ICRANet Newsletter

December 2016 – January

SUMMARY

1. A first generation of young Brazilian professors, graduated from the IRAP PhD, carry on the fundamental message of Prof.s Malheiro, Ruffini and Rueda: an additional clear success of the CAPES-ICRANet joint program

A new paper "Thermal X-ray emission from massive, fast rotating, highly magnetized white dwarfs" is just published by the group of scientists from ICRANet, including: D. L. Cáceres, S. M. de Carvalho, J. G. Coelho, R. C. R. de Lima, Jorge A. Rueda, in one of the leading journals in astrophysics (Impact Factor 4.952), Monthly Notices of the Royal Astronomical Society.

The publication is available here: *https://doi.org/10.1093/mnras/stw3047*.

There are two special types of compact objects: anomalous X-ray pulsars (AXPs) and soft gamma repeaters (SGRs), which possess very distinct properties among pulsars, namely: lack of evidence of binary companions; narrow distribution of the spin period between 5 and 12 seconds; secular spin-down on timescales of 10^3-10^5 years; variability on very different timescales; absence of radio emission; association with supernova remnants (in some cases) [1]. Historically SGRs were discovered through the detection of repeating short bursts in the hard X-ray/soft gamma-ray range, while persistent emission from AXPs was first detected in the soft X-ray range. Subsequent observations at different wavelengths showed that both types of objects share many characteristics. They are now considered as the same class of objects.

When AXPs and SGRs are viewed as (1) neutron stars (NS) (2) with mass equal to solar mass and (3) radius 10 km, their emitted power appears to exceed by several orders of magnitude the rotational energy loss, requiring different energy source. The most unorthodox proposal in the literature was to use the magnetic energy in the bulk as the energy source powering these objects, e.g. *magnetar* [2]. The magnetic field estimate, based on observed period and its first derivative, exceeds many times the critical quantum value for vacuum polarization, $B_c=4.4\times10^{13}$ Gauss.

The group picture of the Adriatic Workshop held in Pescara in June 20-30, 2016, at the time when this new work has been carried out. In the first row is prof. Remo Ruffini (forth from left) and prof. Manuel Malheiro (third from right). In the second row prof. Jorge Rueda (fifth from left), and in the last row Diego Caceres (second from right).

A very different model has been proposed by Malheiro, Ruffini and Rueda [5] following the previous works [6,7]. They critically reanalyzed the above three assumptions, understood as not necessary in the explanation of both SGRs and AXPs. The model is based on canonical physics and astrophysics and describes SGRs and AXPs as powered by rotational energy of massive highly magnetized rotating white dwarfs (WDs), in total analogy with pulsars powered by rotating neutron stars. Given its much larger moment of inertia, the WD model naturally explains the energy budget of persistent emission of AXPs and SGRs. Moreover, emission of giant flares and bursts can be explained as consequences of glitches with rotational period fractional change from 10^{-7} up to 10^{-3}. It turns out that within the WD model the energetic of both the steady emission as well as that of the outbursts following the glitch can be simply explained in terms of the loss of rotational energy. This is in sharp contrast with alternative models of magnetars or quark stars, where different components are required for explanation of steady emission and outbursts, respectively. As opposed to the NS case, the magnetic fields involved in the WD model are not extreme and are of the order of the ones observed in most magnetized isolated WDs.

The new publication by D. L. Caceres et al. [8] focuses on the thermal X-ray emission observed in SGRs and AXPs, in particular 4U 0142+61 and 1E 2259 586, both previously considered in the literature as magnetars [9,10]. Contrary to the magnetar model, where the structure of the magnetic field is unknown, the specific WD rotation assumption, with a well established magnetic field, allows to make the new theoretical developments and further refine the theoretical analysis. Following the Malheiro, Ruffini and Rueda [5] such thermal emission is similar to the one operating in usual pulsars: the magnetic polar cap heating by back flowing electrons and positrons created in the magnetosphere. The authors of publication [8] show that the kinetic energy of particles is effectively transformed into heat in the thin layer on the surface of the WD polar cap, hence this energy is efficiently radiated in the form of thermal soft X-rays. This work by D. L. Caceres et al. confirms previous expectations by Malheiro, Ruffini and Rueda [5] that in AXPs, in addition to the blackbody component observed in the optical wavelengths and interpreted as the surface temperature of the cooling white dwarfs, the blackbody component seen in X-rays can be of magnetospheric origin. This work also adds to the theory of white dwarfs and sheds new light on the properties of magnetosphere, magnetic field structure and pulsed emission properties of rotating magnetized WDs.

Professor S.O. Kepler, the author of the most extended catalogue of white dwarfs.

It is appropriate to recall that Brazil through the work of prof. Kepler has today reached a forefront position in the study of WDs. Up to about 600 magnetized WDs have been recently identified in the largest white dwarf catalogue made with the Sloan Digital Sky Survey (SDSS), published by S.O. Kepler [11,12]. This catalogue now contains dozens of thousands of spectroscopically identified white dwarfs. Such unprecedented number of known WDs had enormous impact on the study of these stars. The most recent update of the catalogue has just appeared in 2017 [13].

The work of D. L. Caceres et al. [8] inserts a new fundamental understanding of the role of rotation and magnetic fields in WDs.

References:

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[12] E. Garcia-Berro, M. Kilic and S.O. Kepler, *IJMPD* **25** (2016) 1630005.
[13] S. O. Kepler, *arXiv:1702.01134*.

About the authors

Diego Leonardo Caceres Uribe is from Colombia, he is a student of the IRAP PhD program. At the moment in ICRANet Pescara with an Italian fellowship.

Sheyse Martins de Carvalho from Brazil has been the Erasmus Mundus IRAP PhD student and received her PhD degree in 2013. She was also CAPES-ICRANet Postdoc at Universidade Federal Fluminense (UFF), from 2014 to February 2016. Currently she is Professor at Universidade Federal do Tocantins (UFT).

Jaziel Goulart Coelho has been the CAPES-ICRANet postdoc at Sapienza University of Rome, from February 2014 to January 2015. Currently he is postdoctoral student at Instituto Nacional de Pesquisas Espaciais (INPE), Brazil.

Rafael de Lima has been the CAPES-ICRANet postdoc at ICRANet headquarters in Pescara from March 2014 to February 2016. Currently he is Professor at Universidade do Estado de Santa Catarina (UDESC), Brazil.

Jorge Rueda is Professor of ICRANet faculty. He has been CAPES-ICRANet senior visitor to Brazil in 2013-2015.

This work is performed within the collaboration between ICRANet and Brazilian universities, see:
ICRANet-UFF: http://icranet.org/documents/agreement_icranet_uff_eng.pdf
ICRANet-INPE: http://icranet.org/docinpe/mouinpe.pdf
ICRANet-UDESC http://icranet.org/documents/agreementICRANet-UDESC_eng.pdf

2. A new ICRANet center in Isfahan and Professor Ruffini's travel in Iran

Prof. Remo Ruffini, Director of ICRANet, visited together Dr. Narek Sahakyan (Director of the ICRANet seat in Yerevan) different centers and institutes in Iran: the Isfahan University of Technology on December 10 and 11, 2016, the Institute for Advanced Studies in Basic Sciences (Zanjan) and the Shahid Beheshti University. During this visit it was inaugurated also the ICRANet Center at the Physics Department of IUT, Isfahan.

On 10 and 11 December Professor Ruffini met the President of Isfahan University of Technology and other Officials. After the tour of department of Physics he had a seminar at the department of Physics and a meeting with the faculty of Physics Department. In this travel Professor Ruffini was together the Prof Sahakyan who gave a lecture at the department of Physics.

From left to right: Dr. Narek Sahakyan (Director of the ICRANet seat in Yerevan), Prof. Remo Ruffini (ICRANet Director), Prof. Mahmood Modarres-Hashemi (President of IUT), Prof Parviz Kameli (Head of IUT physics department) and Prof. Moslem Zarei (Deputy of Research of IUT physics Department).

Prof. Ruffini visits IASBS - Institute for Advanced Studies in Basic Sciences (Zanjan)

During this travel in Iran Professor Ruffini visited also the Institute for Advanced Studies in Basic Sciences (IASBS) in Zanjan and he met Professor Yousef Sobouti, founder of this Institute. Prof. Sobouti Yousef is Iranian theoretical physicist with worldwide scientific prominence. He was a PhD student of the Nobel

Laureate Subrahmanyan Chandrasekhar. The Institute for Advanced Studies in Basic Sciences (IASBS) is currently known as the University of Advanced Studies in Basic Sciences. For more information see: http://iasbs.ac.ir/~sobouti/

Prof. Ruffini visits SBU - Shahid Beheshti University, from left to right: Prof. Seyed Mohammad Sadegh Movahed, Prof. Reza Mansouri, Prof. Vahid Ahmadi, Prof. Remo Ruffini, Dr. Narek Sahakyan

AGREEMENT WITH THE IRANIAN INSTITUTIONS

- I UT Isfahan University of Technology - Isfahan, Iran (February 21, 2016)
- Sharif University of Technology - Teheran, Iran (March 12, 2016)
- IASBS Institute for Advanced Studies in Basic Sciences - Zanjan, Iran (9 April 2016)
- IPM Institute for Research in Fundamental Sciences - Teheran, Iran (May 3, 2016)
- Shiraz University - Shiraz, Iran (March 21, 2016)

The texts of these agreements can be found here

3. The 1st ICRANet Catalog of Binary-driven Hypernovae and the BSDC

The director of ICRANet, Professor Remo Ruffini, announces the publication of the first ICRANet catalog of binary-driven hypernovae (IBdHNe), counting 175 sources observed up to the end of 2016 [1-3].

In a series of recent publications, scientists from ICRANet led by professor Remo Ruffini have reached a novel comprehensive picture of gamma-ray bursts (GRBs) thanks to their development of a series of new theoretical approaches. Among those, the induced gravitational collapse (IGC) paradigm explains a class of energetic, long-duration GRBs associated with Ib/c supernovae (SN), recently named BdHNe (see Figure 1 and 2, and [4-7]).

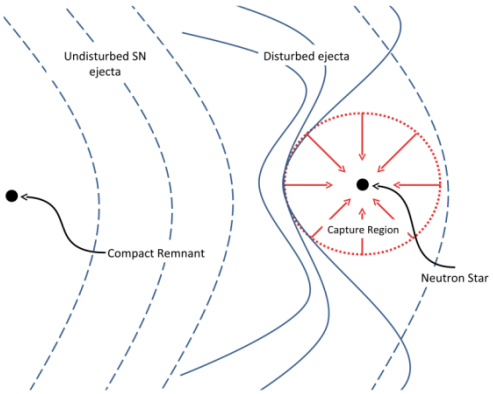

Fig. 1: Graphic representation of the IGC scenario. The Ns companion accretes material from the expanding outer layers of the SN which just exploded. If the binary system is tight enough, the accretion process becomes hypercritical, and the NS eventually collapse to a black hole, emitting a GRB.

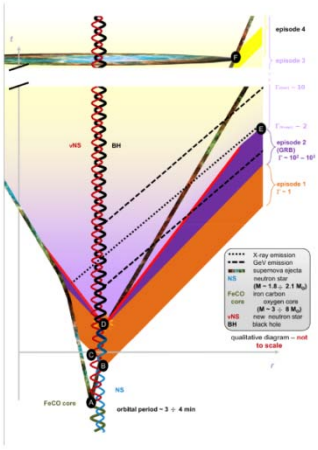

Fig. 2: This space-time diagram shows all the different physical processes and relative emissions occurring in a BdHN phenomenon.

BdHNe have a well defined set of observational features which allow to identify them:

- long duration of the GRB explosion, namely larger than 2 s in the rest frame;
- a total energy, released in all directions by the GRB explosion, larger than 1052 ergs;
- peak energy released during the GRB explosion larger than 200 keV;
- presence of a flare in the X-ray emission around 100 s in the rest-frame after the GRB explosion, visible if dominant over the underlying X-ray decaying emission [1];
- a plateau phase in the X-ray luminosity emitted between ~100 and ~104 s in the rest-frame after the GRB explosion;
- a universal late time power-law decay in the X-rays luminosity after 104 s, with typical decaying slope of ~1.5 [3, 8].

The first three features regard the prompt GRB emission observed in the gamma-rays by the GBM, BAT, Konus instruments onboard, respectively, Fermi, Swift, Wind satellites. The following three features are observed within the long lasting decaying X-ray emission, well covered by the XRT instrument onboard Swift.

