

ICRANet Scientific Committee
Twentieth Meeting (e-meeting)
January 30, 2023

The meeting starts at 10:45 AM via GoToMeeting: <https://global.gotomeeting.com/join/750192021>

The following members are present:

Prof. Mimoza Hafizi (Albania)
Prof. Narek Sahakyan (Armenia)
Prof. Manuel Malheiro (ad interim, Brazil)
Prof. Carlo Luciano Bianco (ICRA)
Prof. Massimo Della Valle (Italy, Chairman)
Prof. Remo Ruffini (Director of ICRANet)

The additional following persons are present:

Prof. Carlos Raul Arguelles (ICRANet Adjunct Professor)
Prof. Seyed Mohammad Taghi Mirtorabi (ICRANet Adjunct Professor)
Prof. Rahim Moradi (ICRANet Faculty Professor)
Dr Fatemeh Rastegar Nia (ICRANet)
Prof. Antonio Enea Romano (ICRANet)
Prof. Jorge A. Rueda H. (ICRANet Faculty Professor)
Prof. Gregory Vereshchagin (ICRANet Faculty Professor)
Prof. Yu Wang (ICRANet Faculty Professor)
Prof. She-Sheng Xue (ICRANet Faculty Professor)
Dr Shurui Zhang (ICRANet visitor and USTC)

Absents

Prof. Christopher Fryer (Arizona University)
Prof. John Mester (Stanford University)
Prof. Gabriele Gionti, S. J. (Vatican City State)

The meeting is chaired by the Director, Prof. Remo Ruffini, who also takes the minutes.

Prof. Remo Ruffini assumes the Chairmanship and presents the 2022 ICRANet scientific report to the Scientific Committee, in particular Volumes 2 and 3, which are composed as follows:

Volume 2

- Multiwavelength and Multimessenger emission from Active Galactic Nuclei (Prof. Narek Sahakyan).....pag. 1-170
- ICRANet-Minsk report (Prof. Gregory Vereshchagin).....pag. 171-190
- Activities with Brazil (Prof. Jorge Rueda).....pag. 191-226
- Gamma-Ray Bursts (Prof. Carlo Luciano Bianco).....pag. 227-378
- Theoretical Astroparticle Physics (Prof. Gregory Vereshchagin).....pag. 379-400
- Generalization of the Kerr-Newman solution (Prof. Hernando Quevedo).....pag. 401-494
- Cosmology Group of Tartu Observatory (Prof. Jaan Einasto).....pag. 495-508
- Black Holes and Quasars (Prof. Brian Punzly)..... pag. 509-510

- Electron-positron pairs in physics, astrophysics and cosmology (Prof. Shesheng Xue)...pag. 511-756

Volume 3

- From heavy nuclei to black holes (Prof. Shesheng Xue).....pag. 757-1102
- Physics and Astrophysics of Compact Objects (Prof. Jorge A. Rueda H.).....pag. 1103-1250
- Self-gravitating Systems of Dark Matter Particles (Prof. Carlos Raul Arguelles).....pag. 1251-1276
- Supernovae (Prof. Massimo Della Valle).....pag. 1277-1278
- Symmetries in General Relativity (Prof. Donato Bini).....pag. 1279-1386
- Self Gravitating Systems, Galactic Structures and Galactic Dynamics (Prof. Simonetta Filippi).....pag. 1387-1428
- Interdisciplinary Complex Systems (Prof. Christian Cherubini).....pag. 1429 -1478

The Director then invites ICRA Net scientists to illustrate their respective fields of research:

- Prof. Rueda presents the report on “*ICRA Net activities with Brazil*” on page 191, emphasizing the collaborations with Brazilian Universities.
- Prof. Narek Sahakyan, Director of ICRA Net Seat in Armenia, illustrates the activities carried on in ICRA Net Seat in Armenia in 2022 as well as the scientific results on the topic “*Multiwavelength and Multimessenger emission from Active Galactic Nuclei*”. In particular he mentioned the participation of his group in MAGIC collaboration resulting in large number of publications.
- The “*ICRA Net-Minsk report*”, presented by Prof. Gregory Vereshchagin, represents the summary of activities carried on in 2022 in the ICRA Net-Minsk center. He pointed out the importance of two new lecture courses developed by Dr. Mikalai Prakapenia, which are delivered to the students of the Belarusian State University.
- Prof. Shesheng Xue and Prof. Yu Wang illustrated the report on the activities developed in 2022 in collaboration between ICRA Net and China, with special emphasis on the new joint PhD program co-organized by the University of Ferrara in Italy and the University of Science and Technology of China together with ICRA and ICRA Net.
- Prof. Gregory Vereshchagin presented the report on “*Theoretical Astroparticle Physics*”, with the novel results and the publications appeared in 2022.
- Prof. Carlos Arguelles presents the main results on the topic “*Self-gravitating Systems of Dark Matter Particles*” and mentions various publications of the group on the fermionic dark matter.
- Prof. Shesheng Xue illustrates the recent results on “*Electron-positron pairs in physics, astrophysics and cosmology: from heavy nuclei to black holes*”, with the emphasis on the works of the last year on the topic of H_0 tension.
- Prof. Jorge A. Rueda H. reports on the topic “*Physics and Astrophysics of Compact Objects*”, with the main results on the theory of black holes, neutron stars and white dwarfs applied to analysis of gamma-ray bursts within the Binary-driven Hypernova model.

