Enclosure 5

Status of the request of adhesion of Belarus

ICRANet activities

in Belarus

2008 - 2022

CONTENTS

Национальная академия наук Беларуси

The National Academy of Sciences of Belarus presents its compliments to the International Center for Relativistic Astrophysics Network (ICRANet).

Aware of the importance of research in relativistic astrophysics for the understanding of the structure and evolution of our universe as well as for the identification of the fundamental laws of nature;

Aware that research in this area must be based on international cooperation as a necessity;

Aware of the Law of the Republic of Belarus "On International Treaties of the Republic of Belarus" from July 23, 2008 No 421-Z;

Aware of the Agreement of the Establishment and Statute of ICRANet;

Recognizing a strong interest of ICRANet in establishing long term cooperation with the Republic of Belarus at the highest level in research and training in relativistic astrophysics and related areas;

Recognizing the leading role of ICRANet in international cooperation of research and training in this area;

The National Academy of Sciences of Belarus acting in accordance with Article 4 of the Law of the Republic of Belarus "On International Treaties of the Republic of Belarus" and in accordance with Article II of the Agreement of Establishment and Statute of ICRANet expresses its interest in accession of the Republic of Belarus to ICRANet as a Member State of ICRANet.

Recalling that the Cooperation Agreement between the National Academy of Sciences and ICRANet is in force from 2013, it allowed organizing several international meetings in Minsk, Belarus, including two Zeldovich meetings.

Recalling that in 2017 the ICRANet-Minsk Center has been established in the National Academy of Sciences. The accession of the Republic of Belarus to ICRANet as a Member State will allow this center to become the official seat of ICRANet in Belarus, which will become a regional seat for collaboration with scientists from nearby countries: Estonia, Latvia, Lithuania, Poland, Russia, Ukraine and Sweden. It will also allow

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establishing the regional data center for data from cosmic, ground and underground observatories operating within the European network GEANT.

The National Academy of Sciences also expresses its interest in full participation in the International Relativistic Astrophysics Ph.D. program – IRAP PhD coordinated by ICRANet.

Yours sincerely,

Acad. Vladimir Gusakov
Chairman of Presidium
National Academy of Sciences
of Belarus

Governing Board
of the International Center for
Relativistic Astrophysics
Network (ICRANet)

Discussion on accession of the Republic of Belarus to ICRANet

In March 2014 prof. Remo Ruffini had a meeting with the First Deputy Minister of Foreign Affairs, Mr Aleksandr Mikhnevich. They discussed successful joint activities, including two international conferences organized by ICRANet in Belarus, as well as organization of ICRANet center in Belarus, and possible entrance of Belarus to ICRANet.

Fig. 9. Meeting of Director of ICRANet, prof. Remo Ruffini and the Chairman of the Standing Committee for Foreign Affairs and National Security prof. Sergei Rakhmanov, 27 April 2017.

In August 2015 Dr. Gregory Vereshchagin had a meeting with the chairman of the State Committee on Science and Technology of the Republic of Belarus, Dr. Alexander Shumilin and discussed with him, on behalf of Director of ICRANet, organization of ICRANet center in Belarus and possible accession of Belarus to ICRANet.

In April 2017 prof. Remo Ruffini had a meeting with the Chairman of the Standing Committee for Foreign Affairs and National Security prof. Sergei Rakhmanov and discussed possible accession of Belarus to ICRANet. In April 2018, during the Third Zeldovich meeting the delegation from ICRANet has been received by the Deputy Minister of Foreign Affairs of Belarus and discussion about the accession of Belarus to ICRANet took place.

Following these meetings the National Academy of Sciences has initiated the request to the Council of Ministers of the Republic of Belarus to start the procedure towards the accession of the Republic of Belarus to ICRANet.

Логотип

Ministry of Foreign Affairs of the Republic of Belarus

Site: http://mfa.gov.by/en/press/news_mfa/fd4a7f5e32424fda.html

Deputy Minister of Foreign Affairs of Belarus A.Dapkiunas meets the ICRANet delegation

24 April 2018

24-04-2018

On April 24, 2018 the Deputy Minister of Foreign Affairs of the Republic of Belarus, Andrei Dapkiunas, met with the delegation of the International Center for the Relativistic Astrophysical Network (ICRANet), headed by the Director of the Center, Professor Remo Ruffini. The delegation visits Minsk to participate in the international scientific symposium dedicated to the memory of the famous scientist, native of Minsk Yakov Zeldovich.

During the meeting, the sides discussed the expansion of international scientific cooperation in the field of relativistic astrophysics, participation of Belarusian scientists in ICRANet programs, joint research and events. R.Ruffini expressed interest in the official accession of Belarus to ICRANet

and opening of the Centers' office in Minsk.

Background Information: The International Center for Relativistic Astrophysics Network (ICRANet) is an international scientific organization promoting research activities in relativistic astrophysics and related areas. Joint international center of relativistic astrophysics ICRANet has been operating on the basis of the Institute of Physics of the National Academy of Sciences of Belarus since April 2017.

русская версия *беларуская версія*

AGREEMENT BETWEEN THE INTERNATIONAL CENTER FOR RELATIVISTIC

ASTROPHYSICS NETWORK (ICRANET) AND THE GOVERNMENT OF THE REPUBLIC OF BELARUS ON THE ESTABLISHMENT OF A ICRANET

HEADQUARTERS IN BELARUS

The International Center for Relativistic Astrophysics Network (ICRANet),

and

The Government of the Republic of Belarus (hereinafter referred to as

"Government")

(both hereinafter referred to as "Parties")

Desiring to strengthen cooperation between ICRANet and Belarus in the promotion, in Belarus, of training, education and research in the field of Relativistic Astrophysics; and

Recognizing that a dedicated ICRANet headquarters in Belarus shall also bring about ICRANet's commitment to enhance knowledge in the domain of Cosmology, Theoretical Physics and Mathematical Physics among Belarusian research and development (R&D) institutions,

Hereby agree as follows:

Article I

The Parties establish the following definitions for the purposes of the interpretation of this Agreement:

a) "Government", means the Government of the Republic of Belarus;

b) "ICRANet" means the International Center for Relativistic Astrophysics Network;

c) "competent authorities", the authorities of the Republic of Belarus, in accordance with its laws;

d) "headquarters", the premises and annexes, whatever their owner, occupied by ICRANet;

e) "property", the real estate, furniture, vehicles, rights, assets in any currency, credits, income, other assets and everything that may constitute the patrimony of ICRANet;

f) "files", the correspondence, manuscripts, audio-visual material of any kind, as well as all other documents belonging to ICRANet or in its possession;

g) "Head of Mission", the head of the permanent regional headquarters of ICRANet in Belarus;

h) "staff, ICRANet's headquarters officers or hired employees who are not Belarusian nationals or do not have permanent residence in the Republic of Belarus;

i) "dependents", every family member who depends economically or is under the legal responsibility of the persons mentioned in subparagraphs g) and h) of this Article, and

j) "local personnel", the employees hired by ICRANet in the territory of Belarus for the performance of administrative duties or services.

Article II

1. ICRANet shall establish a headquarters in Belarus.

2. The ICRANet's headquarters in Belarus shall be responsible for developing, coordinating and actively supporting the overall cooperation among ICRANet and the Government, the academic community, and the civil society to promote development of frontier sciences in the field of Relativistic Astrophysics. Cooperation shall include the development of country studies and research programmes with the participation of Belarusian scientific and technological institutions, the provision by ICRANet of high quality services and the mobilization of resources for the financing of projects.

3. The ICRANet headquarters in Belarus shall have a Head of Mission which, in the performance of his/her duties, shall:

a) Act as accredited representative of ICRANet in Belarus as well as ICRANet representative for important international or regional organizations located in the country;

b) Promote ICRANet's services in Belarus;

c) Develop a strategic framework of cooperation, an annual work programme, active partnerships between ICRANet and Belarus and fruitful relationships and communication with the Government, academic community, civil society, non-governmental organizations, all other multilateral and bilateral organizations;

d) Lead and coordinate the overall programmes and projects development and mobilize related financial resources in Belarus;

e) Support and monitor the implementation of ICRANet projects and programmes, and contribute to the management of all other ICRANet activities in Belarus;

f) Manage the ICRANet's headquarters in Belarus and its resources, and ensure its sustainability;

Article III

This Agreement does not imply any financial obligation to the Belarusian Government regarding the costs deriving from the establishment and functioning of the ICRANet Headquarters in Belarus. Any financial commitment in this regard shall be subject to future Agreements between the Parties.

Article IV

ICRANet possesses legal personality and in order to achieve its purposes is entitled to:

a) hire and contract;

b) acquire goods and real estate, maintain financial resources and freely dispose of said resources;

c) initiate legal or administrative procedures in its own interest;

d) possess funds in foreign currency of any kind and keep their accounting in any denomination, in conformity to the Belarusian legislation, and

e) transfer its funds in foreign currency within the country or abroad, in conformity to the Belarusian legislation.

Article V

The headquarters shall remain under the authority and responsibility of ICRANet. Nevertheless, Belarusian sanitary and other pertinent legal requirements, specially labor related ones, shall apply.

Article VI

The Government shall not be responsible for acts or nonfeasance by ICRANet or by any of the staff members.

Article VII

The headquarters and its files shall be inviolable. Competent local authorities may only enter the headquarters in the performance of their duties with the consent of the Head of Mission. In case of fire or any other accident involving a hazard to public safety, the consent of the Head of Mission shall be tacit. The Government shall take appropriate measures to protect the headquarters against any trespasser or harm.

Article VIII

The headquarters shall not be used for any end not compatible with the purposes and functions of ICRANet. ICRANet shall not allow the headquarters to serve as a haven for fugitives or convicted persons under Belarusian law, or for persons whose extradition may have been requested by another country, or who try to elude judicial proceedings.

Article IX

ICRANet and its properties shall enjoy immunity of jurisdiction and of execution in the territory of the Republic of Belarus, except:

a) in the case of express renunciation, through its Head of Mission;

b) in the case of a labor or social security related suit initiated by an employee or a former employee of the Mission;

c) in the case of a civil suit initiated by a third party for damages, injury or death resulting from accident caused by a vehicle or aircraft belonging to or used on behalf of ICRANet;

d) in the case of a traffic violation involving a vehicle belonging to ICRANet or used on its behalf, and

e) in the case of a countersuit directly related to a court suit initiated by ICRANet.

Article X

In hiring local employees, ICRANet shall be subject to the laws on labor relations and social security of the Republic of Belarus.

Article XI

Properties belonging to ICRANet in the territory of the Republic of Belarus for the purpose of installing and maintaining the headquarters of the Mission, regardless of their location or of whoever holds them, shall be exempt from:

a) any form of requisition, confiscation or sequestration;

b) expropriation, except in the case of public use defined by law and with prior compensation, and

c) any form of restriction or administrative, judicial or legislative interference, except when temporarily necessary for the prevention or investigation of accidents.

Article XII

ICRANet must contract, in the Republic of Belarus, insurance to cover civil liability for damages caused to third parties.

Article XIII

1. ICRANet, the Head of Mission and its staff shall be exempt from state and municipal taxes on the premises and its annexes, of which they are the owners, except when such taxes cover compensation for public services.