Name	z	r-f T_{90} (s)	E_{iso} (erg)	t_{start} (s)	t_{end} (s)	slope	E_{LT} (erg)
1. IBdHN 090618A	0.54	73.5065	2.9×10^{53}	7000.	1.84513×10^{6}	1.48791	1.43605×10^{51}
2. IBdHN 060729A	0.54	75.3247	1.6×10^{52}	20000.	6.62361×10^{6}	1.31323	3.3637×10^{51}
3. IBdHN 061007A	1.261	33.1712	8.8×10^{53}	30.	510467.	1.68247	4.76995×10^{50}
4. IBdHN 080319B	0.94	25.7732	1.2×10^{54}	30.	1.35741×10^{6}	1.58526	1.9892×10^{51}
5. IBdHN 091127A	0.49	4.7651	1.8×10^{52}	2000.	2.70322×10^{6}	1.32196	1.35585×10^{51}
6. IBdHN 111228A	0.716	58.9744	4.1×10^{52}	4000.	1.49877×10^{6}	1.22734	1.24379×10^{51}
7. IBdHN 130427A	0.338	121.674	1.1×10^{54}	300.	1.17788×10^{7}	1.25685	4.17388×10^{51}
8. IBdHN 050315A	1.95	32.5424	8.3×10^{52}	30000.	302657.	0.838208	1.56063×10^{52}
9. IBdHN 050318A	1.44	13.1148	3.7×10^{52}	3000.	24035.6	1.73692	4.4151×10^{50}
10. IBdHN 050319A	3.24	3.53774	2.0×10^{53}	10000.	327517.	1.27211	1.23407×10^{52}
11. IBdHN 050401A	2.9	9.74359	9.2×10^{53}	3000.	140629.	1.5899	3.81786×10^{51}
12. IBdHN 050408A	1.24	15.1786	1.1×10^{53}	10000.	1.13675×10^{6}	1.13536	2.19411×10^{51}
13. IBdHN 050505A	4.27	11.3852	4.5×10^{53}	1100.	213860.	1.40808	8.66053×10^{51}
14. IBdHN 050525A	0.606	6.22665	2.3×10^{52}	3000.	869622.	1.4689	2.43182×10^{50}
15. IBdHN 050730A	3.97	31.1871	4.3×10^{53}	2000.	82133.2	2.41559	1.74003×10^{51}
16. IBdHN 050802A	1.71	4.79705	7.5×10^{52}	2000.	306202.	1.54827	1.23792×10^{51}
17. IBdHN 050814A	5.3	10.3175	2.7×10^{53}	12000.	130462.	2.22574	2.89741×10^{51}
18. IBdHN 050820A	2.61	7.20222	3.9×10^{53}	2000.	1.01284×10^{6}	1.23144	2.20632×10^{52}
19. IBdHN 050922C	2.2	1.5625	2.0×10^{53}	1500.	112067.	1.56565	9.74246×10^{50}
20. IBdHN 051109A	2.35	7.46269	1.8×10^{53}	1000.	452314.	1.20291	9.08963×10^{51}

Fig. 3: The first 20 rows of the 1st IBdHN Catalog showing some of the significant observed quantities. The first seven BdHNe form the so called Golden Sample, the first source which have been identified as BdHNe

Thanks to this novel theoretical and observational understanding, it was possible for ICRANet scientists to build the 1st BdHNe catalog, composed by the 175 BdHNe identified up to the end of 2016. BdHNe are named as "IBdHN", where the "I" stands for ICRANet, followed by the number identifying the correspondent GRB date of explosion.
Figure 3 shows the first 20 rows of the 1st IBdHNe catalog. The columns show some of the significant observed quantities of the BdHN. The complete list of the quantities contained in the catalog follows:

- z: the observed redshift, z, which gives us information on the distance of the source;
- r-f T90: the duration of the GRB in the rest-frame, namely the observed time during which the GRB has released 90% of its energy corrected by the redshift;
- Eiso: the total energy released by the GRB in any direction, computed between 1-104 keV;
- tstart: the beginning rest-frame time of the late X-ray power-law behaviour;
- tend: the rest-frame time of the last X-ray data observed by Swift/XRT;
- slope: decaying slope of the late X-ray power-law behaviour;
- ELT: total energy released in all directions in the X-ray band between 104 and 106 s in the rest-frame after the GRB explosion;
- angle: inferred opening angle of the late beamed X-ray emission
- flare: marks the presence of a flare around 100 s in the rest-frame, visible in the X-rays when dominant over the underlying decaying emission;
- satellite: name of the satellite which has the best observed data in the gamma-ray band;
- GCN: number of the GCN circular correspondent to the best gamma-ray data of the source.

This catalogue is currently uploaded in the BSDC.

References

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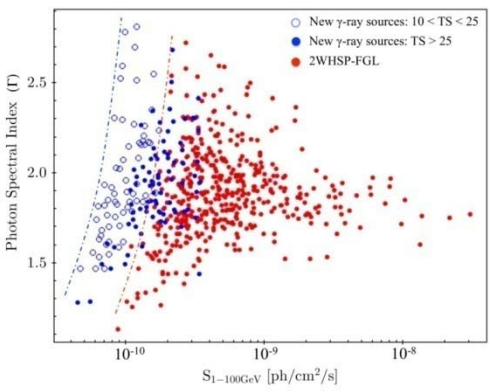
[8] Pisani, G. B., Izzo, L., Ruffini, R., et al. 2013, A&A, 552, L5 https://gcn.gsfc.nasa.gov/gcn3_archive.html

4. The First Brazilian ICRANet Gamma-ray Blazar catalog and BSDC



There are the following five main projects within BSDC, on which Prof. Paolo Giommi collaborates with postdoc from Brazil, Dr. Bruno Sversut Arsioli, who obtained his PhD within IRAP PhD program promoted by ICRANet.
The first one, the 1WHSP, is a sample of HSP blazars, with about 1000 objects at |b|>20, built based on multifrequency selection criteria including IR colours. At the time, this sample was the largest HSP catalog available, and was key to understand that the CTA sky will be full of new sources to study. This sample is a collection of HE and VHE candidates, to be observed with current and future Cherenkov Telescopes.

With this sample, we also study and suggest new association with sources from the 3FGL catalog, which were then considered by the Fermi-LAT team for the 3LAC catalog (listing AGNs with gamma-ray counterparts). In addition, this work also discusses population properties for this particular blazar-family. This work is published in A&A 579, A34 (2015), and is also available online: https://arxiv.org/abs/1504.02801; and a direct link to the SED builder tool is here: http://www.asdc.asi.it/1whsp/ in collaboration with YuLing Chang (also IRAP PhD student, from Taiwan), 1WHSP catalog has been extended. The 2WHSP catalog now goes down to |b|>10 and is also based in multifrequency selection criteria, despite we do not use IR color-color selection this time, so we manage to be more complete. We also used updated X-ray catalog, and benefit from more than 160 new Swift XRT observations of WHSP blazars. This allowed us to have a better description of the synchrotron peak parameters, for many know and new HSP sources, so we could revisit some population studies using the 2WHSP sample. The 2WHSP cat has ~1700 objects, and is published in A&A 598, A17 (2017), also available at: https://arxiv.org/abs/1609.05808; and a direct link to the SED builder tool is here: http://www.asdc.asi.it/2whsp/

The third work of this series, is the First Brazilian ICRANet Gamma-ray Blazar catalog. Since we claim the WHSP samples are a collection of god TeV-candidates, they should also be very helpful to unveil new MeV-GeV sources in reach from Fermi-LAT satellite. So, we have used 7.5 yrs of Pass 8 Fermi-LAT data, and study about 400 bright WHSP sources which yet had no gamma-ray counterpart (bright blazar meaning: a sources with bright synchrotron peak nfn) . As result, we found 150 new gamma-ray sources. This one we called 1BIGB (First Brazilian ICRANet Gamma-ray Blazar catalog). We describe their spectral parameters in the 0.3-500 GeV band, and showed that they might represent 6-8% of the extragalactic diffuse gamma-ray background around 50 GeV. Also, this work is an important "proof of concept" in the sense that the WHSP samples are really useful to unveil HE sources, and certainly very helpful to select promising TeV-targets.

5. Professor Rueda visiting Colombia

On December 12-16, 2016, Prof. Jorge Rueda visited Universidad Industrial de Santander (UIS) in Bucaramanga, Colombia, to receive the “Distinguished Former Student Award”. During this visit Prof. Rueda delivered at the Physics Department of UIS a short 8 h course “Physics and Astrophysics of White Dwarfs and Neutron Stars”; as well as the invited Lecture at the “III Jornadas Científicas Escuela de Física UIS”, and the Public Lecture “Vida después de la muerte: los cataclismos más potentes del Universo” at the event “Café Científico” organized by Casa del Libro Total in Bucaramanga.

Link to the video of the Public Lecture at the Casa del Libro Total in Bucaramanga:
https://www.youtube.com/watch?v=Xs2rSYzwbvA

Public Lecture by Prof. Jorge Rueda at the event "Café Científico" held at Casa del Libro Total on December 15, 2016, in Bucaramanga.

6. Two meetings for the “School – Work” project with the Science High School Galileo Galilei in Pescara

The school-work project was started on December with two appointments with the 3rd class of the Scientific High School "Galileo Galilei" of Pescara. The project involves a total of 25 students and 70 hours divided between theory and practice. The focus of the first lesson with Professor Sigismondi Costantino and Dr. Alessandra Di Cecco was **“The value of research and the work of the researcher”**. Professor Sigismondi made a video presentation, about the work of researcher that is possible to find here: https://www.youtube.com/watch?v=OOVxOlsEDoU&t=1s and another video about “**Geminids and Quadrantids: guide for scientific observation”** that is possible see here: https://www.youtube.com/watch?v=0xLV0BOrvdg&feature=youtu.be

Alessandra Di Cecco dedicated her lesson to the introduction at the astrophysics with this program http://icranet.org/scuola_lavoro/dicecco_sem.pdf

The second meeting was about the **“History of Astrophysics and Relativity”** and the professors were: Gregory Vereshchagin, Vladimir Belinski, and the PhD student from China Yu Wang.

7. New Ph.D Thesis discussion and Diploma

Clément Stahl, *" On early and late phases of acceleration of the expansion of the universe* ", defended on 23rd of January, 2017 at the University of Rome "Sapienza"

Commission members: Jean Audouze (Institut d'Astrophysique de Paris, France), Paolo De Bernardis (University of Rome "Sapienza", Italy), Massimo Della Valle (Osservatorio Astronomico di Capodimonte, Italy) and Nikolaos Mavromatos (King's College London, UK).

This thesis tackles the vast question of generating accelerated periods of expansion of the universe. Models loosely related were developed in the early and late universe. In the early universe, generalizations of the Schwinger effect were developed in curved space (de Sitter) spacetime and some backreaction effects were estimated.

In the late universe, a fractal model was developed and confronted to supernovae data. This relies on the idea of an accelerated expanding universe being nothing but a mirage due to inhomogeneities disposed in a fractal (in this particular model) way. Finally a model of interacting energy based on an Einstein-Cartan gravitational theory was phenomenologically investigated.

List of publications:

E. Bavarsad, C Stahl, and S.-S Xue, Scalar current of created pairs by Schwinger mechanism in de Sitter spacetime, Phys. Rev., vol. D 94, 2016.

C. Stahl and E. Strobel, Semiclassical fermion pair creation in de Sitter spacetime, proceeding of the second Cesar Lattes meeting, 2015.

C. Stahl, E. Strobel, and S.-S. Xue, Fermionic current and Schwinger e_ect in de Sitter spacetime, Phys. Rev., vol. D 93, 2016.