- Prof. Ruffini thanks also Prof. Fernando Quevedo for his report on “*Generalization of the Kerr-Newman solution*”, Prof. Jaan Einasto for his report on “*Cosmology Group of Tartu Observatory*”, Prof. Brian Punsly for his report on “*Black Holes and Quasars*”, Prof. Donato Bini for his report on “*Symmetries in General Relativity*”, Prof. Simonetta Filippi for her report on “*Self Gravitating Systems, Galactic Structures and Galactic Dynamics*”, and Prof. Christian Cherubini for his report on “*Interdisciplinary Complex Systems*”.
- Prof. Massimo Della Valle, Chairman of the ICRANet Scientific Committee, presents his report on “*Supernovae*”. Analysis of the Bright Transient Survey database from the Zwicky Transient Facility has allowed to conclude that only $0.3\% \pm 0.3\text{--}0.1$ of all CCSNe occur in elliptical galaxies. This result constrains, for the first time on robust empirical basis, the times-scale of the star formation activity in early type galaxies. He shows that CCSNe in ellipticals have larger physical separations from their hosts compared to SNe Ia in elliptical galaxies.

The multiwavelength campaign of SN-GRB events found a new result in the observation of the short-duration GRB 200826A ($\sim 0.5\text{s}$) that was found to be associated with a bright SN. The analysis of the data reveals an optical and NIR bump in the light curve whose luminosity and evolution are in agreement with several SNe associated to long duration GRBs. The host galaxy is a low-mass star-forming galaxy, typical of LGRBs, characterized by a very intense star formation activity. The next challenge will be framed this GRB (and the associated SN) characterized by a duration typical of short GRBs, in one of the scenarios explaining the SN-GRB connection, i.e. collapse or binary hypernova scenario.

The Chairman invites the participants to discuss Item 2 of the agenda “*Miscellaneous business*”.

The discussion was mainly focused on what we can consider the flagship of ICRANet's scientific activity in recent years: the development of a new and refined theoretical model to explain the GRB-SN connection. It is based on simple and therefore solid observational basis. In short: two decades of observations have shown that long-duration GRBs are often associated with SN outbursts, which in turn are produced by the gravitational collapse of massive stars. For many years the theoretical models, circulating in the scientific literature, have tried to explain these events in terms of the explosion of single massive stars capable of simultaneously producing both the SN event and the GRB. Several lines of evidence, which have emerged in the last decade, indicate that this model cannot be the main channel for the production of long-duration GRBs. Recent studies carried out at ICRANet have demonstrated that: 1. there is no obvious correlation between the energies of GRBs and associated SNe; 2. about 70% of massive stars are found in binaries rather than single stars, hence any GRB model cannot ignore this important piece of observation. The Binary Driven Hypernova scenario - developed by ICRANet scientists over the last decade - make full use of these notions, namely SN vs. GRB different energies and binarity. They have been presented and further developed in many articles over the last decade, and notably enough, very recently a very comprehensive manuscript was submitted to ApJ, which derives and explains the extraordinary variety of the GRB/SN "zoo". The details of the binary hypernova models will also be presented during 2023 in a series of international workshops that will be organized in person and online by ICRANet.

The Scientific Committee unanimously approves the Report and warmly congratulates with the Director for the achievements of ICRANet in 2022.

The Director thanks all the participants and the meeting ends at 6 PM on January 30, 2023.

Prof. Mimoza Hafizi
Representative of Albania



Prof. Narek Sahakyan
Representative of Armenia



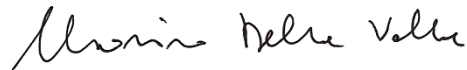
Prof. Manuel Malheiro
Representative of Brazil (ad interim)



Prof. Carlo Luciano Bianco
Representative of ICRA



Prof. Massimo Della Valle
Representative of Italy, Chairman



Prof. Jorge A. Rueda H. on behalf of Chris Fryer
Representative of the Arizona University



Prof. Remo Ruffini
Director of ICRANet