2. The above mentioned fiscal exemption shall not apply to taxes and other dues which, according to Belarusian law, fall under the responsibility of persons hired by ICRANet or by its Head of Mission.

3. Fiscal exemptions, privileges and immunities conferred to ICRANet by means of the present Agreement shall not be extended to Belarusian citizens or permanent residents in Belarus.

Article XIV

ICRANet shall be exempt of any kind of customs duties, taxes and other dues regarding the import and export of articles, publications or goods designed for the official use of ICRANet which shall be not traded in the Republic of Belarus without the authorization of the Government.

Article XV

The Head of Mission and staff members, in addition to the provision of article XIII, paragraph 3 above, shall be exempt from the payment of taxes, except:

a) indirect taxes, normally included in the price of goods and services;

b) taxes and other dues on private real estate located in the Republic of Belarus, unless owned by ICRANet and used as official premises.

c) taxes and other dues on private income, including capital gains originating in the Republic of Belarus, and taxes on income relating to investments in commercial or financial companies in the Republic of Belarus;

d) taxes and other dues relating to compensation for public services;

e) taxes on successions or transmissions demandable by the Republic of Belarus, and

f) dues for registration, court costs, mortgage and stamp, except as provided for in

Article XIV.

Article XVI

1. The staff members who are not Belarusian citizens or who do not have permanent residence in the Republic of Belarus, and who need to remain in the country in the exercise of their duties for a period of not less than one (1) year and have been accredited by the Government pursuant to Article XXIX, may import, within six (6) months of their arrival, or export free of custom duties, taxes and other dues, their belongings and personal effects, which cannot be traded in the country without authorization from the Government.

2. The Head of Mission and the staff members shall not be exempt from dues relating to storage, transport and other charges for related port services.

Article XVII

Staff members, except Belarusian citizens and persons having permanent residence in Belarus, shall enjoy exemption for the import of articles of personal consumption according to the regulations in force in the Republic of Belarus. Such exemption shall be granted pursuant to the rules established by the competent authorities.

Article XVIII

Staff members who are not Belarusian citizens or who do not have permanent residence in Belarus shall enjoy the same facilities and exemptions in monetary or foreign currency exchange matters granted to headquarters of similar functions in other international organizations who are on mission in the Republic of Belarus.

Article XIX

1. The Head of Mission and staff members shall enjoy immunity of jurisdiction relating to acts, including in speech and writing, performed by themselves in the exercise of their official functions and within the limits of their duties, even after the conclusion of the period of their mission, except:

a) in the case of a civil suit initiated by third parties for damages originating in an accident caused by a vehicle or aircraft belonging to them or driven by them, or relating to a traffic violation involving such a vehicle and committed by them;

b) in the case of a suit relating to private real estate located in the Republic of Belarus, unless such real estate is under the possession of ICRANet and serves to fulfill its purposes;

c) in the case of a succession suit in which the Head of Mission or a staff member appears as a private individual and not on behalf of ICRANet as the executor, administrator, heir or legatee of a testament; and

d) in the case of an action relative to any commercial or professional activity exercised before taking headquarters.

2. The Head of Mission and staff members cannot be the object of any executory measure, except in the cases mentioned in subparagraphs a), b), c) and d) of this Article, and except for Belarusian nationals and permanent residents in the country.

Article XX

1. Staff members shall enjoy the following privileges, exemptions and facilities:

a) inviolability of official documents and papers related to the exercise of their functions;

b) exemption from restrictions to immigration and from procedures of registration of foreigners;

c) facilities for repatriation usually accorded to the personnel of international organizations in cases of international crisis;

d) exemption from income tax or any other direct taxes on salaries or retributions paid by the organization, and

e) exemption from any personal service and military service obligations or public service of any kind.

2. The privileges, exemptions and facilities agreed on subparagraphs b), c), d) and e) shall not be granted to Belarusian citizens or permanent residents in the Republic of Belarus.

3. The exercise of paid activity by dependants of the Head of Mission and staff members in Belarusian territory shall not be permitted, except in the case of Belarusian nationals or if authorized by a specific Agreement on the matter.

Article XXI

It is understood that the Head of Mission, the staff members and dependents enjoy the privileges, immunities and facilities set forth in the Vienna Convention on Diplomatic Relations; this does not apply to the situations covered by article XIII, paragraph 3 above.

Article XXII

ICRANet shall take adequate measures to resolve:

a) litigations deriving from contracts or other private law questions of which it is a party,

and

b) litigations to which the Head of Mission or a staff member who enjoys immunity by virtue of his (her) functions is a party.

Article XXIII

1. ICRANet shall cooperate with the competent authorities in order to facilitate the administration of justice and oversee the enforcement of the law.

2. No clause of this Agreement shall be interpreted as preventing the adoption of appropriate security measures in the interest of the Government.

Article XXIV

1. Privileges and immunities recognized in this Agreement are not granted to the Head of Mission or staff members for their own benefit, but in order to safeguard the independent exercise of their functions.

2. ICRANet has the right and the duty to renounce the immunity granted to it if it hinders the course of justice. In the case ICRANet does not renounce immunity, it must do its utmost to arrive at a fair solution of a litigation to which it is a party.

Article XXV

If the Government considers that an abuse of a privilege or immunity granted by virtue of this Agreement has occurred, it shall consult with ICRANet in order to determine whether such an abuse has taken place and, in that case, to prevent its recurrence.

Article XXVI

The number of staff members shall not exceed the limits suitable for the proper performance of the functions of the regional headquarters of ICRANet in the Republic of Belarus.

Article XXVII

ICRANet shall have the right to use codes and to dispatch and receive its correspondence by mail as well as by sealed pouch, which shall enjoy the same immunity and privileges granted to the diplomatic and consular representations headquartered in the territory of the Republic of Belarus, in accordance with the Vienna Convention on Diplomatic Relations.

Article XXVIII

ICRANet shall give written notice to the Government with the necessary advance of:

a) the appointment of the Head of Mission and staff members, as well as the engagement of local personnel, pointing out those who are Belarusian citizens or

permanent residents in the Republic of Belarus. Additionally, it shall give notice of the cessation of the functions of the aforementioned persons in ICRANet; and

b) the arrival and final departure of the Head of Mission and staff members, as well as that of the members of their respective families.

Article XXIX

The Government shall issue to the Head of Mission and staff members, once notice of their appointment has been received, a document of accreditation which shall specify the person's position and the nature of his (her) functions.

Article XXX

1. Each contracting Party shall notify the other of their compliance with the respective internal procedures for the entry into force of this Agreement, which shall take effect 30 (thirty) days after the date on which the second notification is received.

2. This Agreement shall be of indefinite duration. Any of its Parties may notify the other of its desire to denounce this Agreement. Termination shall be effective six (6) months after the date of the receipt of the notification to the other Party.

Article XXXI

The Parties may, by mutual consent, introduce modifications and amendments to this Agreement and shall be subject to the procedure set forth in paragraph 1 of Article XXX.

Done in Rome on _____, in duplicate, in the Russian and English languages, the texts being equally authentic.

FOR THE INTERNATIONAL CENTER FOR RELATIV1STIC ASTROPHYSICS NETWORK	FOR THE GOVERNMENT OF THE REPUBLIC OF BELARUS
_____	_____

Belarusian Republican Foundation for Fundamental Research (BRFFR)

Minsk - Belarus

Cooperation agreement ICRANet - BRFFR

Director
Academician Sergey Gaponenko

Signatories
Academician Sergey Gaponenko

ONGOING AND PREVIOUS ACTIVITIES

Joint Activities

Joint Call for Proposals "BRFFR – ICRANet – 2018"

http://www.icranet.org/callBRFF-ICRANet2018

Joint Call for Proposals "BRFFR – ICRANet – 2021"

http://www.icranet.org/index.php?option=com_content&task=view&id=1311

Joint Call for Proposals "BRFFR – ICRANet – 2022"

https://www.icranet.org/index.php?option=com_content&task=view&id=1447

COOPERATION AGREEMENT

in Science and Technology

between

International Center for Relativistic Astrophysics Network (ICRANet)

and

Belarusian Republican Foundation for Fundamental Research (BRFFR)

The International Center for Relativistic Astrophysics Network (ICRANet), whose headquarters is located at Piazza della Repubblica, 10 – 65122 Pescara, Italy, in this act represented by its Director, Prof. Remo Ruffini,

and

the Belarusian Republican Foundation for Fundamental Research (BRFFR), located at Nezavisimosti ave. 66, 220072 Minsk, Belarus, in this act represented by its Director, Academician Sergey Gaponenko,

(Hereinafter collectively referred to as "the Parties" or individually as the "Party"),

Considering the interest in deepening academic cooperation between scientists from Belarusian institutions and ICRANet, in order to promote the development of science and technology and relativistic astrophysics in particular;

Wishing to strengthen and develop scientific and technological co-operation on the basis of equality and mutual benefit, have agreed as follows:

Article 1
Preamble

The present Agreement intends to provide a legal framework for the establishment of programs and actions that aim to deepen the cooperation between researchers and academics from institutions based in Belarus, and from ICRANet, according to the provisions of this Agreement and the existing legislation and regulations of Belarus and ICRANet.

Article 2
Forms of Co-operation

The Parties shall promote such co-operation, observing their international obligations and national legislation as well as other valid regulations and agree to develop collaborative activity that may come in the form of:

2.1. Joint research and development projects, including exchange of research results and exchange of scientists, specialists and researchers;

2.2. Scholarship programs;

2.3. Organization of seminars, workshops, symposia or other scientific meetings of mutual interest;

2.4. Exchange of scientific and technical research results, information and documentations arising from the bilateral scientific and technological cooperation;

2.5. Other forms of scientific and technological co-operation which may be mutually agreed upon.

Article 3
Finance

3.1. Each Party will facilitate and fund the mentioned activities through their regular funding programs taking into account any constraints of time, funding and other relevant resources.

3.2. The costs of exchange of experts, scientists and other specialists, resulting from this Agreement, unless mutually agreed otherwise in writing, will be covered on the following basis: the sending Party will meet all related costs connected with travel, lodging and allowances according to its own regulations and allowances; the sending Party shall be responsible for the emergency health insurance of its scientists.

3.3. Students and researchers taking part in activities under the scope of this Agreement shall be exempt of ICRANet tuition fees.

3.4. ICRANet and BRFFR undertake to encourage researchers supported under the scope of this Agreement to mention the Parts in any scientific work or paper.

Article 4
Joint Committee

4.1. For the purpose of implementing this Agreement, a Joint Committee, composed of equal number of representatives designated by the two Parties, shall be established. The tasks of the Joint Committee shall be as follows:

a. Identifying the fields of co-operation on the basis of information delivered by institutions of each country and the national policies in science and technology;

b. Creating favourable conditions for the implementation of this Agreement;

c. Facilitating the implementation of joint programmes and projects;

d. Encouraging exchange of experience arising from the bilateral scientific and technological co-operation and evaluating proposals for its further development.

4.2. It is the responsibility of the Joint Committee to resolve any technical, and/or administrative questions that may arise during the execution of this Agreement, as well as to oversee its overall functioning, consulting with their respective superiors of each institution, if the need should arise.