C. Stahl, E. Strobel, and S.-S. Xue, Pair creation in the early universe, proceeding of MG14, 2016.

C. Stahl and S.-S. Xue, Schwinger effect and backreaction in de Sitter spacetime, Phys. Lett., vol. B760, 2016.

C. Stahl, Inhomogeneous matter distribution and supernovae, Int. J. Mod. Phys., vol. D25, 2016.

R. Ruffini, C. Stahl, Cosmological fractal matter distribution with an upper cutoff, proceeding of IK14, 2016

D. Bégué, C. Stahl, and S.-S. Xue, A model of interacting dark energy and supernovae, to appear, 2017.

8. Recent publications

"*Thermal X-ray emission from massive, fast rotating, highly magnetized white dwarfs*", D. L. Cáceres, S. M. de Carvalho, J. G. Coelho, R. C. R. de Lima, Jorge A. Rued, MNRAS (2016) 465 (4): 4434-4440

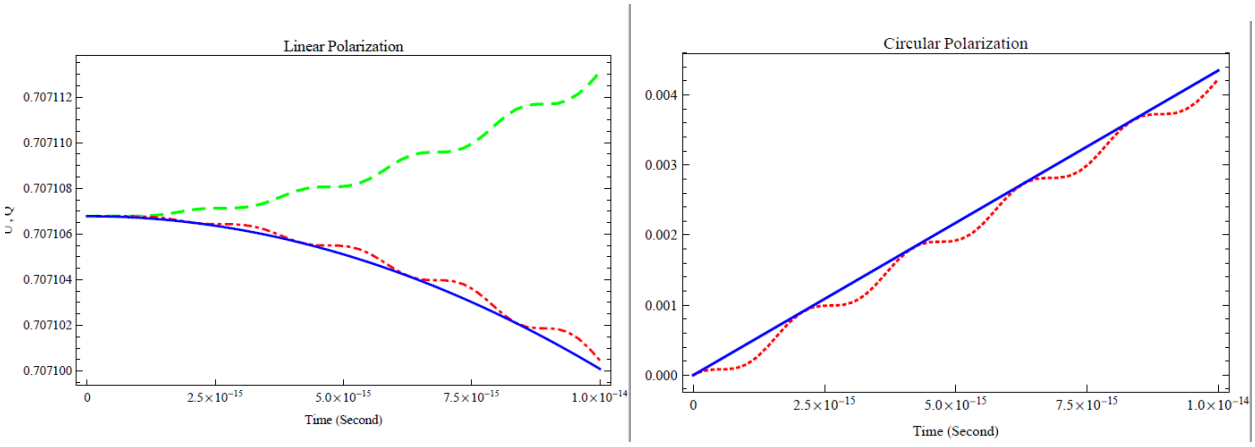
There is solid observational evidence on the existence of massive, $M \sim 1\,M_{\odot}$, highly magnetized white dwarfs (WDs) with surface magnetic fields up to $B \sim 10^9$ G. We show that, if in addition to these features, the star is fast rotating, it can become a rotation-powered pulsar-like WD and emit detectable high-energy radiation. We infer the values of the structure parameters (mass, radius, moment of inertia), magnetic field, rotation period and spin-down rates of a WD pulsar death-line. We show that WDs above the death-line emit blackbody radiation in the soft X-ray band via the magnetic polar cap heating by back flowing pair-created particle bombardment and discuss as an example the X-ray emission of soft gamma-repeaters and anomalous X-ray pulsars within the WD model.

The paper is available here: https://doi.org/10.1093/mnras/stw3047

"*Polarization of a probe laser beam due to nonlinear QED effects*", Soroush Shakeri, Seyed Zafarollah Kalantari, and She-Sheng Xue, Phys. Rev. A 95, 012108

Nonlinear QED interactions induce different polarization properties on a given probe beam. We consider the polarization effects caused by the photon-photon interaction in laser experiments, when a laser beam propagates through a constant magnetic field or collides with another laser beam. We solve the quantum Boltzmann equation within the framework of the Euler-Heisenberg Lagrangian for both time-dependent and constant background field to explore the time evolution of the Stokes parameters Q, U, and V describing polarization. Assuming an initially linearly polarized probe laser beam, we also calculate the induced ellipticity and rotation of the polarization plane.

The paper is available here: http://link.aps.org/doi/10.1103/PhysRevA.95.012108



Figures: Comparison between dimensionless Stokes parameters U, Q, and V in both time-dependent and static background fields. In the time-dependent case we used the numerical solution of Sec. 4b to plot U [dashed (green) line] and Q [dot-dashed (red) line] in the left panel and for V [dotted (red) line] in the right panel. In the static magnetic field we have used the analytic solution of Sec. 4a to plot Q and U [solid (blue) line] in the left panel and V [solid (blue) line] in the right panel. These figures are plotted for a 10-keV linearly polarized probe laser beam interacting with a target laser beam in optical frequency ω=1eV and peak intensity I=3×1022W/cm2.

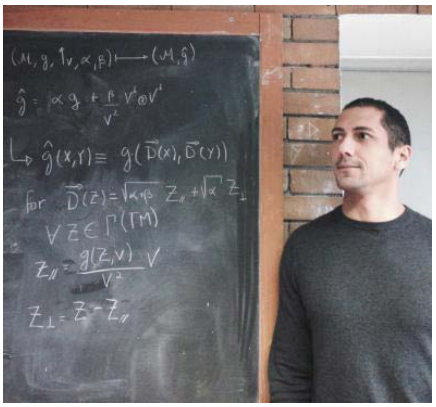
ICRANet Newsletter

February – March 2017

SUMMARY

1. A further success of the ICRANet-CAPES program: two new PhD thesis discussions by Gabriel Guimarães Carvalho and Iarley Pereira Lobo also joining collaboration with ICRANet-CAPES post-doc Eduardo Henrique Silva Bittencourt

On February 2017 at the University of Rome "Sapienza" two students graduated from the IRAP PhD program, Gabriel Guimarães Carvalho and Iarley Pereira Lobo, have presented their theses in relativistic astrophysics. The IRAP PhD is jointly delivered by the Universities of Bremen, Oldenburg, Savoie, Rome, Ferrara, Nice, Grenoble. Both students were admitted to the IRAP PhD program in 2013, and the fellowships for their studies were provided by CAPES within the ICRANet-CAPES program. Their work, in collaboration with ICRANet-CAPES post-doc Eduardo Henrique Silva Bittencourt, resulted in two publications in leading refereed journals: Physical Review D (IF: 4.506) and Classical and Quantum Gravity (IF: 2.837)



Gabriel Guimarães Carvalho

Iarley Pereira Lobo

Eduardo Henrique Silva Bittencourt

Gabriel Guimarães Carvalho presented a thesis "A walk through mathematical physics with disformal trasformations and scalar field self-force effects on a particle orbiting a Reissner-Nordström black hole", and defended it on February 13th, 2017.

Commission members: Prof. Dr. Massimo Testa (University of Rome "Sapienza", Italy), Dr. Roberto Natalini (CNR – Rome) and Dr. Giampiero Esposito (INFN – Naples). Thesis Advisor Prof. Dr. Remo Ruffini, Co-Advisor Prof. Donato Bini.

This doctorate thesis is divided in two parts. The first part presents a thorough and original study of the algebraic and geometric properties of what is known as disformal metrics. Such disformal metrics arise in scalar-tensor theories of gravity, in which scalar field derivatives are coupled to the metric. The usual conformal transformation are there extended to a more general mapping of the metric, dubbed the disformal transformations. A new formalism for such metrics is developed and two physical applications are given. The first application concerns the disformal invariance of the Dirac equation. The second application, the new formalism developed for disformal metrics is used as the mathematical framework for the description of a phenomenological approach to quantum gravity known as rainbow gravity. In the second part, scalar field self-force effects on a scalar charge orbiting a Reissner-Nordström black hole are investigated. The scalar wave equation is solved analytically in a post-Newtonian framework, and the solution is used to compute the self-field as well as the components of the self-force at the location of the particle up to 7.5 post-Newtonian order. The energy fluxes radiated to infinity and down the hole are also evaluated. A comparison with previous numerical results in the Schwarzschild case shows a reasonable agreement in both strong-field and weak-field regimes. This thesis is particularly interesting in light of the recent claim about the first observation of gravitational waves with the event GW150914, which has made the problem of the gravitational radiation one of the hottest topics in relativistic astrophysics.

The co-adivsor of Gabriel Guimarães Carvalho, professor Donato Bini from the Istituto per le Applicazioni del Calcolo "M. Picone" of CNR, mentioned: “This work is a first effort in exporting explicitly gravitational self-force effects from the Schwarzschild background to the Reissner-Nordstrom one. The application has been performed here at the simplest level of scalar self-force effects and, indeed, at this level all the subtleties and difficulties of the underlying formalism have been completely solved. So far a future step will consist in considering both gravitational and electromagnetic perturbations of the Reissner-Nordstrom black hole. These results have been published in Physical Review D (IF: 4.506) The implications for relativistic astrophysics of these studies, i.e. the main motivation of the work itself, are of great interest.”

List of publications of Gabriel Guimarães Carvalho:

- D. Bini, G.G. Carvalho and Andrea Geralico; "*Scalar field self-force effects on a particle orbiting a Reissner-Nordström black hole*", Phys. Rev. D 94, 124028 (2016), IF: 4.506.
- G.G . Carvalho , I. P. Lobo and E. Bittencourt - “*Extended disformal approach in the scenario of rainbow gravity*”, Physical Review D 93, 044005 (2016), IF: 4.506.
- E. Bittencourt, I. P. Lobo, G.G. Carvalho - “*On the disformal invariance of the Dirac equation*”, Class. Quantum. Grav. 32, 185016 (2015) IF: 2.837.

Originally Gabriel Guimarães Carvalho is from the Universidade Federal de Pernambuco, Recife, PE, Brazil. ICRANet has a collaboration agreement with this University. The fellowship for this PhD study was provided by CAPES within the CAPES-ICRANet program. For more information please see the thesis and the video of thesis discussion.

Iarley Pereira Lobo presented a thesis “*Geometrical approach to Planck-scale deformations of phase spaces*", and defended it on Friday February 24th, 2017 at the University of Rome "Sapienza".

Commission members: Prof. Paolo Pani (University of Rome "Sapienza", Italy), Prof. Salvatore Mignemi (University of Cagliari, Italy); Prof. Stefano Liberati (Sissa Trieste). Thesis Advisor: Prof. Giovanni Amelino-Camelia.

In this thesis some semi-classical properties of Quantum Gravity are described by the use of non-trivial geometries as a common language. Deformed interactions that emerge from the deformation of the Lorentz symmetry by means of curved momentum spaces are described. In particular, the problem of how particles would interact if momentum space had an anti-de Sitter geometry is considered: it is shown that some usual paths followed in the de Sitter momentum space literature could not be followed in the anti-de Sitter case due to some internal inconsistencies, and some alternative scenarios that could be considered are presented. Regarding spacetime, also a link between the disformal metrics literature and the Rainbow Gravity one is exhibited, that is consistent with the deformed causal structure, presents an inherent group structure and is intrinsically covariant under coordinate transformations. Finally, an alternative way of describing the natural spacetime for Modified Dispersion Relations is presented by means of a generalized Finsler geometry (which is intimately attached to variational techniques) with a well-defined massless limit, which allows to analyze its relativistic properties and to derive observables that are compatible with this picture.

The supervisor of Dr. Lobo, Prof. Giovanni Amelino-Camelia from the University of Rome “Sapienza”, mentioned: “This is a study that contributes to the recent wave of interest in "dimensionally reduced" 3D quantum gravity, as a toy model for "real" 4D quantum gravity. 3D quantum gravity is still complex, but much less than 4D quantum gravity and most of the conceptual complexity of the quantum-gravity problem is preserved in the 3D case. As gradually over the last decade 3D quantum gravity was better understood, considerable interest was gained by the fact that it is characterized by deformed relativistic symmetries and momentum-space curvature. The most significant result of the PhD work of Iarley Lobo has been to provide for the first time a systematic investigation of pairings of metric and affine connection for 4D momentum space, establishing that 3 such pairings preserve the logical structure of the 3D results. The relativistic properties of these 3 candidates models have been studied in detail, also providing some avenues for phenomenology based on the analysis of gamma-ray-burst signal structure.”

List of publications of Iarley Pereira Lobo:

- E. Bittencourt, I. P. Lobo and G. G. Carvalho, *On the disformal invariance of the Dirac equation*, Class. Quant. Grav. 32 185016 (2015).
- I. P. Lobo, A. B. Barreto and C. Romero, *Space-time singularities in Weyl manifolds*, Eur. Phys. J. C75 448 (2015).
- G. G. Carvalho, I. P. Lobo and E. Bittencourt, *Extended disformal approach in the scenario of Rainbow Gravity*, Phys. Rev. D93 044005 (2016).
- I. P. Lobo and G. Palmisano, *Geometric interpretation of Planck-scale-deformed co-products*, Int. J. Mod. Phys. Conf. Ser. 41 1660126 (2016).
- I. P. Lobo, G. Palmisano and G. Amelino-Camelia, *Geometric picture of DSR-relativisitc theories with de Sitter and anti-de Sitter momentum spaces*,submitted to IJMP Conf. Ser. (2015).
- I. P. Lobo, N. Loret and F. Nettel, *Rainbows without unicorns: Metric structures in theories with Modified Dispersion Relations*, arXiv: 1610.04277, submitted to EPJ C.
- I. P. Lobo, *Frame transformations in Brans-Dicke theory from the viewpoint of Weyl geometry*, arXiv:1610.05004, submitted to IJMP D.
- I. P. Lobo, N. Loret and F. Nettel, *Investigation of Finsler geometry as a generalization to curved spacetime of Planck-scale-deformed relativity in the de Sitter case*, Phys. Rev. D95 046015 (2017).

