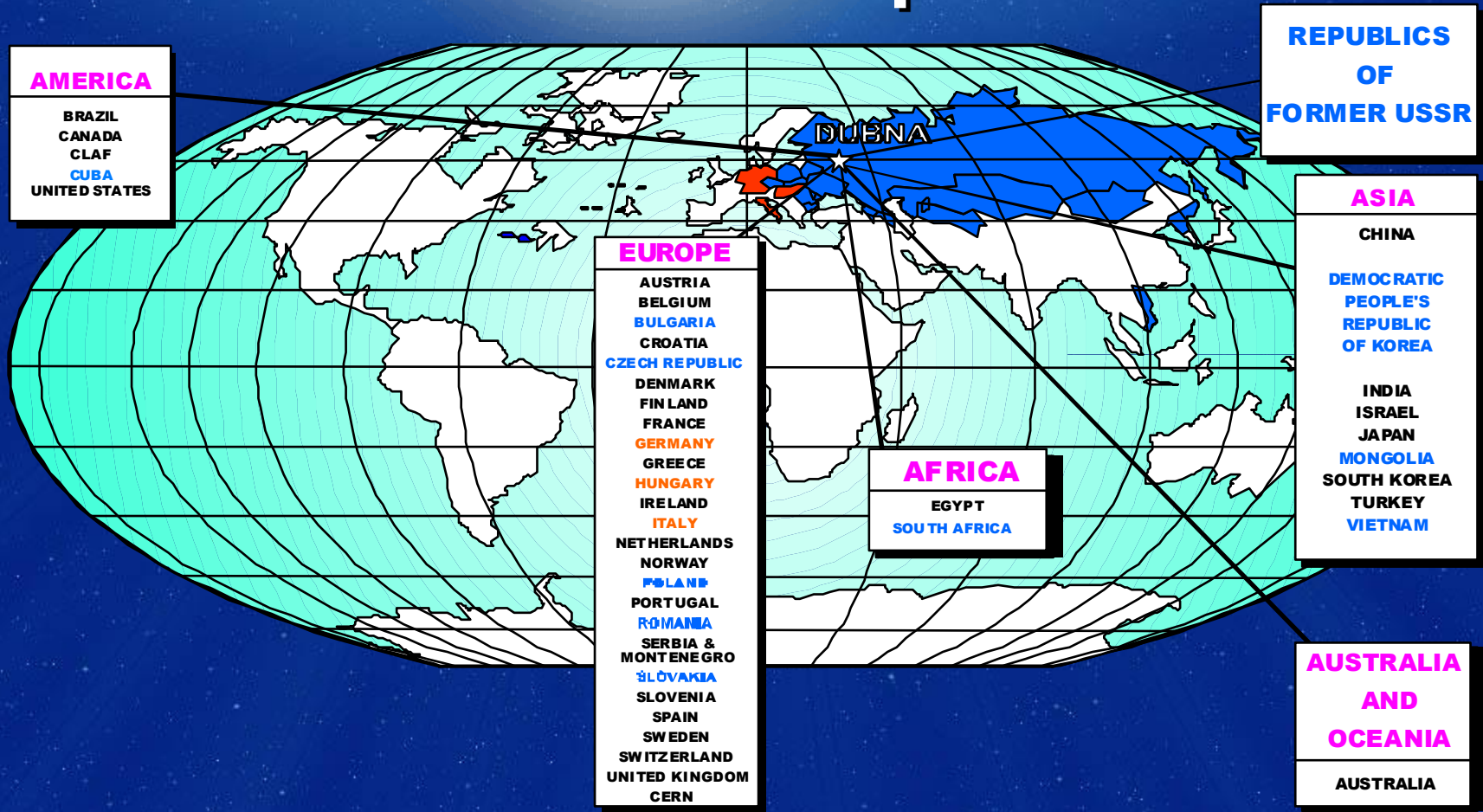


Safety systems

IT and Telecommunication



International Cooperation



JINR's partners are about 700 institutions located in 60 countries

Cooperation with Germany



- Location of centres collaborating with JINR

- JINR's partners are
 - 71 institutions located in 45 cities
- Research activities are regulated by the Agreement between BMBF and JINR concluded in 1991
- About 300 joint publications annually

JINR-USA Cooperation

Main Scientific Partners

Institutions:

Fermi National Accelerator Laboratory
Brookhaven National Laboratory
Lawrence Berkeley National Laboratory
Lawrence Livermore National Laboratory
Argonne National Laboratory
Los Alamos National Laboratory

...



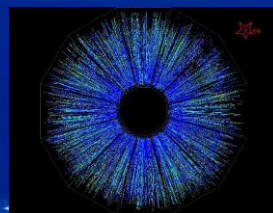
At present, JINR collaborates with 75 U.S. scientific centres and universities



Dr. J. Marburger at JINR, Dubna, 3 June 2002



DZero



STAR



synthesis
of superheavy elements

Visit of the President of the RF D.Medvedev to Dubna (JINR)



18 April 2008



Welcome to JINR (Dubna)