4.3. The Joint Committee meetings are arranged by mutual agreement when matters requiring detailed discussion arise. However, the Joint Committee may also operate by correspondence.

4.4. The Joint Committee may elaborate its own rules of procedure.

Article 5
Joint Research and Development Projects

In accordance of the provisions of the Article 2.1., the joint research and development projects will be implemented as follows:

5.1. The Parties will publish simultaneously a Call for Proposals every two years.

5.2. Project proposals have to provide detailed information on the objectives and justification of the planned joint research work, the methodology to be followed, the composition of each research team and the intended time schedule.

5.3. Project proposals prepared in English should be submitted for evaluation and approval simultaneously to ICRANet and the BRFFR. Unless both sides agree otherwise in writing, proposals will be independently evaluated and approved by each of the two Parties, following their own rules and regulations, and only those proposals which are approved by both Parties will be supported.

5.4. The execution period of a joint research project should not exceed two years.

5.5. Each scientific visit has to be reported by the ICRANet scientists to ICRANet Director and by the Belarus scientists to the BRFFR one month in advance. The application must include a brief description of the work to be performed during the planned visit.

5.6. Within two months after completion of the execution period, a final report, presenting the work carried out and the results obtained, will be prepared in English jointly by the two research teams and submitted to ICRANet and to BRFFR.

5.7. Besides the financial support towards the exchange of project researchers mentioned above, the Parties may provide additional research funds to their respective project teams whenever they consider it appropriate. It is desirable but not essential to fund the two sides equally.

Article 6
Dissemination of Resulting Information

6.1. Scientific and technological results and any other information derived from the co-operation activities under this Agreement, will be shared, announced, published or commercially exploited with the written consent of both cooperating partners and according to the international agreements concerning intellectual property rights to which states of the both Parties are signatories.

6.2. Scientists, technical experts and institutions of the third countries or international organisations may be invited, upon written consent of the both co-operating partners, to participate in projects and programmes being carried out under this Agreement. The cost of such participation shall normally be borne by third countries, unless both sides agree otherwise in writing.

Article 7
Implementation and Legal Aspects

7.1. This Agreement is concluded with a view to enhancing and developing cooperation between the Parties and does not constitute an agreement binding upon the States of the Parties under international law. No provision of this Agreement shall be interpreted and implemented as creating legal rights or commitments for the States of the Parties.

7.2. Any dispute related to the interpretation or implementation of this Agreement shall be settled through consultations within the Joint Committee or between the Parties.

7.3. With respect to the co-operation activities established under this Agreement, each Party shall take, in accordance with the respective national legislations of their States, all necessary measures to ensure the best possible conditions for their implementation.

7.4. This Agreement shall not affect the validity or execution of any obligation arising from other international treaties or agreements concluded by the States of the Parties.

7.5. This Agreement may be amended at any time through mutual consent of the Parties, in writing.

Article 8
Validity and Termination

8.1. This Agreement shall enter into force on the date when it is signed by both Parties.

8.2. This Agreement shall remain in force for a period of five years and shall automatically be renewed for further periods of five years, unless either Party notifies in writing its intentions to terminate this Agreement.

8.3. The termination will come into effect in six months from the receiving date of the written notification. The termination of this Agreement shall not affect the projects or programmes undertaken under this Agreement and not fully executed at the time of the termination of this Agreement.

Signed in two original copies in English by both Parties.

Date and Venue: 26.04.2017, Minsk

For International Center for Relativistic Astrophysics Network

Prof. Remo RUFFINI
Director

Date and Venue: 26.04.2017, Minsk

For the Belarusian Republican Foundation for Fundamental Research

Prof. Sergey GAPONENKO
Chairman of Board & Director

ICRANet-BRFFR joint calls

The Belarusian Republican Foundation for Fundamental Research (BRFFR) and the International Center for Relativistic Astrophysics Network (ICRANet) announced a call for proposals for joint basic research projects in relativistic astrophysics. Scientific areas of the call are: relativistic astrophysics, cosmology, gravitation.

Joint applications from international research teams including Belarusian scientists have to be submitted simultaneously using agreed application forms to both organizations: Belarusian team apply to the BRFFR, international ones – to ICRANet. Duration of the projects is up to 2 years.

The first call was closed in December 2018 and the joint project "Relaxation of multicomponent optically thick relativistic plasma with quantum degeneracy" was selected for funding. The project is led by Dr. Ivan Siutsou from the Belarusian side and by Prof. Gregory Vereshchagin from the ICRANet side.

The second call was closed in September 2020. Two research projects were approved: 1) "The motion and radiation of a test charged particle in the vicinity of a black hole" with Belarusian PI prof. Alexander Gorbatsievich from Belarusian State University and ICRANet PI prof. Gregory Vereshchagin and 2) "Kinetics of nonuniform and (or) anisotropic relativistic plasma with correlations" with Belarusian PI Dr. Alexander Mikhalychev from the B.I Stepanov Institute of Physics of the National Academy of Sciences of Belarus and ICRANet PI prof. Gregory Vereshchagin.

The third call was closed in September 2022. Three projects were submitted: 1) "Electromagnetic field of a system of charges moving near spherically symmetric and magnetized black holes" with Belarusian PI prof. Alexander Gorbatsievich from the Belarusian State University and ICRANet PI prof. Gregory Vereshchagin; 2) "Kinetic processes and radiation transfer in relativistic plasma in external electric and magnetic fields" with Belarusian PI Dr. Mikalai Prakapenia from the B.I Stepanov Institute of Physics of the National Academy of Sciences of Belarus and ICRANet PI prof. Gregory Vereshchagin and 3) "New effects in interaction of electromagnetic radiation with astrophysical plasma resulting from lower permittivity and density of states as compared to vacuum" with Belarusian PI Dr. Oleg Romanov from the Belarusian State University and ICRANet PI prof. Gregory Vereshchagin.

Cooperation Agreements with the Belarusian State University

On September 5, 2008 a Cooperation Agreement between ICRANet and the Belarusian State University (BSU) was signed by the director of ICRANet, prof. Remo Ruffini, and Rector of BSU, prof. Vasily Strazhev in Minsk, Belarus. This cooperation agreement has been renewed on August 26, 2013 by the director of ICRANet, prof. Remo Ruffini, and Rector of BSU, prof. Sergei Ablameyko.

Fig. 1 Opening of the First Zeldovich meeting, organized by ICRANet and BSU. From left to right are the Rector of BSU, prof. Sergei Ablameyko, the director of ICRANet, prof. Remo Ruffini, and Dr. Gregory Vereshchagin. Minsk, 2009.

The goal of this agreement is to deepen the scientific and research cooperation, as well as to arrange bilateral seminars, make possible exchange of expertise, research and educational staff, publication of joint works. Within this agreement ICRANet has organized together with BSU the Zeldovich meeting in Minsk in 2009.

In addition, within this agreement two PhD students from BSU, Yuri Tsalkou and Aleksander Tarasenko, visited ICRANet. Two undergraduate students at the Department of Theoretical Physics and Astrophysics of BSU, Svetlana Vlasenko and Ivan Rybak, were supervised by Dr. Gregory Vereshchagin in their course works. Dr. Mikalai Prakapenia has defended his Ph.D. thesis under the supervision of Prof. Gregory Vereshchagin in 2020.

Belarusian State University

Agreement ICRANet - BSU

Rector
Andrei Karol

Signatories
Prof. Sergey V. Ablameyko
Prof. Alexander Gorbatsevich

Contact person
Prof. Alexander Gorbatsevich

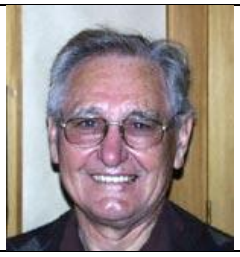
ONGOING AND PREVIOUS ACTIVITIES

Joint Activities

THE SUN, THE STAR, THE UNIVERSE AND GENERAL RELATIVITY The International Conference in Honor of Ya. B. Zeldovich 95th Anniversary

Belarusian State University, Minsk, Belarus, April 20-23, 2009

Visiting Professors to BSU

	**Dr. Alexei Aksenov** Participation in the: · *Zeldovich meeting*, 20-23 April 2009		**Prof. Hagen Kleinert** Participation in the: · *Zeldovich meeting*, 20-23 April 2009
	**Prof. Vladimir Belinski** Participation in the: · *Zeldovich meeting*, 20-23 April 2009		**Prof. Vladimir Popov** Participation in the: · *Zeldovich-100 Meeting*, 10-14 March 2014
	**Prof. Sandip Kumar Chakrabarti** Participation in the: · *Zeldovich meeting*, 20-23 April 2009		**Prof. Remo Ruffini - ICRANet Director**
	**Prof. Jaan Einasto** Participation in the: · *Zeldovich meeting*, 20-23 April 2009		**Prof. Gregory Vereshchagin**
	**Prof. Roy Patrick Kerr** Participation in the: · *Zeldovich meeting*, 20-23 April 2009		**Prof. She-Sheng Xue** Participation in the: · *Zeldovich meeting*, 20-23 April 2009

THE COOPERATION AGREEMENT
BETWEEN
INTERNATIONAL CENTER FOR RELATIVISTIC ASTROPHYSICS NETWORK
IN PESCARA, ITALY
AND THE BELARUSIAN STATE UNIVERSITY IN MINSK, BELARUS

International Center for Relativistic Astrophysics Network - ICRANet in Pescara (Italy) and the Belarusian State University (the Republic of Belarus), hereinafter referred to as 'Parties', having an intention to further deepen the scientific and research cooperation, have decided to sign the present Agreement.

Article 1

The participants in the implementation of the Cooperation Agreement from the Italian side will be:
ICRANet Coordinating Center in Pescara, Italy
and from the Belarusian side:
Belarusian State University in Minsk, Belarus

Article 2

The scientific and research cooperation will include:
1. Conducting joint research on scientific issues of interest to both Parties,
2. Arranging bilateral seminars,
3. Exchange of expertise between research and educational staff,
4. Publication of joint scientific works in international journals,
5. Exchange of publications, manuals and course books.

Article 3

1. The Parties will conduct the exchange of academic staff and students by means of formal letters of invitation. The invitations will be sent by the Director of ICRANet and the Rector of Belarusian State University.
2. The aim of the academic staff and students exchange is: participation in scientific conferences, seminars, symposiums as well as exchange of expertise, methodological training and joint discussions on up-to-date scientific issues of interest to both Parties.
3. By norm the exchange program will be done on reciprocal basis. All the travel expenses will be paid by the home institutions, while the local expenses will be paid by the receiving institutions. Motivated exceptions can be allowed.
4. Detailed conditions of realization of cooperation agreement and especially with regards to methods of financing, plan of exchanges of the academic staff and students of both parties will be specified in an Attachment to this Agreement.

Article 4

The present Agreement shall remain in force for five years, and will be automatically renovated for an equal period barring communication by either of the Parties, at least three months before the expiry of the Agreement, of its intention to withdraw the Agreement. Once signed, Agreement does not exclude a possibility of undertaking other cooperative activities which may be subject to annex to the present Agreement. Any changes in the content of the Agreement, as well as in the particular stages of joint activities, may only be performed in the written form with the approval of both Parties.