Originally Iarley Pereira Lobo is from Universidade Federal da Paraíba, João Pessoa, PB, Brazil. ICRANet has a collaboration agreement with this University. The fellowship for this PhD study was provided by CAPES within the CAPES-ICRANet program. For more information please see the thesis and the video of thesis discussion.

The thesis work of Gabriel Guimarães Carvalho and Iarley Pereira Lobo was successfully marked by the collaboration with Eduardo Henrique Silva Bittencourt, who co-authored two publications with them (no. 3 and no. 7 in the list below).

Eduardo Henrique Silva Bittencourt has visited ICRANet twice, from 20 of October to 23 of November 2011, and from 2 to 19 of October 2012, and then has been admitted to the CAPES-ICRANet Postdoctoral program. He worked at "Sapienza" University of Rome, from December 2013 to November 2015. He currently holds a Professor position at Universidade Federal de Itajubá (UNIFEI), Itajubá, MG, Brazil. ICRANet has a collaboration agreement with this University.

List of publications of Eduardo Henrique Silva Bittencourt:

- 1. Bini, Donato, Bittencourt, Eduardo, Geralico, Andrea, Jantzen, Robert T, Slicing black hole spacetimes. International Journal of Geometric Methods in Modern Physics, Volume 12, Issue 7, id. 1550070, 2015.
- Bini, Donato; Bittencourt, Eduardo; Geralico, Andrea, Massless Dirac particles in the vacuum C-metric, Classical and Quantum Gravity, Volume 32, Issue 21, article id. 215010 (2015).
- G.G . Carvalho , I. P. Lobo and E. Bittencourt - "Extended disformal approach in the scenario of rainbow gravity", Physical Review D 93, 044005 (2016).
- Bittencourt, E.; Moschella, U.; Novello, M.; Toniato, J. D., More about scalar gravity, Physical Review D, Volume 93, Issue 12, id.124023 (2016).
- Bittencourt, Eduardo; Pereira, Jonas P.; Smolyaninov, Igor I.; Smolyaninova, Vera N., The flexibility of optical metrics, Classical and Quantum Gravity, Volume 33, Issue 16, article id. 165008 (2016).
- Santos, G. B.; Bittencourt, E.; Salim, J. M., Scalar perturbations in a Friedmann-like metric with non-null Weyl tensor, Journal of Cosmology and Astroparticle Physics, Issue 06, article id. 013, (2015).
- E. Bittencourt, I. P. Lobo, G.G. Carvalho - "On the disformal invariance of the Dirac equation", Class. Quantum. Grav. 32, 185016 (2015).

2. ICRANet Steering Committee meeting on the 1st of February 2017

On the 1st of February 2017 the 16th Steering Committee of ICRANet took place. The following members were present: Prof. Ashot Kocharian (Representative of Armenia), Fabrizio Nicoletti, Cons. Enrico Padula, Prof.ssa Immacolata Pannone (DGSP Representatives of the Italian Ministry of Foreign Affairs and International Cooperation - Italy), Dr. Antonio Bartolini (General Government Accountancy IGAE Uff. IX - Representative of Ministry of Economy), Dr. Giulietta Iorio on behalf of Dr. Vincenzo Di Felice (Representative of Ministry of Education, Universities and Research), Prof. Carlo Luciano Bianco with the proxy of Prof. Remo Ruffini (Representative of ICRA), Prof. She Sheng Xue with the proxy of Prof. Xiaohui Fan (Representative of the University of Arizona in Tucson), Prof. Jorge Armando Rueda Hernandez with the proxy of Prof. C. W. Francis Everitt, Chairman (Representative of Stanford University), Ing. Carlo Pace (Representative of the Municipality of Pescara for the Mayor, Avv. Marco Alessandrini) and Prof. Remo Ruffini (Director of ICRANet). In addition ICRANet Auditors were present: Cons. dr. Giacinto Dammicco (Advisor, Italian Court of Auditors) and Dott.ssa Claudia Martinelli. Participated as observer also Dr. Piero Redolfi (Accounting consultant).

3. Professor Ruffini in Singapore for the “Conference on Cosmology, Gravitational Waves and Particles” from 6 to 10 of February 2017

On February prof. Ruffini went in Singapore, at Nanyang Executive Centre, Nanyang Technological University, for the conference on “Cosmology, Gravitational Waves and Particles”. In this occasion, the Director of ICRANet has delivered a talk titled "Gamma Ray Bursts, from Supernovae to Hypernovae to Binary Drive Hypernovae".

Details can be found here: http://icranet.org/index.php?option=com_content&task=view&id=1081

4. New agreement signed on the 17th of February 2017 with the Universidade Tecnológica Federal do Paraná – Brazil

On the 17th of February was signed the agreement between ICRANet and the UTFPR, Federal University of Technology. This new agreement was signed by Prof. Dr. Luiz Alberto Pilatti, Rector of the University, and Prof. Ruffini, Director of ICRANet. This agreement will be valid for 5 years and the joint activities will consist of: to give in a mutual way scientific and cultural support; to develop joint investigation projects; to develop cooperation forms and actions in other areas of mutual interest; realization of staff and students exchange programs.

For the agreement see: http://www.icranet.org/documents/agreementICRANet-UTFPR.pdf

5. Three lectures with students of Science High School Galileo Galilei in Pescara

On February and March the ICRANet Center of Pescara has hosted the students of Science High School Galileo Galilei for three lectures related to the project “school-work”. In these three occasions the lectures were given by Dr. Alessandra Di Cecco on “Dangers, natural and artificial, that come from the space”, by Dr. Gregory Vereshchagin on “Big Bang: primordial cosmology and the formation of the large scale structure” and by Professor Costantino Sigismondi about spectroscopy, photometry, mathematical fits, physical models, scientific theory, and the Occam's razor.

Details (in Italian) can be found here:
http://www.icranet.org/index.php?option=com_content&task=view&id=1066

6. In memory of Carlo Pace, member of the ICRANet Steering Committee

On March 28, 2017, Carlo Pace, member of ICRANet Steering Committee for the Municipality of Pescara, passed away. As Mayor of Pescara, he was characterized with a constant and passionate ample vision of the future development of Pescara and of Abruzzo. Since 1994 he expressed his will to host the ICRANet headquarters in the town of Pescara. He personally followed the restructuring of the ancient train station into an international research center. In 2005 ICRANet was unanimously approved by the Italian Parliament. Carlo followed constantly, day by day, with great understanding and passion, ICRANet research and teaching activities.

7. Seminars in ICRANet centers in Rome and Pescara on the 21st of February with Marco Merafina, on the 1st of March with Alessandro Nagar and on the 6th of March with Luc Blanchet

- On February 21, 2017, Dr. Marco Merafina, of the Department of Physics, University of Rome La Sapienza, has given a seminar at the ICRANet center of Pescara, with the title: "Gravity and thermodynamics: a new point of view in the analysis of equilibrium and dynamical evolution of globular clusters".

Dr. Merafina presented a new approach to theoretical study of the dynamics of globular clusters, by applying thermodynamic principles to a Boltzmann distribution function with an Hamiltonian function which contains an effective potential depending on the kinetic energy of the stars, due to the effect of tidal interactions induced by the hosting galaxy. In this theory new relations for the thermodynamical equilibrium in presence of a gravitational potential, a different form of the virial theorem are obtained, and the concepts of thermodynamic and kinetic temperature, pressure and chemical potential (the intensive quantities) are introduced. It is shown that a globular cluster can be described as a model containing regions with positive and negative specific heat producing thermodynamic instabilities which drive the systems towards the gravothermal catastrophe, without the necessity of an external thermal bath. The influence of the effective potential on the virial theorem is described, together with the related consequences on the gravothermal stability limit for star clusters through the analysis of the caloric curve and its critical points. This new limit is different from one obtained by Katz in 1978 and it is in complete accordance with the value related to the maximum of cluster distribution constructed by data from Harris Catalogue for globular clusters.

Direct observation of gravitational radiation from astrophysical objects promises a revolution in astronomy and astrophysics, as it opens new observational window to the Universe. Recent claims on possible discovery of gravitational wave signals (https://en.wikipedia.org/wiki/First_observation_of_gravitational_waves) has attracted much attention in scientific community and general public. ICRANet invited two leading experts in this field to discuss theoretical progress in gravitation wave emission.

- On March 1st Dr. Alessandro Nagar has given a seminar in Rome, at Aula Rasetti, Physics Department, University of Rome La Sapienza. Dr. Nagar is one of the leading theorists and a collaborator of Thibault Damour. He is an author of the The IHES effective-one-body (EOB) code, treating the general relativistic two body problem. The subject of this seminar was "Binary Black Hole Merger: The Theory interfacing numerical and analytical relativity". Dr. Nagar presented a very comprehensive talk with details about the semi-analytical approach to calculations of gravitational wave templates as well as the use of simulations from Numerical Relativity as input for unknown parameters in the EOB model. The lecture can be found here: http://www.icranet.org/documents/nagar_icranet.pdf

- On March 6, 2017, Professor Luc Blanchet, Director of Research in CNRS - Institut d'Astrophysique de Paris, France, has given a seminar on "Gravitational waves and the two-body problem in GR" at the Physics Department, University of Rome La Sapienza.

Prof. Blanchet is one of the leading theoreticians working on Post-Newtonian (PN) approximations to gravitational radiation in the general relativistic two body problem. In the seminar he presented most recent advances in this field. He underlined, that: "The theoretical and numerical works on the two-body problem in general relativity play a very important role when deciphering and interpreting the gravitational wave signals. In particular, state-of-the-art approximation methods in GR permit to build very precise and reliable gravitational wave templates to be used in the data analysis of detectors. The flagship of these methods is the post-Newtonian (PN) approximation which describes both the dynamics of two compact bodies (including black holes) and the gravitational radiation emitted."

8. Upcoming international meetings

- **ICRANet-Minsk workshop on high energy astrophysics**

National Academy of Sciences of Belarus, Minsk, Belarus, April 26-28, 2017

Meeting Rationale

ICRANet-Minsk workshop on high energy astrophysics will be the first scientific event organized in the new ICRANet center in

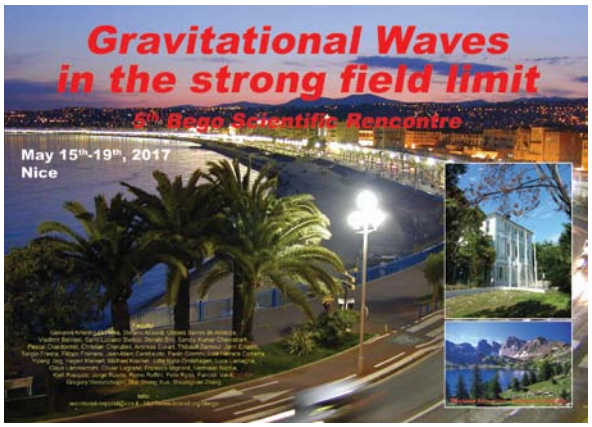
Minsk, Belarus. It will be a parallel meeting to a larger symposium on nuclear physics at the National Academy of Sciences of Belarus. This workshop is an opportunity for young scientists working in relativistic astrophysics from European and Asian countries to exchange experience and to present results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

Official webpage of the meeting: http://www.icranet.org/imw

- **Fifth Bego Rencontres IRAP Ph.D. school**

Villa Ratti, Nice - May 15th-19th, 2017

The school will take place in Nice from the 15 to the 19th of May. It is traditionally devoted to frontier topics in relativistic astrophysics and to the students of the IRAP PhD Program. This meeting is dedicated to gravitational waves in the strong field limit and is open to all interested scientists and graduate students. We recall that the IRAP-PhD is coordinated by ICRANet, involving various universities and research centres, and the diploma are jointly delivered by all the universities participating in the program: University of Bremen (Germany), University of Ferrara (Italy), University of Nice Sophia Antipolis (France), University of Oldenburg (Germany), University of Rome "La Sapienza" (Italy), University of Savoie (France), University of Grenoble (France).