Article 5

The present Agreement is signed in two copies in English, and two copies in Russian, both texts are legally

valid. The two Parties receive one copy in either language.

Article 6

All disputes which might arise from this Agreement shall be resolved by the Director of ICRANet and Rector of the Belarusian State University, or by the persons authorized by them on the basis of the powers of attorney granted in writing in the process of the conciliation procedure.

Article 7

This Agreement shall be in force from the date of signing by both Parties

Agreement approved by:

International Center for Relativistic Astrophysics Network

Signature _____

Prof. Remo Ruffini

Belarusian State University

Signature _____

Prof. Sergey V. Ablameyko

Co-ordinators of the Co-operation

Signature _____

Dr. Gregory V. Vereshchagin

"26" August 2013

Signature _____

(Prof. Gorbatsevich A.K.)

"26" August 2013

Contact details of the Parties

International Center for Relativistic Astrophysics Network
P.le della Repubblica, 10, Pescara, Italy 65122
tel: +39-085-23054 / fax: +39-085-4219252
email: ruffini@icra.it

Belarusian State University
4, Nezavisimosti Ave., 220030,
Minsk, Belarus
tel./fax: +375-17-209-54-45
email: ablameyko@bsu.by

National Academy of Sciences of Belarus

ICRANet-NASB Agreement

Annex to Cooperation Agreement

The Chairman of NASB Presidium
Vladimir G. GUSAKOV

Signatories of Agreement
Prof. Sergei Ya. KILIN
Prof. Yuri A. Kurochkin

Signatories of Annex
Prof. Vladimir G. GUSAKOV

Contact person
Prof. Sergei Ya. KILIN
Dr. Mikalai Prakapenia

ONGOING AND PREVIOUS ACTIVITIES

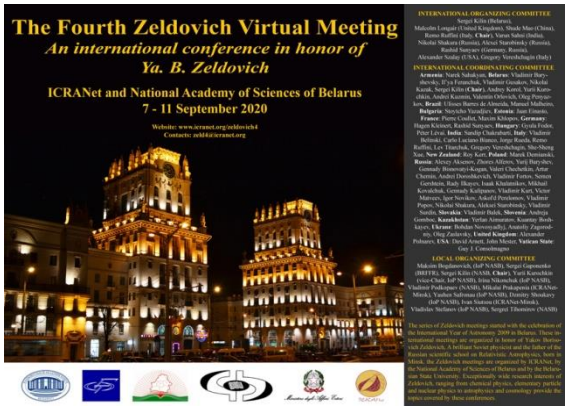
Zeldovich-100 Meeting
Minsk (Belarus)
March 11-14, 2014

ICRANet-Minsk workshop
Minsk (Belarus)
April 26-28, 2017

The Third Zeldovich meeting

Minsk (Belarus)

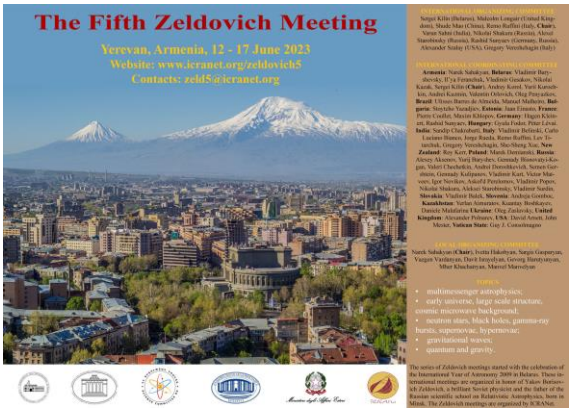
April 23-27, 2018



The Forth Zeldovich meeting

virtual meeting

September 7-11, 2020



The Fifth Zeldovich meeting

Yerevan (Armenia)

June 12-17, 2023

ICRANet-Minsk center

Dr. Stanislav Komarov
Current position: Senior Lecturer, Belarusian State University
researcher at ICRANet-Minsk
Visits in ICRANet-Pescara:
From 9 to 30 of May, 2022
Seminar: “Spectrum of electromagnetic radiation of a particle, falling into Schwarzschild black hole”

Dr. Mikalai Prakapenia
Current position: Researcher at ICRANet-Minsk
Senior lecturer, Belarusian State University
Adjunct professor at ICRANet
Visits in ICRANet-Pescara:
From 1 to 27 of July 2018
Seminar: "Thermalization of electron-positron plasma with quantum degeneracy"
From 17 to 26 of September 2019
From 5 to 16 of December 2022

Dr. Vladislav Stefanov
Current position: Scientific secretary at ICRANet-Minsk

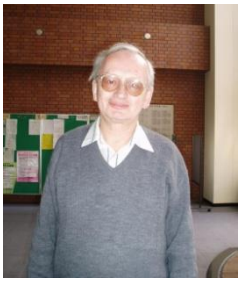
Prof. Gregory Vereshchagin
Current position: professor at ICRANet (Pescara, Italy)
Visiting researcher at ICRANet-Minsk

Visiting Professors to NASB

Prof. Vladimir Belinski
Participation in the:
· *Zeldovich-100 Meeting*, 10-14 March 2014

Prof. Remo Ruffini - ICRANet Director

Prof. Sandip Kumar Chakrabarti
Participation in the:
· *Zeldovich-100 Meeting*, 10-14 March 2014



Prof. Alexei Starobinsky
Participation in the:
· *Zeldovich-100 Meeting*, 10-14 March 2014

Prof. Valeri Chechetkin
Participation in the:
· *Zeldovich-100 Meeting*, 10-14 March 2014

Prof. Lev Titarchuk
Participation in the:
· *Zeldovich-100 Meeting*, 10-14 March 2014

Dr. Marco Muccino
Participation in the:
· *Zeldovich-100 Meeting*, 10-14 March 2014

Prof. Gregory Vereshchagin

Visiting Professors from NASB

Academician Sergei KILIN
Visiting Professor at ICRANet
From 15 to 17 of December 2019

Prof. Yuri Vyblyi
Visiting Professor at ICRANet
From 4 to 22 of September 2017
From 5 to 15 of August 2019

Cooperation with the National Academy of Sciences of Belarus

On September 6, 2013 a Cooperation Agreement between ICRANet and the National Academy of Sciences of Belarus (NASB) was signed by the director of ICRANet, prof. Remo Ruffini, and the Chief Scientific Secretary of NASB, prof. Sergei Kilin.

Within this agreement ICRANet has organized together with NASB the Zeldovich-100 meeting in Minsk in 2014. The 3rd Zeldovich meeting was held in NASB in 2018.

In addition, a student from Belarus, Ivan Siutsou, was enrolled in the IRAP PhD program and successfully defended his thesis in 2013, receiving his PhD degree in relativistic astrophysics from all Universities participating in the program. He has spent two years in Rio de Janeiro, Brazil, with a post-doc position within the ICRANet-CAPES program. From 2017 to 2021 he has been a researcher in ICRANet-Minsk.

ICRANet-Minsk center

On July 18, 2016 an Annex to the Cooperation Agreement between ICRANet and NASB was signed by the director of ICRANet, prof. Remo Ruffini, and the Chairman of NASB Presidium, prof. Vladimir Gusakov in Minsk, Belarus.

Fig. 2. Signature of the Annex to the Cooperation Agreement between ICRANet and NASB by the director of ICRANet, prof. Remo Ruffini, and Chairman of the Presidium of NASB, prof. Vladimir Gusakov. Minsk, 2016.

This document brought the collaboration between ICRANet and NASB to a new level and led to creation in Belarus of an ICRANet international academic center, ICRANet-Minsk. The ICRANet-Minsk center aims fostering scientific research in relativistic astrophysics, gravitation and cosmology in Belarus. The center is funded within the Belarusian state scientific program "Convergence", subprogram "Microworld and Universe" and it is located at the Stepanov Institute of Physics of NASB.

Fig. 3. Opening of ICRANet-Minsk center at the B.I. Stepanov Institute of Physics, 2017.

The staff of ICRANet-Minsk center includes the director, Academician Sergei Kilin and researchers: Dr. Mikalai Prakapenia, Dr. Vladislav Stefanov and Dr. Stanislav Komarov.

Dr. Mikalai Prakapenia completed his PhD studies at the department of theoretical physics and astrophysics of the Belarusian State University under the supervision of Dr. Gregory Vereshchagin and successfully defended his thesis in 2020. In addition, Dr. Stanislav Komarov and Dr. Vladislav Stefanov, both defended their PhD in 2020 and joined ICRANet-Minsk.

The scientific activities of ICRANet-Minsk center are coordinated by ICRANet and one of the ICRANet faculty members Dr. Gregory Vereshchagin is a frequent visitor at ICRANet-Minsk.

In 2017 ICRANet-Minsk center has organized the first workshop on high energy astrophysics in Belarus. It was a parallel meeting to a larger symposium BelINP-2017 on nuclear physics at the National Academy of Sciences of Belarus. This workshop was an opportunity for young scientists working in relativistic astrophysics from European and Asian countries to exchange experience and to present results in their fields to the Belarusian scientists. This event was organized within the 2017 Year of Science, declared by the Presidential decree.

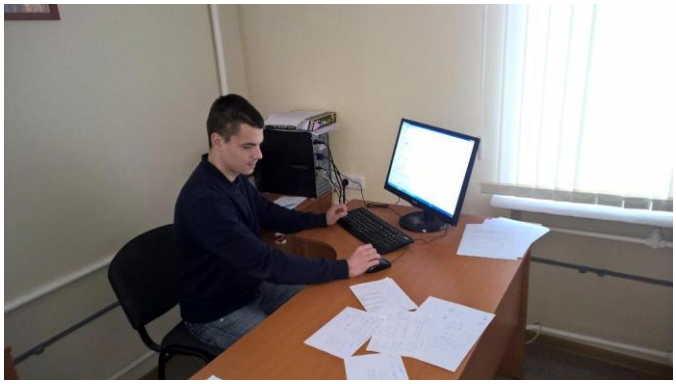


Fig. 4. Mikalai Prakapenia working at ICRANet-Minsk.

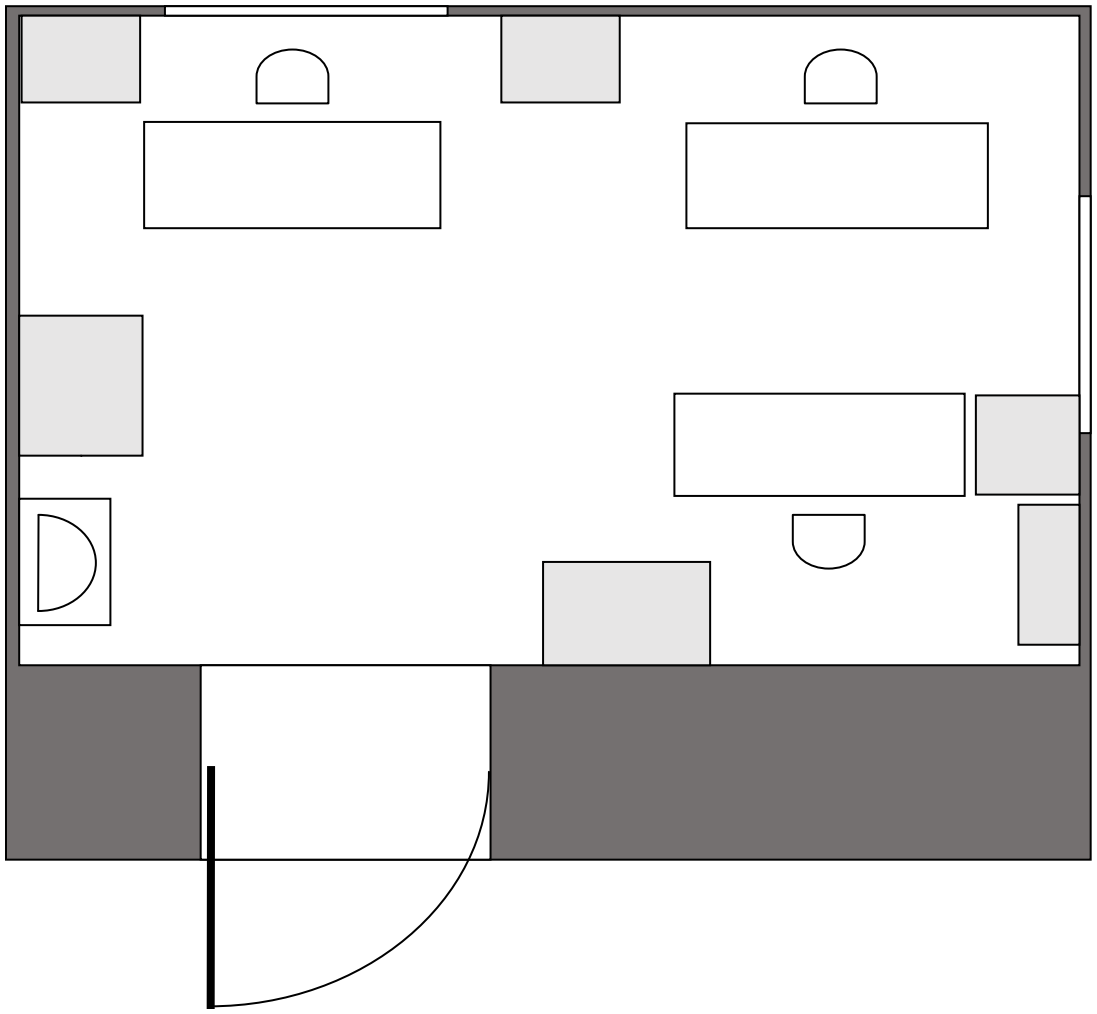
In 2021 Dr. Mikalai Prakapenia has initiated two novel lecture courses for the graduate students of the Belarusian State University:

1. Relativistic astrophysics, 4^{th} year, 50 hours.
2. Relativistic kinetics, 5^{th} year, 108 hours.

Both these course are introduced in Belarus for the first time. They open a possibility for the students of the Belarusian State University to follow the most recent development these active fields of research. The development of these lecture courses was essentially done in collaboration with ICRANet.

ICRANet-Minsk center is supported within the joint ICRANet-BRFFR funding program since 2017.

ICRANet-Minsk
Room 474 of the B.I. Stepanov Institute of Physics of the National Academy of Sciences of Belarus



Belarusian scientists visiting ICRANet

The collaboration agreements between ICRANet and the National Academy of Sciences of Belarus allows organization of exchange of scientific staff: Belarusian scientists visited ICRANet and ICRANet scientists visited Belarus.

- **Dr. Ivan Siutsou**
  Current position: Researcher at ICRANet-Minsk
  Previous positions: CAPES-ICRANet post-doc at CBPF 2014-2016
  Visited ICRANet in Pescara (Italy):
  From 2 to 31 May 2017
  From 15 September to 15 October 2017 (supported by MOST program, an EU funded project for enhancing professional contacts between Belarus and the EU)
  From 24 September to 22 October 2018

- **Dr. Stanislav Komarov**
  Current Position: Lecturer at the Belarusian State University
  Visited ICRANet in Pescara (Italy):
  From 9 to 30 of May 2022

- **Mikalai Prakapenia**
  Current position: Researcher at ICRANet-Minsk, lecturer at the Belarusian State University
  Visited ICRANet in Pescara (Italy):
  From 1 to 27 of July 2018.
  From 17 to 26 of September 2019.
  From 5 to 16 of December, 2022.

ICRANet scientists visiting Belarus

- **Prof. Remo Ruffini**
  Current position: Director of ICRANet, Italy
  Frequent visits to NASB in Minsk, Belarus: April 2017; July 2017; April 2018.

- **Prof. Gregory Vereshchagin**
  Current position: Faculty professor at ICRANet, Italy
  Frequent visits to NASB in Minsk, Belarus: April 2017; October 2017; December 2017; April 2018; August 2018; August 2021; August 2022.

- **Prof. Jorge Rueda**
  Current position: Faculty professor at ICRANet, Italy
  Visit to NASB in Minsk, Belarus: April 2018.

NASB scientists visiting ICRANet

- **Academician Sergei Kilin**
  Current position: Deputy chairman of the Presidium of NASB
  Visits to ICRANet: From 15 to 17 of December 2019

- **Prof. Yuri Vyblyi**
  Current position: leading researcher at the B.I. Stepanov Institute of Physics of NASB
  Visits to ICRANet: From 4 to 22 of September 2017 and from 5 to 15 of August 2019.

Publications with affiliation to ICRANet-Minsk

- G.V. Vereshchagin, "Cosmic horizon for GeV sources and photon-photon scattering", Astrophysics and Space Science 363:29 (2018).
- V.A. Belinski, G.V. Vereshchagin, "On the cosmological gravitational waves and cosmological distances", Physics Letters B, Volume 778 (2018) 332-338.
- N. O. Prokopenya, I. A. Siutsou, G. V. Vereshchagin, "Numerical scheme for treatment of Uehling-Uhlenbeck equation for two-particle interactions in relativistic plasma", J. Comput. Phys. 373 (2018) 533-544.
- N. O. Prokopenya, I. A. Siutsou, G. V. Vereshchagin, "Thermalization of electron-positron plasma with quantum degeneracy", Physics Letters A 383 (2019) 306-310.
- Suzana Bedic and G. V. Vereshchagin, "Probability of inflation in Loop Quantum Cosmology", Phys. Rev. D 99 (2019) 043512.
- R. Ruffini, J. D. Melon Fuksman and G. V. Vereshchagin, "On the Role of a Cavity in the Hypernova Ejecta of GRB 190114C", The Astrophysical Journal, Vol. 884, Issue 1 (2019) article id. 191.
- M. A. Prakapenia and G. V. Vereshchagin, "Bose-Einstein condensation in relativistic plasma" EPL, 128 (2019) 50002.
- V. Stefanov, I. Siutsou, and D. Mogilevtsev, "Gravitational dephasing in spontaneous emission of atomic ensembles in timed Dicke states" PRD 101, 044042 (2020).
- I. A. Siutsou and G. V. Vereshchagin, "Diffusive photospheres in gamma-ray bursts" MNRAS 494, (2020) 1463-1469.
- M.A. Prakapenia and G.V. Vereshchagin, "Pauli blocking effects in thermalization of relativistic plasma", Phys. Lett. A, Vol. 384 (2020) 126679.
- V. P. Stefanov, "Conditional Disappearance of Gravitational Dephasing in Multilevel Atomic Systems", Journal of Applied Spectroscopy, 87 (2020) pp. 641-646.
- M. A. Prakapenia, I. A. Siutsou and G. V. Vereshchagin, "Numerical scheme for evaluating the collision integrals for triple interactions in relativistic plasma", Phys. Plasmas 27, 113302 (2020) pp. 1-10.
- M. A. Prakapenia and G. V. Vereshchagin, "Reaction Rates of Three-Particle Interactions in Relativistic Plasma", Astronomy Reports 65 (2021) 1011.
- Gregory Vereshchagin, Liang Li and Damien Bégué, "Is magnetically dominated outflow required to explain GRBs?", MNRAS Volume 512 (2022), pp.4846-4851.
- Gregory Vereshchagin and Mikalai Prakapenia, "Kinetics of Degenerate Electron–Positron Plasmas", Universe 2022, 8, 473.

Zeldovich Meetings

ICRANet has initiated a series of international meetings in Minsk, Belarus, celebrating Yakov Borisovich Zeldovich, the famous Soviet physicist and astrophysicist.

From 1943, Zel'dovich played a crucial role in the development of the Soviet Union's nuclear bomb project. From 1963, he turned to cosmology and astrophysics, with pioneering contributions to these fields. He is known as a founder of the Russian school of Relativistic Astrophysics.

Exceptionally wide research interests of Ya. B. Zeldovich ranging from chemical physics, elementary particle and nuclear physics to astrophysics and cosmology provide the topics to be covered at these conferences:

- Early cosmology, large scale structure, cosmic microwave background;
- Neutron stars, black holes, gamma-ray bursts, supernovae, hypernovae;
- Ultra high energy particles;
- Gravitational waves.

Fig. 5. Prof. Remo Ruffini with close collaborators of Ya. B. Zeldovich in front of his monument in Minsk, 2014.

From 2009 to 2018 three international meetings in honor of Ya. B. Zeldovich have been organized in Belarus by ICRANet and co-sponsored by ICRANet, NASB, BSU, and the Central European Initiative.

Many participants at these conferences are the members of the world-famous scientific school in astrophysics and cosmology, founded by Ya. B. Zeldovich, who are leading scientists in these fields in many countries worldwide including Germany, France, Italy, UK, USA and Russia.

The First Zeldovich meeting, 2009

Fig. 6. Participants of the First Zeldovich meeting in Minsk, 2009.

In 2009, within the celebration of the International Year of Astronomy, ICRANet organized the international conference, the First "Zeldovich meeting" in Minsk on April 20-23, 2009. Yakov Barosovich Zeldovich, the outstanding soviet scientist, was born in Minsk, Belarus, and the conference celebrated his 95th anniversary. The conference has created a stimulating environment for scientific exchange and contacts between scientists in the West, those coming from the great Russian school of Zeldovich, and local scientist from Belarus. Such internationally renowned scientists as Roy Kerr, Hagen Kleinert, Nikolay Shakura attended the conference and presented talks there. In addition, a memorable public lectures were given by Remo Ruffini, Gregory Vereshchagin and Vladimir Kurt, as well as a round table with participation of Zeldovich collaborators such as Vladimir Belinski, Valeri Chechetkin, Jaan Einasto, Vladimir Kurt, Vladimir Popov, and Nikolai Shakura, was organized. The proceeding of the meeting were published by the American Institute of Physics, in volume 1205 of AIP conference proceedings.

The Second Zeldovich meeting, 2014

In 2014, the 100th anniversary of Yakov Barosovich Zeldovich was celebrated with many international conferences. The first international meeting in this series was the Second Zeldovich meeting in Minsk. Many of the lecturers at the conference were the closest former collaborators of Ya. B. Zeldovich. Many young researchers took part in the meeting. In particular, the students from International Relativistic Astrophysics PhD program, including both CAPES-ICRANet and Erasmus Mundus program, participated in the conference and presented results of their scientific work. The conference was jointly organized by ICRANet and the National Academy of Sciences of Belarus. The opening address was given by Nobel Laureate prof. Zhores Ivanovich Alferov and by Prof. Remo Ruffini. There were more than 80 participants, nationals of Argentina, Armenia, Belarus, Brazil, China, Germany, India, Italy, Kazakhstan, Poland, Russia, and other countries. The conference covered many topics including cosmology, relativistic astrophysics, general relativity, elementary particle and nuclear physics, detonations and explosions.