Invited lecturers include: Donato Bini, Luc Blanchet, Christian Cherubini, Nathalie Deruelle, Simonetta Filippi, Mile Karlica, Jutta Kunz-Drolshagen, Claus Lämmerzahl, Felix Mirabel, Marco Muccino, Tsvi Piran, José Rodriguez, Jorge Rueda, Remo Ruffini, Narek Sahakyan, Gregory Vereshchagin, Yu Wang, She-Sheng Xue.

Directors: Prof. Remo Ruffini - Prof. Pascal Chardonnet.

Faculty: Giovanni Amelino-Camelia, Stefano Ansoldi, Ulisses Barres de Almeida, Vladimir Belinski, Carlo Luciano Bianco, Donato Bini, Sandip Kumar Chakrabarti, Pascal Chardonnet, Christian Cherubini, Andreas Eckart, Thibault Damour, Jaan Einasto, Sergio Frasca, Filippo Frontera, Jean-Marc Gambaudo, Paolo Giommi, Luis Herrera Cometta, Yipeng Jing, Hagen Kleinert, Michael Kramer, Jutta Kunz-Drolshagen, Luca Lamagna, Claus Lämmerzahl, Olivier Legrand, Francois Mignard, Hermann Nicolai, Kjell Rosquist, Jorge Rueda, Remo Ruffini, Felix Ryde, Farrokh Vakili, Gregory Vereshchagin, She Sheng Xue, Shuangnan Zhang.

Official webpage of the meeting: http://www.icranet.org/5bego

- **The 2017 Annual meeting of the Division of Gravitation and Relativistic Astrophysics of the Chinese Physical Society /The Fifth Galileo-Xu Guangqi Meeting**

School of Physical Science and Technology - Southwest Jiaotong University, Chengdu – China - June 25 - 30, 2017

Scientific Objectives

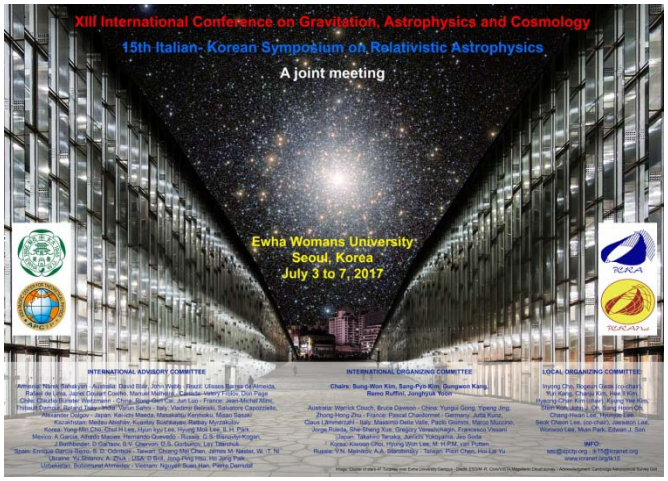
This year jointed with the annual meeting of the Division of Gravitation and Relativistic Astrophysics of the Chinese Physical Society, the Fifth Galileo-Xu Quangqi meeting will be held in the School of Physical Science and Technology, Southwest Jiaotong University, at Chengdu – China on June 25 -30.

The meeting is particularly dedicated to recall the roots of the modern scientific research in the East and the West and review the recent progress in one of the most advanced fields of scientific research: the one of relativistic astrophysics. We will review current progress in Relativistic Astrophysics made possible by astronomical observations of the Sun, of the Stars and of the Universe, and the current developments of theoretical studies of gravitation and cosmology as well as other fundamental physics. These results have been achieved thanks to the theories of Albert Einstein and to the unprecedented numbers of observational techniques: in X-ray, Gamma-ray, optical wave-lengths from space based observatories, in radio telescopes wavelengths from telescopes on the ground as well as in particle physics from underground observatories. The International Conference on Gravitational and Cosmology the Fifth Galileo-Xu Guangqi meeting follows the 1st, 2nd, the 3rd and 4th meeting of this series held in October 2009 in Shanghai - China (http://www.icranet.org/galileo-xuguangqi), in July 2010 in Ventimiglia, Italy, and Nice, France (http://www.icranet.org/2nd_galileo-xuguangqi), in October 2011 (http://www.icranet.org/3gx) and in May 2015 both in Beijing (http://www.icranet.org/4gx), China. The goal is to create a forum for strategic exchanges between eastern and western science at the highest level dealing with relativistic astrophysics and related fundamental theoretical, experimental and observational fields. The aim is to enlarge the audience from the one strictly Chinese and Italian, to one embracing European and western scientific interests and to the eastern ones. Therefore a broader participation from Korea and Taiwan is encouraged, as well as a participation of scientists from Europe and the Americas.

Official webpage of the meeting: http://www.icranet.org/5gx

- **XIII International Conference on Gravitation, Astrophysics and Cosmology- 15th Italian-Korean Symposium on Relativistic Astrophysics - A joint meeting**

Ewha Womans University - Seoul, Korea, July 3 to 7, 2017



This symposium started in 1987, then continued for every two years alternatively in Korea and Italy with the support from Korea Science and Engineering Foundation (KOSEF), Consiglio Nazionale delle Ricerche (CNR), International Center for Relativistic Astrophysics Network (ICRANet) and hosting institutes. Main purpose of this symposium is to accelerate the exchange

between scientists of Italy and Korea, especially young researchers. Traditionally, the subjects of this series of symposium have been mainly theoretical astrophysics, especially in the fields of relativistic astrophysics. In the symposium, results of relevant astrophysical observations and experiments, as well as their theoretical understanding will be presented, including gravitational wave detection experiments in which Korean astrophysicists are actively participating. This year the symposium is held in conjunction with the XIII International Conference on Gravitation, Astrophysics and Cosmology (ICGAC-13), a series of biennial conferences on Gravitation, Astrophysics and Cosmology which takes place in the Asia-Pacific region with the goal to promote cooperation among the member countries and within an international context, to promote high level studies on hot topics and to encourage young physicists on these fields.

Official webpage of the meeting: http://www.icranet.org/ik15

9. New students of the IRAP Ph.D program

	Baghmanyan, Vardan (Armenia) Yerevan State University *"Currently, I am PhD student in Yerevan State University but for my PhD thesis I work in ICRANet Armenia. In the PhD thesis, I study X-ray and gamma-ray emissions processes in the radio galaxies and blazars (BL Lacs and FSRQs)."*
	Bedić, Suzana (Croatia) University of Rome "La Sapienza" "*After graduating on University of Zagreb in Croatia, I have enrolled in IRAP PhD program. While in a process of defining my thesis topic, I am currently working on gamma-ray bursts and my research interests also include general relativity, quantum gravity, black holes, dark matter and cosmology."*
	Campion, Stefano (Italy) University of Rome "La Sapienza" *"I'm graduated in Astronomy and Astrophysics at the University of Rome "La Sapienza". My research topic is the study of the production and characteristics of the neutrino in the GRB (according to the supercritical accretion model) and their detection on Earth. Other research interests are: the study, the dynamic point of view of self-gravitating systems (galaxies, globular clusters, galactic halos)."*
	Chen, Yen-Chen (Taiwan) National Central University, Graduate Institute of Astronomy *"I graduated from the graduate institute of astronomy of National Central University in Taiwan. I have not decided my Ph.D topic and my research interesting is AGNs, dwarf galaxy, and dark matter."*

Gasparyan, Sargis (Armenia)
National Academy of Sciences of Armenia

"I'm coming from Yerevan State University. I am first year PhD student in ICRANet-Armenia. I study high energy gamma ray emission processes in the Blazars."

Marongiu, Marco (Italy)
Università degli Studi di Ferrara

Master's Degree in Physics at Cagliari University with a thesis about simulations of observations of pulsars with the Sardinia Radio Telescope (SRT). Graduate student enrolled in the Ph.D. programme in Physics at the Ferrara University (supervisor Cristiano Guidorzi). Main research topics: multiwavelength study of Gamma-Ray Bursts (GRBs), Fast Radio Bursts (FRBs), involvement in future astrophysical missions (HXMT, THESEUS).

Martone, Renato (Italy)
Università degli Studi di Napoli Federico II

Bachelor's Degree in Physics at Napoli Federico II University with a thesis about gamma-ray bursts (GRBs). Graduate student enrolled at the Ph.D. programme in Physics at the Ferrara University (supervisor Cristiano Guidorzi). Main research topics: multiwavelength study and data analysis of GRBs and of the transient sky.

Vieira Lobato, Ronaldo (Brazil)
Instituto Tecnológico de Aeronáutica

"I have Licentiate degree in Natural Sciences, habilitation in Physics (2009-2013), Master of Science, with major in Nuclear Physics (2013-2015). I am a PhD student at Technological Institute of Aeronautics (ITA); on February I was granted a scholarship (CAPES Sandwich Fellowship) from March 2017 to February 2018 for internship at the University "Sapienza" of Rome. My research focuses on structure and evolution of compact stars and emission mechanisms. Member of Brazilian Society of Physics (SBF) and American Physical Society (APS)"

Zargaryan, Davit (Armenia)
National Academy of Sciences of Armenia

"I am coming from Yerevan State University and I am PhD student in ICRANet Armenia. My PhD thesis is devoted to study particle acceleration and emission processes in the large scale jets of AGNs."

ICRANet Newsletter

April – May 2017

SUMMARY

1. Two additional cases support the classification of short GRBs proposed in Ruffini et al. (2015)

A new paper "GRB 081024B and GRB 140402A: two additional short GRBs from binary neutron star mergers" by the group of scientists from ICRANet, including: Y. Aimuratov, R. Ruffini, M. Muccino, C.L. Bianco, A.V. Penacchioni, G.B. Pisani, D. Primorac, J.A. Rueda, Y. Wang has just been submitted for publication to Astrophysical Journal. The paper is available online at: http://lanl.arxiv.org/abs/1704.08179

This article continues the approach by the GRB group led by professor Ruffini on the way of understanding the physics of gamma-ray bursts [1, 2], with a special focus on short gamma-ray bursts [3, 4, 5]. According to the new classification of GRBs introduced in [1] the authentic short gamma-ray bursts (S-GRBs), with isotropic energy $E_{iso}>10^{52}$ erg, are evidencing a BH formation in the binary neutron star merging process. The signature for the BH formation consists in the on-set of the high energy (0.1-100 GeV) emission, coeval to the prompt emission, in all S-GRBs.

The paper focuses on two additional examples of S-GRBs: GRB 081024B, with E_{iso} =2.6x10^{52} erg and $E_{p,i}$=9.6 MeV, and GRB 140402A, with E_{iso} =4.7x10^{52} erg and $E_{p,i}$=6.1 MeV. By performing the time-integrated and time-resolved spectral analyses on both these sources their cosmological redshifts are inferred: z=3.12 for the S-GRB 081024B and z=5.52 for the S-GRB 140402A, respectively. Their P-GRB spectral emission is also identified. For S-GRB 081024B it results as the convolution of BB spectra at different Doppler factors arising from a highly spinning BH. The P-GRB emission of S-GRB 140402A is consistent with a single BB, expected to occur for a moderately spinning BH [4].

It is shown that two additional S-GRBs, 081024B and 140402A, share the common behavior of GeV emission of the already identified members of such a subclass, namely 090227B [3], 090510 [4] and 140619B [5].