Fig. 8. Nobel Laureate prof. Zhores Alferov addresses participants of the Second Zeldovich meeting in Minsk, 2017.

Fig. 7. Participants to the Second Zeldovich meeting in Minsk, 2014.

Plenary papers are published in the leading Russian journal on astronomy and astrophysics, Astronomy Reports, vol. Volume 59, Issues 6 and 7. Regular contributions are published in special open access issue of Nonlinear Phenomena in Complex Systems, Vol. 17 No 4 (2014).

The Third Zeldovich meeting, 2018

Fig. 9. Participants to the Third Zeldovich meeting in Minsk, 2018.

The Third Zeldovich meeting was held in April 23-27, 2018 in Minsk, Belarus. The conference was jointly organized by ICRANet and the National Academy of Sciences of Belarus. The meeting was sponsored by these two organizations and by the Central European Initiative (CEI).

Fig. 10. Profs. Vladimir Fortov, Sergei Kilin, Remo Ruffini and Gregory Vereshchagin. The Third Zeldovich meeting in Minsk, 2018.

About 80 participants, nationals of Argentina, Armenia, Belarus, Bosnia and Herzegovina, China, Colombia, Germany, Hungary, Italy, Kazakhstan, Poland, Russia, Slovenia, Taiwan, Ukraine and other countries took part in the meeting.

The conference covered many topics including cosmology, relativistic astrophysics, general relativity, elementary particle and nuclear physics, detonations and explosions. This celebration was the third international conference in Minsk dedicated to Ya. B. Zeldovich. The previous meetings were held on 20-23 of April 2009 and was organized jointly by ICRANet and Belarusian State University celebrating also the 2009 Year of Astronomy, and on March 11-14, 2014 celebrating 100th anniversary of Ya. B. Zeldovich.

The Fourth Zeldovich meeting, 2020

The Fourth Zeldovich meeting was held on September 7-11, 2020. The meeting was originally scheduled for 20-24 April 2020, but due to COVID pandemic it was first postponed to September, and then converted into virtual format. It was organized jointly by ICRANet and the National Academy of Sciences of Belarus.

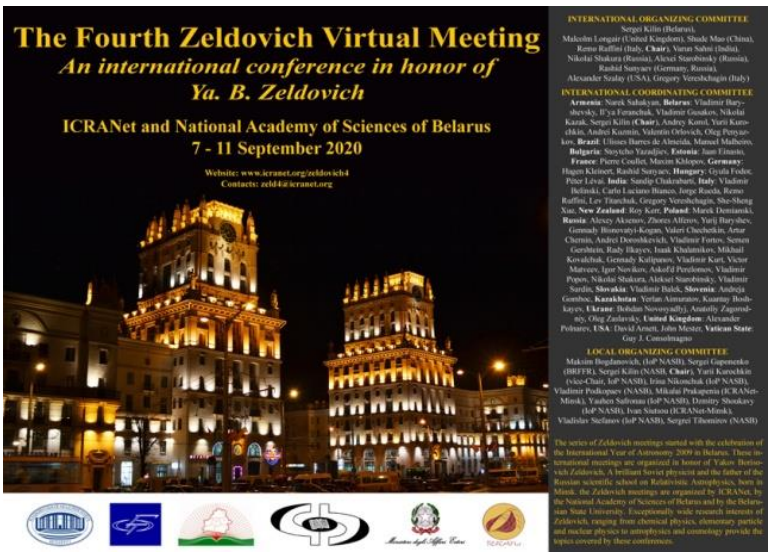


Fig. 11. The poster of the Fourth Zeldovich meeting.

The total number of participants registered at the meeting is 146 persons from all continents represented by the following countries: Argentina, Armenia, Belarus, Brazil, Chile, Columbia, China, Czech Republic, Denmark, Estonia, France, Germany, India, Iran, Italy, Netherlands, Pakistan, Poland, Russia, Romania, Moldova, South Africa, Ukraine, United Kingdom, United States. There were 90 talks among them 31 invited.

There were 90 talks among them 31 invited. Each day was divided in three sessions following the Central European Summer Time (CEST):

- Monday: Gravity, Gamma-ray bursts, General relativity and the quantum;
- Tuesday: The space missions, Magnetic fields, General relativity and alternative theories;
- Wednesday: Early Universe, Black hole horizons, Multi-messenger astrophysics;
- Thursday: Gravity, astrophysics and elementary particles, Large scale structure of the Universe, Sturburst and dark matter in the Universe;
- Friday: Exoplanets and astrobiology, Dark matter and dark energy, Supernovae and gravity.

The conference booklet and presentations are available from the conference website: http://www.icranet.org/zeldovich4.

The meeting was recorded and its contents is available on the ICRANet YouTube channel: https://www.youtube.com/playlist?list=PLr5RLbSWSonutlLDMpO1OnGV97rnCEdum

The proceedings of the meeting are published in Astronomy Reports in October 2021: https://link.springer.com/journal/11444/volumes-and-issues/65-10

The Fifth Zeldovich meeting, 2023

The Fifth Zeldovich meeting will be held on September 7-11, 2020. The meeting was originally scheduled for 20-24 April 2020, but due to COVID pandemic it was first postponed to September, and then converted into virtual format. It was organized jointly by ICRANet and the National Academy of Sciences of Belarus.

Fig. 12. The poster of the Fifth Zeldovich meeting.

The Fifth Zeldovich meeting, organized by ICRANet, is an international conference in honor of Ya. B. Zeldovich, which will be held in Yerevan (Armenia) on June 12-17, 2023.

The topics covered at the meeting will include: multimessenger astrophysics; early universe, large scale structure, cosmic microwave background; neutron stars, black holes, gamma-ray bursts, supernovae, hypernovae; gravitational waves; quantum and gravity.

The official website: www.icranet.org/zeldovich5.

The proceedings of this meeting will be again published by Astronomy Reports.

Invited speakers include:

Gennady Bisnovatyi-Kogan, Space Research Institute (IKI), Russia

Massimo Della Valle, Capodimonte Astronomical Observatory and INAF, Italy (TBC)

Marat Gilfanov, Max-Planck Institute for Astrophysics, Germany and IKI, Russia

Paolo Giommi, Italian Space Agency (ASI), Italy

Luca Izzo, Niels Bohr Institute, Denmark (TBC)

Michael Kramer, Max-Planck-Institut fuer Radioastronomie, Germany (TBC)

Jutta Kunz, University of Oldenburg, Germany (TBC)

Klaus Laemmerzahl, University Bremen, Germany

Di Li, National Astronomical Observatories of China, China

Ruoyu Liu, Nanjing University, China

Andrea Merloni, Max Planck Institute for extraterrestrial Physics, Germany (TBC)

Razmik Mirzoyan, Max-Planck-Institute for Physics, Germany

Tsvi Piran, The Hebrew University, Israel

Konstantin Postnov, Sternberg Astronomical Institute, Moscow State University, Russia

Rashid Sunyaev, Max-Planck Institute for Astrophysics, Germany and Space Research Institute (IKI), Russia (TBC)

Alexei Starobinsky, Landau Institute for Theoretical Physics, Russia

Lev Titarchuk, University di Ferrara, Italy and Astro Space Center, Lebedev Physical Institute, Russia

Nan Zhang, Institute of High Energy Physics, China

THE SUN, THE STARS, THE UNIVERSE AND GENERAL RELATIVITY

INTERNATIONAL CONFERENCE IN HONOR OF YA. B. ZELDOVICH'S 95th ANNIVERSARY

Minsk, Belarus 20-23 April 2009

EDITORS

Remo Ruffini
ICRANet
Pescara, Italy

Gregory Vereshchagin
ICRANet
Pescara, Italy

SPONSORING ORGANIZATIONS

BSU – Belarusian State University
CEI – Central European Initiative
ICRANet – International Center of Relativistic Astrophysics
ICTP – International Center for Theoretical Physics

AIP American Institute of Physics

Melville, New York, 2010
AIP CONFERENCE PROCEEDINGS ▮ 1205

CONTENTS

Moments with Yakov Borisovich Zeldovich

Remo Ruffini

ICRANet, p.le della Repubblica, 10 - 65122 Pescara, Italy and
ICRA and University of Rome "Sapienza", p. Aldo Moro 5, I-00185, Rome, Italy and
ICRANet, University of Nice-Sophia Antipolis, 28 avenue de Valrose, 06103 Nice Cedex 2, France

Abstract. A recollection of special moments spent with Yakov Borisovich Zeldovich and with the scientists of Soviet Union and abroad.

The first impression upon meeting a person is the one which characterizes all subsequent interactions.

I met Yakov Borisovich Zeldovich for the first time in 1968 at the GR5 meeting in Tbilisi. I had known his name from his two classic papers on relativistic astrophysics in Physics Uspekhi coauthored with Igor Novikov [1, 2]. There had been a strong impulse to boycott the GR5 meeting due to the tense relations over human rights between the Soviet Union and the USA at that time. Finally a small group around Johnny Wheeler decided to participate. Among them were Arthur Komar, Bruce Partridge, Abe Taub and myself.

It was also my first visit to the Soviet Union. The entrance to Leningrad was already very special showing the difference in organization from our Western world. I will recall elsewhere some of the anecdotes. It was in the airplane to Tbilisi that a very particular experience occurred. The year 1968 was a time in which dissent was growing in the Soviet Union and the New York Times had just written an article on Andrei Sakharov and his reflections on peaceful coexistence and intellectual freedom. I boarded the plane for Tbilisi with Arthur Komar. We sat in the last row of a quite modern jet plane with open seats and shining windows, and we were commenting and laughing on all those stories we had heard in the West about windowless seats reserved for westerners on Soviet planes. When the plane was almost full the stewardess called the names of Arthur Komar and Remo Ruffini asked us to move to seats reserved for us in the front of the plane. We were delighted and we considered this an honor. Our two seats were in a line of three seats ... the only ones in the plane without a window. We were quite upset. In between us there was a third person who did not seem to speak English. So we started complaining about these methods and commenting appropriately also about Sakharov's recent opinions as presented in the New York Times and asking ourselves about the fate of Sakharov after his open statements. The plane was supposed to be a direct flight to Tbilisi of approximately seven hours. After approximately three hours of flight, without any announcement, the plane abruptly started to descend quite rapidly and landed in a town called Mineralnye Vody. After landing there was a lot of confusion, there were additional planes and finally it was disclosed that, as a common practice in the Soviet Union in the presence of bad weather, the plane had stopped and we would continue the flight the morning after. It was also announced that for foreigners there would be *a* room to sleep. Soon after I realized that there was only one room for all the foreigners! Since it was impossible to sleep I went back to the airport hall and I noticed this person who had been sitting between me and Komar on the plane to be alone in the hall and had found a chair. He was seating quietly waiting for the morning. I was attracted by his silence and his self-control. I approached him introducing myself: "Ruffini, Italy." To this his answer: "Sakharov, Soviet Union!" I still remember his serene smile. He was the first Soviet scientist I met on the way to our meeting in Tbilisi. The arrival in Tbilisi with Kumar and Sakharov was marked by the fortunate encounter with other monumental scientific figures.