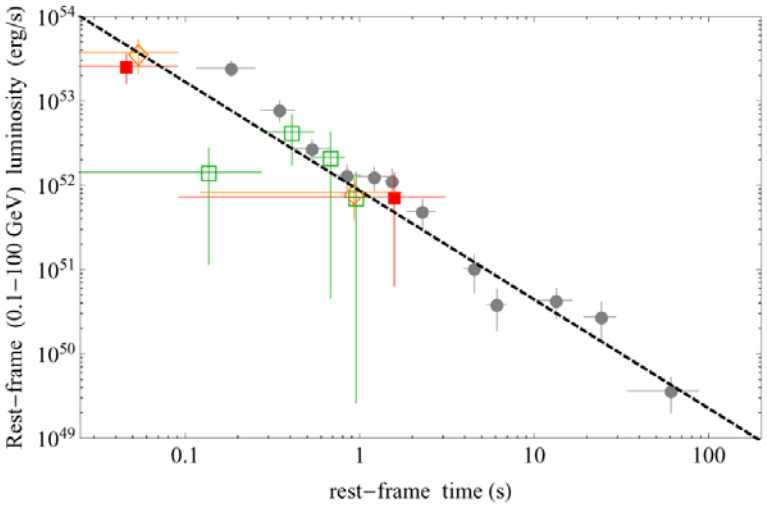


Figure 1. The rest-frame 0.1-100 GeV isotropic luminosities of the S-GRBs: 081024B (orange empty diamonds), 090510 (gray filled circles), 140402A (red filled squares), and 140619B (green empty squares). All the light curves are shown from the burst trigger times on, while in the case of the S-GRB 090510 it starts after the precursor emission, i.e., from the P-GRB emission on (see [4] for details). The dashed black line marks the common behavior of all the S-GRB light curves.

Most noteworthy, the existence of a common power-law behavior in the rest-frame 0.1-100 GeV luminosities (see Figure 1), following the BH formation, points to a commonality in the mass and spin of the newly-formed BH in all these S-GRBs. This result is explainable with the expected mass of the merging NSs, each one of M= 1.3-1.5 solar masses [6], and the expected range of the non-rotating NS critical mass M_{NS_crit}=2.2-2.7 solar masses [5].

In all the identified S-GRBs, within the Fermi-LAT FoV, GeV photons are always observed [4, 1]. This implies that no intrinsic beaming is necessary for the S-GRB GeV emission.

References

[1] Ruffini, R., Rueda, J.A., Muccino, M., Aimuratov, Y. et al. 2016, ApJ, 832, 136.
[2] Becerra, L., Bianco, C.L., Fryer, C.L., Rueda, J.A., Ruffini, R. 2016, ApJ, 833, 107.
[3] Muccino, M., Ruffini, R., Bianco, C.L., Izzo, L., Penacchioni, A. 2013, ApJ, 763, 125.
[4] Ruffini, R., Muccino, M., Aimuratov, Y., Bianco, C.L., et al. 2016, ApJ, 831, 178.
[5] Ruffini, R., Muccino, M., Kovacevic, M., Oliveira, F.G. et al. 2015, ApJ, 808, 190.
[6] Ozel, F., Freire, P. 2016, ARA&A, 54, 401.

2. Fifteenth Marcel Grossmann meeting (MG15) announcement

The Fifteenth Marcel Grossmann Meeting on General Relativity and Relativistic Astrophysics (MG15) will be held on the campus of the University of Rome "La Sapienza" in Rome, Italy in the year 2018. The important dates are:

Sunday July 1 - Onsite registration

Monday July 2 – Conference opening

Saturday July 7 – Conference closing.

3. Professors Roy Kerr and Fulvio Melia at ICRANet and the ongoing scientific discussions

Professor Kerr during his stay in Pescara worked extensively with the ICRANet faculty to attempt to reach inferences for General Relativity from Advanced LIGO published results.

In May 2017 professor Roy Kerr, member of the Faculty of ICRANet, recipient of the Crafoord Prize 2016 and honorary citizen of Pescara is visiting ICRANet center in Pescara.

In the presence of prof. Kerr on 24 of May Professor Fulvio Melia from the University of Arizona has presented a seminar on zero active mass cosmology and illustrated how present day observations favor the cosmological model with constant rate of expansion with respect to the Lambda-CDM model.

For video please see: https://youtu.be/mheIJOKMx10

4. Meeting at the Council of the Republic of Belarus for possible entrance of Belarus in ICRANet on 27 of April, 2017

The meeting between the Director of ICRANet, Prof. Remo Ruffini and the Chairman of the Standing Committee of the Council of the Republic of the National Assembly of the Republic of Belarus for Foreign Affairs and National Security, prof. Sergey Rakhmanov, as well as the Vice Chairman of the Presidium of the National Academy of Sciences of Belarus, Academician Sergei Kilin was held on April 27, 2017 at the Council of the Republic of Belarus.

Prof. Ruffini has illustrated the opportunities for Belarus as a state to be member of ICRANet as international organization, as well as the scientific activities of ICRANet. He mentioned successful collaboration between ICRANet and National Academy of Sciences and Belarusian State University in organization of several international conferences in Minsk, active role of belarusian scientists in ICRANet, as well as opening of new ICRANet center in Minsk.

Prof. Rakhmanov has expressed strong interest and support from the Council of the Republic of the National Assembly of the Republic of Belarus for the initiative of the National Academy of Sciences for Belarus to become a member state of ICRANet.

5. New Cooperation Agreement signed between ICRANet and Belarusian Republican Foundation for Fundamental Research on 26 of April, 2017

The new Cooperation Agreement between ICRANet and Belarusian Republican Foundation for Fundamental Research (BRFFR) was signed on April 26, 2017 by the Director of ICRANet, prof. Remo Ruffini and Director of BRFFR, Academician Sergei Gaponenko.

BRFFR is the oldest scientific fund on the territory of the former USSR and it is the only institution providing financial support of fundamental research for Belarusian scientists on competitive basis.

This new agreement intends to provide funding for joint scientific activities between ICRANet and Belarus. Publication of joint calls for proposals is planned every two years.

The text of the Agreement can be found here: http://www.icranet.org/documents/Accordo_ICRANet-BRFFR.pdf

6. The First ICRANet-Minsk workshop on high energy astrophysics and opening of ICRANet-Minsk Center, 26-28 of April, 2017

On April 26-28, 2017 the first ICRANet-Minsk workshop on high-energy astrophysics has been held at the National Academy of Sciences of Belarus in Minsk, Belarus. This workshop has been the first scientific event organized in the new ICRANet Center in Minsk and it provided 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. The workshop was a parallel meeting to a larger symposium BelINP-2017 on nuclear physics at the National Academy of Sciences of Belarus. This event was organized within the 2017 Year of Science, declared by the Presidential decree.

At the conference opening, in presence of the Ambassador of Italy, Director of ICRANet, Professor Remo Ruffini and the Vice Chairman of the presidium of the National Academy of Sciences of Belarus, Academician Sergei Kilin, have signed the protocol of the opening of ICRANet-Minsk Center. The new center is located at the B.I. Stepanov Institute of Physics and has a high speed internet connection to other ICRANet centers.

The plenary session of the conference BelINP-2017 was opened with the public lecture, given by Professor Ruffini: “Black Holes, Gravitational Waves and Binary Driven Hypernovae”.

The ICRANet-Minsk workshop focused on the following topics: gamma-ray bursts, neutron stars, supernovae, topological defects in cosmology, dark energy, motion of extended bodies in General Relativity, propagation of high energy particles at cosmological distances. Such workshops are planned to be held on the regular basis, which will allow exchange of ideas among ICRANet scientists, as well as active participation of Belarusian researchers in scientific activities in relativistic astrophysics, coordinated by ICRANet.

The website of the meeting: http://www.icranet.org/imw

The website of the BelINP symposium: http://nasb.gov.by/npc/en/

Protocol of the opening of ICRANet-Minsk Center: http://icranet.org/documents/prtocollo_opening.pdf

The video of the public lecture of prof. Ruffini: https://www.youtube.com/watch?v=TCEzQp38YTc

Article in the newspaper of the Academy of Sciences “Navuka” (in Russian):
http://gazeta-navuka.by/images/electronic-catalog/29.05.17.pdf

For local news reports (in Russian) see:
http://www.belta.by/regions/view/mezhdunarodnyj-tsentr-reljativistskoj-astrofiziki-icranet-otkrylsja-v-minske-244441-2017/

http://www.zviazda.by/ru/news/20170421/1492792731-mezhdunarodnyy-akademicheskiy-centr-icranet-otkroetsya-v-minske

http://www.ecopress.by/ru/news/19/detail/213926.html

7. Fifth Bego Rencontres - IRAP Ph.D. school, Nice-Rome, 15-19 May 2017

From 15 to 19 May the 5° Bego Rencontres “Gravitational waves in the strong field limit” was held in Nice (France) and Rome (Italy). The lectures in Nice were held in Villa Ratti, while those in Rome were held at the Department of Physics of University of Rome “La Sapienza”. There were around 40 participants, including prof. Roy Kerr and other distinguished scientists as well as graduate students, who are active in the fields of Physics and Relativistic Astrophysics, coming from: Argentina, Brazil, China, Colombia, Croatia, France, Germany, Italy and Russia.

Among the participants there were: Roy Patrick Kerr, Pascal Chardonnet, Vladimir Belinski, Narek Sahakyan, Felix Aharonian, Felix Mirabel, Paolo Giommi, Yu Wang, Paolo de Bernardis, Carlo Bianco, Christian Cherubini, Gregory Vereshchagin, Jose Rodriguez, She Sheng Xue, Camilo Delgado, Massimo Della Valle, Carlo Bianco, Giovanni Pisani, Carlos Arguelles, Marco Muccino, Andreas Krut, Donato Bini, Volcker Perlick, Tais Maiolino, Angeles Moliné, Jutta Kunz, Ana Penacchioni.

In this meeting an overview of black hole formation in binary systems has been given by prof. Felix Mirabel, **based on his recent article “The Formation of Stellar Black Holes”,** available online: http://www.sciencedirect.com/science/article/pii/S1387647316300501. A progress in understanding on gravitational wave emission in strong field limit and electrodynamics of gravitational accretion to the Kerr black hole in the Ruffini-Wilson framework have been discussed. **Particularly important were lively discussions with prof. Mirabel who presented the latest observations of intermediate mass black holes of 10 Solar masses, e.g. Cygnus X-1.**

The video of presentations can be seen here:

http://www.icranet.org/index.php?option=com_content&task=view&id=1121

The conference web page: http://icranet.org/5bego

8. Recent publications

Pugliese, D.; Quevedo, H.; Ruffini, R. *"General classification of charged test particle circular orbits in Reissner-Nordström spacetime"*, The European Physical Journal C 77 (2017) 206.

In this work charged particle circular motion in the gravitational field of a charged mass distribution described by the Reissner-Nordström spacetime is investigated. A set of independent parameters completely characterizing the different spatial regions in which circular motion is allowed, is introduced. A most complete classification of circular orbits for different sets of particle and source charge-to-mass ratios is given. This analysis shows in an alternative manner that the behavior of circular orbits can in principle be used to distinguish between black holes and naked singularities. This work plays an important role in the study of the coupled electromagnetic and gravitational interactions, and the investigation of the role of the charge in the gravitational collapse of compact objects.

Federico Cipolletta, Christian Cherubini, Simonetta Filippi, Jorge A. Rueda, Remo Ruffini, *"On the last stable orbit around rapidly rotating neutron stars"*, accepted by Physical Review D, also available at https://arxiv.org/abs/1612.02207.

The binding energy and angular momentum of a test-particle at the last stable circular orbit (LSO) on the equatorial plane around a general relativistic, rotating neutron star (NS) is computed. Simple, analytic, but accurate formulas for these quantities that fit the numerical results and which can be used in several astrophysical applications are presented. The accuracy of these formulas for three different equations of state (EOS) is demonstrated based on nuclear relativistic mean-field theory models and it is argued that they should remain still valid for any NS EOS that satisfy current astrophysical constraints. These numerical results are compared and contrasted with the corresponding ones for the Kerr metric characterized by the same mass and angular momentum.

9. The first project of school – job with High School "Galileo Galilei" is concluded

On May, 2017, the first project "School-Job" with the students of High School "Galeileo Galilei" of Pescara has been successfully concluded. Dr. Marco Muccino, member of the ICRANet Faculty, had given a lecture "Gamma-ray Bursts: the biggest explosions in the universe".

Within this lecture the following topics were illustrated: Electromagnetic spectrum; Discovery of GRBs, nuclear tests and cold war; satellites performing astrophysical observations such as Vela, BATSE, Beppo-SaX, Swift and Fermi satellites; Luminosity distance; Formation of a black hole; Vacuum polarization; Compactness problem; GRB progenitors.

The link of the lecture: http://icranet.org/index.php?option=com_content&task=view&id=1066

10. Danish students visited the ICRANet center in Pescara

On the 5 of April 2017, at the ICRANet center of Pescara, there was a meeting with six young Danish students that came to Italy for a cultural exchange, organized by the High School “Da Vinci” of Pescara.