We had the marvelous opportunity to meet some historical figures like Vladimir Fock, Iosif Shklovsky and Alexei Petrov and also Dmitry Ivanenko. It was amusing to see the ceremonial relations between Fock and Ivanenko. Fock, who as expected was always in the first row, had a conspicuous auditorial "apparat." Every time Ivanenko was taking the floor to speak, Fock was disconnecting his "apparat" with a very explicit gesture. In addition of course there was Yakov Borisovich surrounded by a large number of then young collaborators including Gennady Bisnovatyi-Kogan, Valery Chechetkin, Viktor Shvartsman, Nikolay Shakura, Alexei Starobinsky, Rashid Sunyaev, Sergei Shandarin and others. Zeldovich was encouraging all his students to attack in their scientific presentations almost like a boxer ring trainer.

The first day of the meeting Zeldovich invited me to lunch and asked me just at the beginning to speak about my research. I started to explain my work on self-gravitating bosons I had started in Rome and just recon-

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Figure 1. Solvay meeting of 1933. The series of photos from the Solvay meetings has been kindly given to ICRANet by Jacques Solvay, the descendant of Ernest Solvay in occasion of the assignment of the Marcel Grossman award to the Solvay foundation. Gamow is on the last row, perfectly symmetric with respect to other participants.

sidered after an interaction with the Pascual Jordan group in Hamburg. Indeed it was there that we realized that the previous treatment on Einstein-Klein-Gordon fields had a fatal error in the energy-momentum tensor leading to meaningless results. Later the correct work was completed by myself at Princeton and the published paper [3] became known as the paper in which the new concept of Boson Stars was introduced. After my first words Yakov Borisovich stopped me. I asked why. He stated "How long did you speak?" I answered "approximately forty seconds." To that he replied "If Landau would have been here he would have stopped you after twenty seconds." To that I immediately replied somewhat amused and self-confident "I do not think so, I am sure Landau would have said how new is this idea and he would have approved my considerations." He followed then my presentation of the new results and more polite and constructive discussions followed for the rest of the lunch. We also talked about George Gamow. Zeldovich recalled the animosity of all Soviet physicists towards Gamow since he did not return to Moscow after the famous Solvay meeting of 1933, see figure 1. By this action Gamow hampered the possibility for all Soviet physicists to travel abroad after that date. He recalled how he was motivated by a matter of pure confrontation against Gamow for some time. As soon as Gamow presented the theory of a hot universe he himself presented an alternative theory of a cold universe, initially at zero temperature [4]. The process of building up heavy elements was stopped in his theory by the presence of a degenerate sea neutrinos and only hydrogen would be born from an expanding Friedman universe. He stressed again, how building such a theory was motivated ideologically and politically. He recognized the crucial role of the Penzias and Wilson discovery of the cosmic microwave background radiation which disproved his 'political' theory and proved instead the validity of Gamow's theory[1]. He finally con-

[1] I have made recollection of all this in a recent publication in [5].

cluded "Yes: although Gamow made many mistakes he is one of the greatest Soviet scientists!" And then recalling the fundamental contributions Gamow made to the understanding of the DNA structure he asked: "How many Nobel prizes did Gamow receive? Two?" I answered: "None." And I was surprised how distant he was from our world.

Paradoxically the work of neutrinos in cosmology was later reproposed by Viktor Shvartsman [6] by considering the role of the many neutrino species and in general to the number of "difficult to observe particles with zero rest mass". In that paper Viktor, see figure 2 established his classical result of an upper limit to the number of neutrino species $N_\nu \leq 3$ assuming that the chemical potential of the electron neutrino be zero. This result signed a new

Figure 2. Picture of Viktor Shvartsman taken by myself in Moscow in 1975. Among the students of Zeldovich I was most impressed by Viktor. We reproduced one of his fundamental works in one of our book [22]. It was clear to all of us that his isolation in the Caucasian mountains, so far from the world of Moscow and the world of theoretical research he was so strongly aiming for, was a key factor in the tragic epilogue of his life.

beginning in the dark matter problem in the Universe. I myself worked later on the role of massive neutrinos in cosmology. I considered their fundamental role both in cosmological nucleosynthesis [7] and in formation of the structure in the Universe due to dark matter, leading to a fractal structure of the Universe [8].

But let us go back to Zeldovich: we became very good friends in the following years, and I regularly met him in Moscow. We had also the great pleasure to share so many common friends. In particular, I remember many interactions with Bruno Pontecorvo, see figure 3. In particular,

Figure 3. Picture taken by myself in an unplanned visit to an hospital in Moscow. On the left side Zeldovich, on the right side Pontecorvo.

with the participation of Bruno and Italian television we produced a documentary "Il caso neutrino" recovering the fundamental moments of the discovery of the neutrino all the way to the determination of their mass and their role in cosmology [9].

Since 1973 I had the great fortune to become a very close friend of Evgeny Lifshitz. He had just granted to me and John Wheeler the honor of being quoted in a named exercise in the volume "Theory of Fields" of his classic series with Landau. As we became more familiar with Evgeny, I developed a profound admiration of his intellectual abilities, of his understanding of physics and of his moral stature. Evgeny often recalled a series of anecdotes. One of the best aphorisms of Landau: "Astrophysicists often in error, never in doubt," and a different one related not only to astrophysicists but to physicists at large: "Due to the shortness of our lives we cannot afford the luxury to spend time on topics which are not promising successful new results". It was Evgeny who made me aware of some additional peculiarities in Zeldovich's character.

Lifshitz described that famous argument on the equation of state of neutron stars. Zeldovich first challenged the concept of the critical mass of the neutron star using an ad hoc model of supranuclear density interaction [10]. He had then purported the possibility of having an equation of state with the speed of sound equal to the speed of light, see [11]. Lifshitz then recalled that Landau did not want "to offend" the intelligence of colleague physicists. If an issue was very difficult and important he would explain this issue. In other cases he was not going to explain and would ask the person to answer himself. In the specific case of the extreme equation of state

Figure 4. The picture of Li-Zhi Fang with his wife, myself, Leopold Halpern, Volodia Belinski and his wife at the Rimini Meeting of CL of 1991.

Figure 5. Dinner at Lifshitz home in Moscow (circa 1985). At the center Evgeny Lifshitz and, on his left, Zeldovich and Vitaly Ginzburg with their wifes. Picture taken by my wife Anna Imponente.

Figure 6. Picture taken by myself.

$p = \rho$ of Zeldovich he simply told him "wrong!", and to Zeldovich's request "why?" he simply answered "you find out." This was before the tragic Landau car accident. After the accident Landau was no longer in any condition to give a proof of the statement, and Zeldovich was unable to give a proof either. One day at the restaurant of the Academy in Leninsky Prospect, Yakov Borisovich asked Evgeny in my presence "Why you did not insert my equation of state in the Landau and Lifshitz book?"

Figure 7. Ya. B. Zeldovich monument in Minsk in front of National Academy of Sciences of Belarus.

Figure 8. The picture of George Coyne and myself greeting John Paul II.

To this Lifshitz replied "Did you solve the problem assigned by Landau?", and to that Zeldovich said "No.", and to that Lifshitz's answer was "Then I do not quote the result in the Landau and Lifshitz book."

Figure 9. I look with terror Zeldovich approaching the Pope John Paul II clearly with an unidentified object disguised under his jacket.

Figure 10. Zeldovich presenting his books to Pope John Paul II.

Figure 11. Zeldovich after the presentation of his books. To the offering of the books the Pope said "Thanks" and Zeldovich very loudly shouted "Not just 'thanks' ! These are fifty years of my work!" The Pope kept Zeldovich's collected papers under his arm during the entire rest of the audience.

My visit to Moscow was specially joyful due to the interactions with so many extraordinary scientists like Aleksandr Prokhorov, Isaac Khalatnikov, Pavel Cherenkov, Vitaly Ginzburg and others kindly invited to lunch with me in the Italian Embassy by the then Italian ambassador Sergio Romano and his predecessors. Encounter with Khalatnikov was especially productive. Khalat was the founder of the Landau Institute. However, among the others faculty members was Vladimir Belinski. The friendship with Lifshitz and Khalat soon extended to Volodia. So much so, that it transfered to Italy with his wife Elena, see figure 4, and became Italian citizen and one of the first faculty members of the newly founded ICRANet since 2005. Also extremely pleasant were the meetings at Yevgeny's home with friends and their wives, see figures 5 and 6. One very special occasion took place in Moscow. One day I was visiting Yakov Borisovich in his Institute. He said "Come and see a present I received from my friends in Minsk, where I was born." And he showed me a bronze statue of him-

Figure 12. Picture of Wheeler, Christodoulou and myself in Fine Hall in Princeton in the former office of Albert Einstein. The picture is taken in front of the fireplace where Einstein wrote with charcle, and now is engraved in gothic scripture in the marble, the famous sentence "Raffiniert ist der HerrGott, aber boshaft ist er nicht".

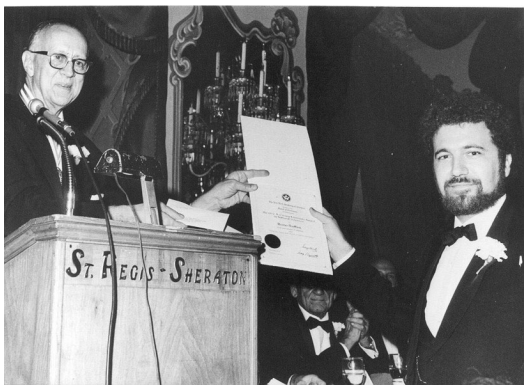

Figure 13. Receiving the Cressy Morrison Award of the New York Academy of Sciences in 1972.

Figure 14. Solvay meeting of 1973.

self. I told him "Congratulations, I can finally say that I have a friend with the bronze face!" using the Italian meaning "faccia di bronzo" which are not very complementary words addressed to someone who is insensitive to problems. Full of these memories I was delighted to see in the city of Minsk, now reconstructed and rebuilt, in the serenity of the spring his statue in form of a monument in front of the Academy of Sciences, see figure 7.

In 1985 I decided to create an international consortium dedicated to the field of relativistic astrophysics, the International Center for Relativistic Astrophysics (ICRA). This consortium relates the University of Rome "La Sapienza" to the University of Stanford, and the Space Telescope Institute at the USA, the University of Science and Technology in Hofei, China, the Specola Vaticana and the ICTP. It was coherently founded by George Coyne, Li-Zhi Fang, Francis Everitt, Riccardo Giacconi, Abdus Salam, and myself, see figure 8.

The most unique occasion with Zeldovich came in 1986 in Rome during the visit of the four delegations of the space research program of Europe, Japan, Soviet Union and the USA in occasion of the Halley comet mission. ICRA organized the meeting at "La Sapienza" and the Vatican. It was the first time Zeldovich could come to the West as a member of a very exceptional delegation created by Roald Sagdeev for this epochal meeting. There are many anecdotes with Zeldovich being shocked by a number of cars in the Italian streets and proposing to help himself with one since in his opinion it would be impossible to trace back the real owner. I did successfully convince him no to proceed in such an idea. Entering in the "Sala Regia" in the Vatican he attempted to seat in the first row and to my request to take his assigned seat in the 21st row seeing all the remaining ones still empty he said "Nobody will notice me in the first row." I insisted that he should come back to the seat assigned to him by the Vatican ceremonial office. After few minutes he realized that the first rows were occupied on one side by the cardinals, the bishops and personnel

of the Vatican, and on the other side by the ambassadors to the Vatican all in their sumptuous vests. Certainly the presence of Zeldovich in the first row would have been quite obvious and unjustifiable! But the surprises were not yet over. I was supposed to introduce him to the Pope during the audience with the members of the delegations. And I saw Zeldovich approaching with a clearly large object under his jacket. I was terrified, see figure 9.

Suddenly Zeldovich opened the jacket in front of John Paul II, extracted two books and put them into the hands of the Pope John Paul II, see figure 10. His holiness said "Thank you very much, professor Zeldovich", and to this with a very loud voice which penetrated the entire "Sala Regia" Zeldovich forcefully replied "Not just 'thanks'! These are fifty years of my work!" There was a great laugh from everybody as they relaxed. Later on John Paul II recalled that this was one of joyful audiences he had ever had. And he kept the two large red volumes over his white robe during the entire audience, see figure 11.

Finally I would like to remark that a great scientist can even make a great discovery when he participates in some irrational actions. In the late fifties when the race to the Moon between the US and the Soviet Union was on someone proposed to show the great technical ability in the space vehicles and in the nuclear technology proposing to the Soviet superiority to explode at a fixed time an atomic bomb on the Moon[2]. This awful project fortunately was never implemented. Nevertheless it was one of the motivations to develop a highly secret mission from the United States in order to test the no proliferation agreement: the Vela satellites. These satellites were conceived to patrol all the region around the Earth and the Moon for possible nuclear explosions! Everybody knows today that this led to the discovery of gamma-ray bursts and we were very honored and pleased to announce their discovery at the 1972 AAAS meeting in San Francisco which was chaired by Herb Gursky and myself [14].

In 1987 I visited Zeldovich in Moscow for the last time. There was a meeting at the Academy of Sciences on cosmology. While he went to deliver his talk he asked me to keep his jacket with the three gold stars and red stripes of the Hero of Socialist Labor. He was among the few people to have three such decorations. They told me that even Stalin had only one such "star". I was not surprised. By that time I had become aware of his many contributions in ignition, combustion, explosions as well as of his work with Yulii Khariton and Igor Kurchatov on the atomic bomb. Slowly but inevitable I became also aware of the role of John Wheeler in the American H-bomb project. Of course it was clear they had done an

[2] Different versions exist of this story. Some presented direct involvement of Zeldovich [12], some show Zeldovich as an opponent of this idea on technical grounds [13].

Figure 15. Jonhy enjoying the pictures of Jacopo in 1999.

Figure 16. Picture of Ginette and Johny Wheeler with Anna in High Island with Ginette holding one of her preferred Gucci scarf.

Figure 17. Picture taken in my office at "La Sapienza" of Vladimir Popov surrounded by Gregory Vereshchagin, She-Sheng Xue and myself in 2006.

Figure 18. The picture of the participants of the Varenna summer school. In the second row Anthony Hewish (Nobel Prize, 1974), Joe Taylor (Nobel Prize, 1993), Subrahmanyan Chandrasekhar (Nobel Prize, 1983) and Riccardo Giacconi (Nobel Prize, 2002).

enormous work in the physics of the bomb and also it was evident that they had learned one of the greatest amount of physics reachable at the time.

When it came to the work on Relativistic Astrophysics I was surprised to see that this vast quantity of knowledge in physics they had acquired in making the bombs did not help as much as one would have expected. They were somewhat overshooting and did not catch the beauty, the different and possibly more profound physical scientific complexity, and also the conceptual simplicity of the new phenomena. In the case of Wheeler the interactions with him during the first years in Princeton had be tremendously intense. At times we were working 13 hours a day. We wrote that celebrated article for Phyiscs Today [17], recently reprinted [18], in which we were presenting for the first time a Black Hole as a physical object and not just as a mathematical solutions. Such an object was indeed interacting actively with the rest of the Universe by a vast amount of energy, in principle extractable: the rotational and the electromagnetic energy. These works were received an exponential growth with the coming to Princeton of Demetrios Christodoulou from Greece at the age of 16. When he started his thesis of PhD at the age of 18 Demetrios approached the problem suggested by Wheeler of the collapse of a scalar field forming a black hole which he finally solved in 2009 [19]. A second part of his thesis was developed under my guidance [5] which has led to the general mass formula of the black hole [24], see figure 12. Interestingly precisely these concepts have made later the Black Holes through their "Blackholic energy" the explanation of Gamma Ray Bursts [25]: the largest instantaneous energy sources in the Universe second only to the Big Bang [5, 20, 21]. In collaboration with Rees we also wrote a book giving guidelines for the study of Black Holes, Gravitational Waves and Cosmology [22]. The field of Relativistic Astrophysics started to grow exponentially after the introduction of X Ray Astronomy by Riccardo Giacconi and his group [23]. Paradoxically Wheeler interest started to depart from these topics and drifted toward a (possibly too) vast field of exploring the world of mathematics in the quest for better expressing the laws of physics, see also my recollections in [5]. It was that time in which I proposed the paradigm for the first identification of a Black Hole in our Galaxy [26], see figure 13.

A profound separation of scientific interests had already occurred in those days at the Les Houches summer school: the first one solely dedicated to black holes [27]. After that event I dedicated myself to the study of Black Holes larger than 3.2 solar masses. While S. Hawking and his group directed all the attention to mini black holes (see e.g. [28]). The field of matter accretion on a Black Hole was not developed in the West and became dominated by the Russian (see Titarchuk contribution to

this volume) and Indian schools (see Chakrabarti contribution to this volume). In the case of Wheeler a different point of view on the role of European scientists in the United States of America emerged, and a separation of our scientific interest became manifest in the 1973 Solvay meeting (see figure 14), which was followed by my return to Europe. These differences did not affect in any way the deep friendship between us extended to our families, see figures 15 and 16.

In the case of Zeldovich some similar event happened. I was trying to make him appreciate the beauty of the work I was developing with an American hero of Relativistic Astrophysics, Jim Wilson, himself a distinguished participants of the American Bomb projects. The work on the relativistic magnetohydrodynamics effect around Black Holes have today reached the greatest interest for microquasars and active galactic nuclei explanations [29]. To that he was answering with his interests toward the possible radiation of a rotating sphere due to quantum effects. To me that work did nor appear so promising in view of the intrinsic stability imposed by quantum effects on a rotating system.

Thinking over my scientific discussions with Zeldovich I was especially admiring his work with Vladimir Popov on heavy nuclei, as expressed in our recent report [21]. On this topic see also Popov's contribution in this book. This topic has become central to our current research, see figure 17.

In all my discussions with Zeldovich through the seventies I was particularly eager to illustrate to him my work on the black hole identification and to observe his feedback. Much of these works, following the Solvay meeting, were summarized in our celebrated Varenna summer school, see figure 18. This basic work then appeared in the book [15] which is currently being reprinted [16]. That epochal meeting in the scientific content was followed until today by three Nobel Prize winners among the lecturers as S. Chandrasekhar (1983), J. Taylor (1993), and R. Giacconi (2002), see figure 19.

But let us return after this digression to my last meeting with Zeldovich. While he was speaking Sakharov entered the room and sat in the first row near me. He had just been permitted to return to Moscow after the Gorky exile. I had just been helping at the University of Rome to attribute to him a *laurea honoris causa - in absenzia*. I looked at him closely: the face had changed from the Tbilisi days, his smile was gone and his gentle aspect had been modified. Even the structure of the face was somewhat more tense with a more prominent jaw. I gave my hand to him: "Ruffini, Italy" and his immediate answer recalling a serene expression resembling the old days "Sakharov, Soviet Union!"

In June 1988 on the hundredth anniversary of the birth of Alexander Alexandrovich Friedman we went to Leningrad with Werner Israel and a few other relativists. It was a very emotional occasion to find the tomb of Friedman and put some flowers on it. Yakov Borisovich Zeldovich had died on December 2, 1987. This was the occasion of a trip by night sleeping train between Moscow and Leningrad with my wife Anna.

Figure 19. Picture of Riccardo Giacconi receiving the Nobel Prize.

Figure 20. Television broadcast made by Igor Novikov, Andrei Sakharov and myself in the celebration of Alexander Alexandrovich Friedman's 100th Anniversary, Leningrad, 1988.

The next compartment on that train was occupied by Andrei Sakharov and Elena Bonner. The day after a memorable broadcast from the television was made by Igor Novikov, Andrei Sakharov and myself in the celebration of Alexander Alexandrovich Friedman, see figure 20.

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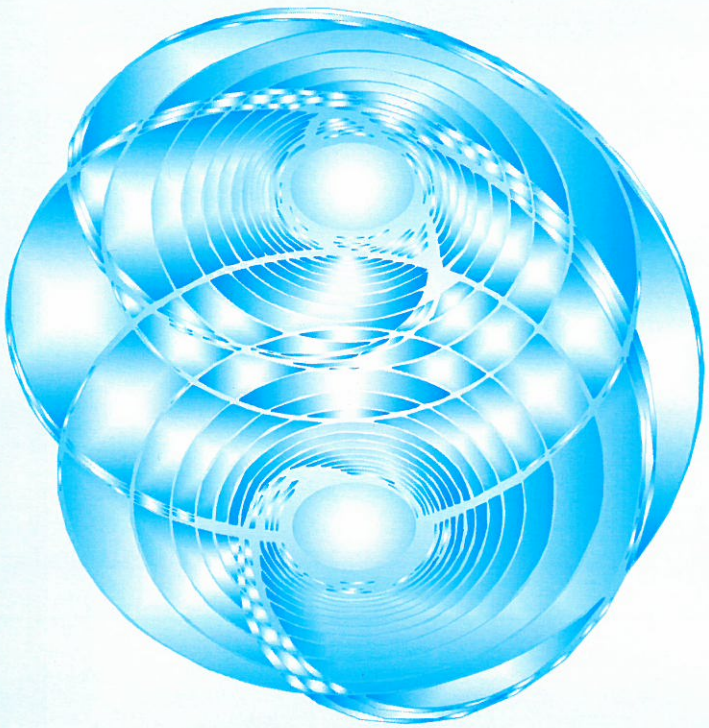

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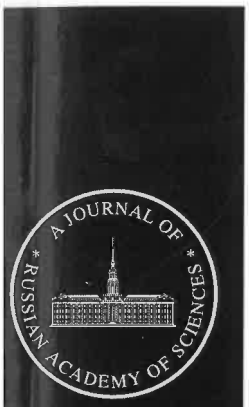

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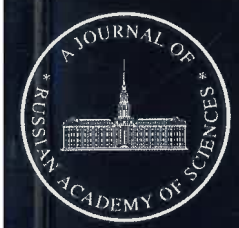

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