In this occasion, the students have met Professor Remo Ruffini, Director of ICRANet, Dr. Giovanni Pisani, member of ICRANet Faculty, and Gabriel Gomez, student IRAP PhD. Dr. Giovanni Pisani has given a lecture “Big Bang and Gamma Ray Burts”, illustrating some subjects of the relativistic astrophysics.

During the discussion with Gabriel Gomez, IRAP PhD student from Colombia, the students asked questions about his motivation to choose ICRANet for doctorate studies, his motivations to come to Italy and the reasons that have led him to choose the relativistic astrophysics as subject of his studies.

11. New seminar for students of the High School “Galileo Galilei” with Alessandra di Cecco

On the 12 of May 30 students of High School “Galileo Galilei” visited ICRANet in Pescara for a lecture of Dr. Alessandra Di Cecco "*the Space debris*".

In this occasion the students deepened their knowledge on the following topics: Solar System, Satellites in orbits, Kepler laws and orbital perturbations, ESA space missions, the manned space flight and the International Spatial Station, the danger of the Space debris, European Programs of "Spatial Overseeing and Tracing (SST)", proliferation of the Space debris and measures of mitigation.

12. Chinese scientists of the next mission on the Moon, visited the ICRANet center in Pescara

After 40 years since the last mission of Soviet Union “Luna 24”, Chinese space mission “Chang'e 5” will come back on the Moon, with the goal to pick up and study samples of rocks. The mission is planned for November 2017.
On 2 of May 2017 20 Chinese scientists, a team, led by prof. Xie Gengxin, that work for the Chinese space mission “Chang'e 5”, visited the ICRANet headquarters in Pescara, together with Professor Paolo Giommi from ASI. They have met professors and researchers of ICRANet, and attended the presentation of Professor Ruffini, Director of ICRANet.

13. Professor Kerr and Professor Ruffini dialoguing with students of High School “Galileo Galilei”

On 24 of May, students of the High School “Galileo Galilei”, met at the ICRANet headquarters in Pescara, Professor Roy Patrick Kerr, recipient of the Crafoord Prize 2016 and honorary citizen of Pescara, and Professor Fulvio Melia, of Italian-origin expert in cosmology from the University of Arizona. The Mayor of Pescara, Marco Alessandrini, has also participated in this meeting together with Paolo Mastri, journalist of Italian newspaper "Il Messaggero”. Professor Kerr reminded to the students the importance of the scientific research as fundamental element in the everyday life. With a constantly evolving world and new experimental **facilities made available, there is a constant increase of knowledge and fundamental discoveries in new research areas are made possible. A good example being the work on GRBs. Science is very possibly an endless field of activities moving to greater and greater discoveries.** Professor Sigismondi Constantino completed the meeting.

The important message of profs. Kerr and Ruffini can be followed in the video, recorded also for posterity:

http://www.icranet.org/index.php?option=com_content&task=view&id=1118

ICRANet Newsletter

June – July 2017

SUMMARY

1. An ICRANet publication lead by the Director of ICRANet-Yerevan, prof. Narek Sahakyan just published in MNRAS (Impact factor: 4.961)

This publication also signs the beginning of collaboration with MAGIC recently joined by ICRANet-Yerevan as a Member, see: https://magic.mpp.mpg.de/newcomers/magic-team/addresses/

N. Sahakyan and S. Gasparyan, "*High Energy Gamma-Ray Emission From PKS 1441+25*", MNRAS (2017) 470 (3): 2861-2869 (08 June 2017), available here:

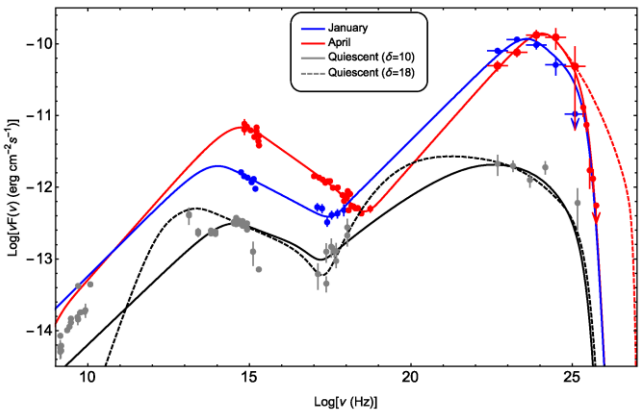


Figure 1. The broad-band spectral energy density of PKS 1441+25 for January (red), April (blue) and for the quiescent state (grey). The blue, red and grey lines are the models fitting the data.

The γ-ray observations of the flatspectrum radio quasar PKS 1441+25 (z = 0.939), using the Fermi large Area Telescope data have been accumulated during 2015 January – December. A γ-ray flare was observed in January 24, when the flux increased up to $(2.22 \pm 0.38) \times 10{-}6$ photon cm^{-2} s^{-1} with the flux-doubling time-scale being as short as ∼1.44 d. The spectral analysis shows that from 2015 April 13 to April 28, the MeV-to-GeV photon index has hardened and changes in the range of $\Gamma = (1.73 - 1.79)$ for most of the time. The hardest photon index of $\Gamma = 1.54 \pm 0.16$ has been observed on MJD 57 131.46 with 11.8σ which is not common for flat-spectrum radio quasars. For the same period the γ-ray spectrum shows a possible deviation from a simple power-law shape, indicating a spectral cutoff at $E_{cut} = 17.7 \pm 8.9$ GeV.

2. Kerr and Ruffini discussing with Hawking in Cambridge

Figure 2. Prof. Ruffini and Prof. Stephen Hawking in Cambridge, June 19th, 2017.

Professor Remo Ruffini, Director of ICRANet, and Professor Roy Patrick Kerr, the discoverer of the world famous "Black Hole Kerr metric" and appointed professor "Yevgeny Mikhajlovic Lifshitz - ICRANet Chair", have had a 4 days intensive meeting at the University of Cambridge, both at DAMTP and at the Institute of Astronomy, with Professor Stephen Hawking and the resident scientists: they illustrated recent progress made by scientists of ICRANet.

The presentation, which can be seen on www.icranet.org/documents/Ruffini-Cambridge2017.pdf, includes:

- GRB 081024B and GRB 140402A: two additional short GRBs from binary neutron star mergers, by Y. Aimuratov, R. Ruffini, M. Muccino, et al.; Ap.J in press.

This ICRANet activity presents the evidence of two new short gamma-ray bursts (S-GRBs) from the mergers of neutron stars binaries forming a Kerr black hole. The existence of a common GeV emission precisely following the black hole formation has been presented. Yerlan Aimuratov is a young scientist from the

ICRANet associated University in Alamaty Kazakistan. A free-available version of the article can be found on: https://arXiv.org/abs/1704.08179

- X-ray Flares in Early Gamma-ray Burst Afterglow, by R. Ruffini, Y. Wang, Y. Aimuratov, et al.; Ap.J submitted.

This work analyses the early X-ray flares, followed by a "plateau" and then by the late decay of the X-ray afterglow, ("flare-plateau-afterglow phase") observed by Swift-XRT. It is shown that only binary-driven hypernovae (BdHNe), long-GRBs generated by the explosion of a Supernova with a close binary neutron star companion generates such flares. The nature of the flares is identified by the collision of the GRB emitted by the formation of a Black hole with the supernova ejecta. Particular important has been the contribution of a young Chinese ICRANet scientist: Wang Yu.

A free-available version of the article can be found on:

https://arXiv.org/abs/1704.03821

Figure 3. An image of computer of Stephen Hawking, Cambridge, June 19th, 2017.

Figure 4. Prof. Ruffini and Prof. Kerr with his wife at the dinner at Prof. Hawking's place, June 20th, 2017.

- On the induced gravitational collapse scenario of gamma-ray bursts associated with supernovae , by L. Becerra, C. L. Bianco, C. L. Fryer, J. A. Rueda, R. Ruffini; Ap.J. 833 (2016) 107.

This work presents the most advanced numerical simulations of the induced gravitational collapse (IGC) model of long-GRBs associated with type Ib/c supernovae, named BdHNe. Particularly important has been the contribution of a young ICRANet scientist from the ICRANet associated University in Santander Colombia, also collaborating with the Los Alamos National Laboratory: Laura Becerra. A free-available version of the article can be found on:
https://arXiv.org/abs/1606.02523

- Strong-field gravitational-wave emission in Schwarzschild and Kerr geometries: some general consideration, J. F. Rodriguez, J. A. Rueda, R. Ruffini.

In this work the latest results possibly necessary to the interpretations of LIGO-VIRGO observations are presented. A free-available version of the article can be found on: http://arxiv.org/abs/1706.06440

The activities have continued on Tuesday at Prof. S. Hawking's home, where both Prof. Ruffini and Prof. Kerr have been invited for dinner.

On Wednesday and Thursday additional meetings and a joint seminar for the Mathematics and Astronomy departments has been held at DAMTP of the University of Cambridge respectively on "Black Holes", by Prof. Roy P. Kerr, and on "The Moment of formation of a Black Hole in Gamma-Ray

Figure 5. Prof. Ruffini and Prof. Kerr in Cambridge, UK, June 21th, 2017.

Bursts" by Prof. Remo Ruffini
(see http://www.icranet.org/documents/Ruffini-Cambridge2017.pdf).
The video of the seminars: http://www.icranet.org/kerr-ruffini-cambridge.

3. The 2017 Annual meeting of the Division of Gravitation and Relativistic Astrophysics of the Chinese Physical Society / The Fifth Galileo-Xu Guangqai Meeting, June 25 -30, 2017, Chengdu – China

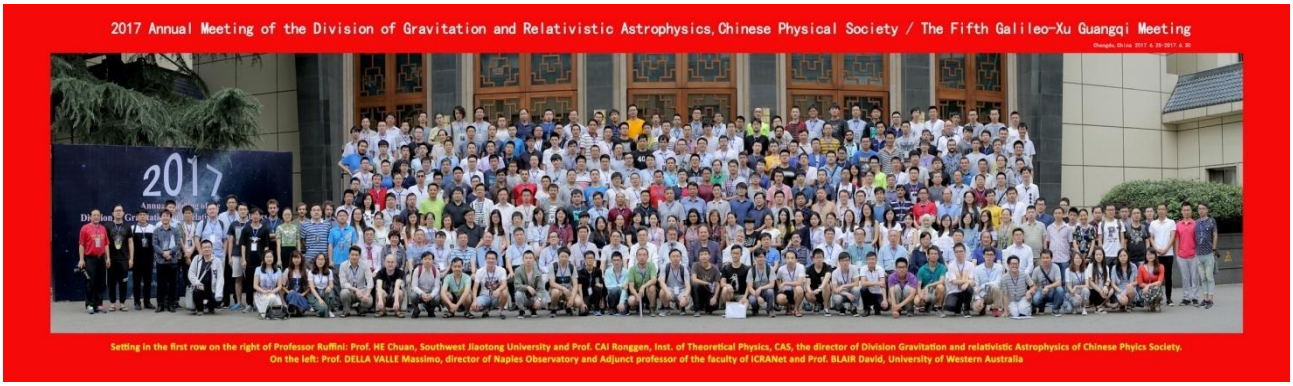


Figure 6. Group photo of the participants to the 2017 Annual meeting of the Division of Gravitation and Relativistic Astrophysics of the Chinese Physical Society / The Fifth Galileo-Xu Guangqai Meeting, June 25 -30, 2017, Chengdu – China.

This year the fifth Galileo-Xu Guangqi was jointed with the annual meeting of the Division of Gravitation and Relativistic Astrophysics of the Chinese Physical Society, and was held in the School of Physical Science and Technology, Southwest Jiaotong University, at Chengdu – China on June 25 -30. It represents a CAS-TWAS-ICRA-ICRANet's collaboration with University of Roma "Sapienza", University of Nice "Sophia Antipolis", Stockholm University, Free University of Berlin, University of Bremen, ICRA, ENEA, INFN, ICTP, TWAS , Observatoire de la Côte d'Azur, CBPF, the Tartu Observatory, the Vatican Observatory, together with Chinese Academy Science institutions including: the Shanghai Astrophysical Observatory, the Institutes of High Energy Physics, the Institute of Theoretical Physics, the University of Science and Technology of China, as well as other Chinese leading universities among them: Shanghai Jiao-Tong University, Southwest Jiaotong University, the Beijing Normal University.

Figure 7. Prof. Ruffini during his talk at the 2017 Annual meeting of the Division of Gravitation and Relativistic Astrophysics of the Chinese Physical Society / The Fifth Galileo-Xu Guangqai Meeting, June 25 -30, 2017, Chengdu – China.

The joint meeting is particularly dedicated to recall the roots of the modern scientific research in the East and the West and review the recent progress in one of the most advanced fields of scientific research: the one of relativistic astrophysics. Current progress in Relativistic Astrophysics made possible by astronomical observations of the Sun, of the Stars and of the Universe, and the current developments of theoretical studies of gravitation and cosmology as well as other fundamental physics was reviewed. These results have been achieved thanks to the theories of Albert Einstein and to the unprecedented numbers of observational techniques: in

X-ray, Gamma-ray, optical wave-lengths from space based observatories, in radio telescopes wavelengths from telescopes on the ground as well as in particle physics from underground observatories. In this joint meeting, there were more than 450 participants coming worldwide, in particular Asia area, including many young Chinese researchers and Ph.D. students from all over China. The researchers and Ph.D. students of ICRANet institutions have actively participated the meeting. The joint organizing committee organized four day intensive scientific program of plenary and parallel sessions for about 120 speakers, and one day free discussion among participants while they were together or visiting the Chengdu area which has most rich cultural heritage and long history in China. The joint meeting program covered a broad topics, including but not limited to the theory of gravitation, gravitational wave physics, black hole physics, quantum gravity, gravitational experiments, curved space quantum field theory, relativistic astrophysics, dark matter and dark energy, and cosmology. The meeting was scientifically very successful and discussions and idea exchange were fruitful. Young students and researchers have made their important presentations to the meeting and particular awards were delivered to excellent presentations.

Figure 8. Prof. Ruffini and prof. Cai at the closing ceremony of the 2017 Annual meeting of the Division of Gravitation and Relativistic Astrophysics of the Chinese Physical Society / The Fifth Galileo-Xu Guangqai Meeting with the staff.

In addition, Prof. Ruffini presented a public lecture in Southwest Jiaotong University, undergraduate students were interested very much and raised many stimulating question and discussions. The fifth Galileo-Xu Guangqi meeting follows the first, second, the third and fourth meetings of this series held on October 2009 in Shanghai – China (http://www.icranet.org/galileo-xuguangqi), on July 2010 in Ventimiglia - Italy and Nice – France (http://www.icranet.org/2nd_galileo-xuguangqi), on October 2011 in Beijing (http://www.icranet.org/3gx) and on May 2015 always in Beijing (http://www.icranet.org/4gx) – China.

The meeting's program is available here: http://gra2017.csp.escience.cn/dct/page/70010

At this link the photos of the meeting: http://www.icranet.org/index.php?option=com_content&task=view&id=1130

At this link the video of the public lecture of Professor Ruffini:
http://www.icranet.org/index.php?option=com_content&task=view&id=1120

4. XIII International Conference on Gravitation, Astrophysics and Cosmology - 15th Italian-Korean Symposium on Relativistic Astrophysics - A joint meeting, July 3 to 7, 2017, Ewha Womans University, Seoul, Korea

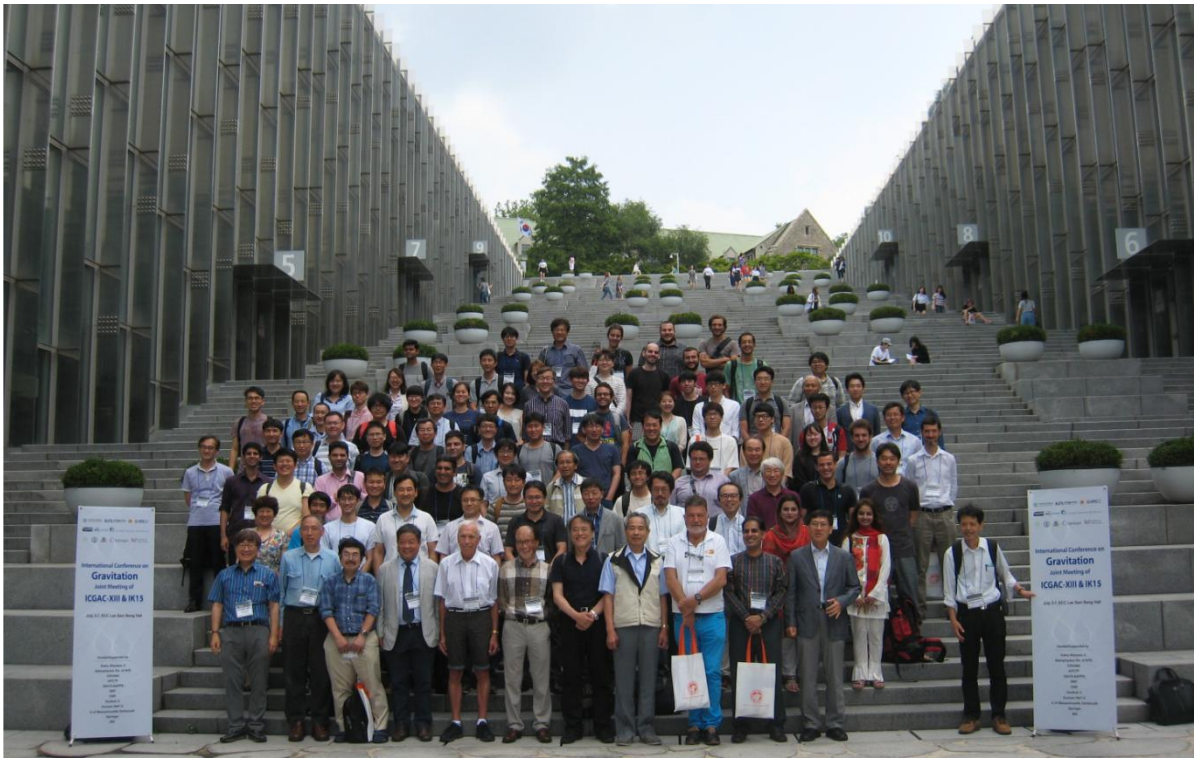


Figure 9. Group picture of the participants of the joint ICGAC-13-IK15 meeting at Ewha Womans University underground campus in Seoul, on July 3 to 7, 2017. In the first rows with prof. Ruffini co-chairs of the International Organizing Committee of the meeting: Gungwon Kang, Sang Pyo Kim, Sung-Won Kim and Jonghyuk Yoon.

This year the symposium was held at Ewha Womans University in Seoul, on July 3 to 7, 2017, in conjunction with the XIII International Conference on Gravitation, Astrophysics and Cosmology (ICGAC-13), a series of biennial conferences on Gravitation, Astrophysics and Cosmology which takes place in the Asia-Pacific region with the goal to promote cooperation among the member countries and within an international context, to promote high level studies on hot topics and to encourage young physicists on these fields. The first ICGAC meeting was initiated by Prof. Yong Min Cho, Korea, one of the founders of the APCTP, in 1993.

The Italian-Korean meeting started in 1987, then continued for every two years alternatively in Korea and Italy with the support from Korea Science and Engineering Foundation (KOSEF), Consiglio Nazionale delle Ricerche (CNR), International Center for Relativistic Astrophysics Network (ICRANet) and hosting institutes.

At this meeting many important contributions have been given, in particular in connection to the recent claim about the discovery of gravitational waves. Other topics included: inflationary theory, electroweak monopoles production and search, dark matter and dark energy, black holes, neutron stars and gamma-ray bursts.

In this meeting there were 164 participants including researchers from Austria, Canada, China, India, Iran, Italy, Japan, Kazakhstan, Korea, Pakistan and Russia.

Two PhD students from ICRANet, Daria Primorac (talk: Analysis of the GRB110731A within the fireshell model) and Rahim Moradi (talk: Charged Cosmological Black holes), have received awards for best presentations.

All presentations are declared eligible for publication in a proceedings through EPJ (European Physical Journal) Web of Conferences after proper reviewing process in accordance with the journals' Policy on Publishing Integrity.

The website of the meeting: http://www.icranet.org/ik15

The program is available here: https://www.apctp.org/plan.php/ICGAC-IK/1874

The photos of the meeting: http://www.icranet.org/index.php?option=com_content&task=view&id=1132

5. Prof. Ruffini, in Zurich, for the Conference in Honor of Demetrios Christodoulou's 65th Birthday

Figure 10. Participants of the Conference in Honor of Demetrios Christodoulou's 65th Birthday. On his right is prof. Remo Ruffini.

On July 10-14, 2017, Prof. Remo Ruffini, Director of ICRANet has participated to the Conference in Honor of Demetrios Christodoulou's 65th Birthday at the Department of Mathematics of ETH in Zurich (Switzerland). At this conference, organized by Lydia Bieri (University of Michigan), Jürg Fröhlich (ETH Zürich), Tristan Rivière (ETH Zürich), Michael Struwe (ETH Zürich), about 146 scientists, professors and researches have participated along with prof. Yau (Fields medal).

Professor Ruffini, in this occasion, recalled how the introduction of an effective potential technique to integrate the geodesic equations in the Kerr-Newman geometry has been extremely fruitful leading, among others: to the concept of last circular orbits of a particle around Kerr solution, to the mass energy formula of a Kerr and a Kerr-Newman Black Hole, and to the explanation of a vast number of observational properties of astrophysical objects ranging from active galactic nuclei to Gamma Ray Bursts. This, in turn, leads to the almost daily observation of the formation of a Kerr-Newman Black hole in our entire Universe. This technique has been equally successfully applied to inquire the consistency of claimed discoveries of gravitational waves.

The meeting website: https://www.math.ethz.ch/fim/conferences/christodoulou.html

6. IRAP PhD 2017 call

The International Relativistic Astrophysics Ph.D. (IRAP PhD) – Joint Doctorate Program sponsored by ICRANet.

A deadline of 30th September 2017 has been established for eight positions open internationally and directly sponsored by the participating institutions.

The coordinated effort of many international organizations such as the National Aeronautics and Space Administration (NASA), the European Center for Nuclear Research (CERN), the European Space Agency (ESA), the European Southern Observatory (ESO), has led to an unprecedented amount of scientific information from the microphysical world all the way to the entire Universe. To harvest the results of these scientific missions, a specific Ph. D. program has been envisaged in order to involve the students in the analysis and modeling of the above observational data within the theory of general relativity and relativistic quantum and classical field theories.

The students will also be involved in innovative experimental programs in relativistic astrophysics. The program provides expertise in the most advanced topics of experimental, mathematical and theoretical physics relevant to the context of astronomy, astrophysics and cosmology. These activities, being necessarily international, the scientific and academic institutions, indicated below, participate with their own specific scientific specialties and a joint degree is delivered, at the end of the program.

The Institutions participating in the IRAP PhD are: the international organization ICRANet (Pescara, Rio de Janeiro and Rome) as coordinating institution and the University of Nice Sophia Antipolis as the host Institution; the Albert Einstein Institute, Potsdam (Germany); Indian Centre for Space Physics, Kolkata (India); Observatoire de la Cote D'Azur, Nice (France); University of Ferrara (Italy); University of Rome, la Sapienza (Italy); University of Savoie, Annecy (France).

The Final Ph.D. degree will be jointly delivered by the Academic Institutions participating in the program.

The website of the IRAP PhD program: http://www.icranet.org/irap-phd/

Hyperspace link: http://hyperspace.uni-frankfurt.de/2017/07/31/irap-phd-2017-call/

7. Recent publications

C. R. Argüelles, A. Krut, J. A. Rueda, R. Ruffini , "*Novel constraints on fermionic dark matter from galactic observables*", Submitted to MNRAS, 27 Jun 2017, available here: https://arxiv.org/abs/1606.07040

We have recently introduced a new model for the distribution of dark matter (DM) in galaxies, the Ruffini-Arguelles-Rueda (RAR) model, based on a self-gravitating system of massive fermions at finite temperatures. The RAR model, for fermion masses above keV, successfully describes the DM halos in galaxies, and predicts the existence of a denser quantum core towards the center of each configuration. We demonstrate here, for the first time, that the introduction of a cutoff in the fermion phase-space distribution, necessary to account for the finite Galaxy size, defines a new solution with a compact quantum core which represents an alternative to the central black hole (BH) scenario for SgrA*. For a fermion mass in the range 48 keV/$c^2 \lesssim m \lesssim$ 345 keV/c^2, the DM halo distribution fulfills the most recent data of the Milky Way rotation curves, while harbors a dense quantum core of $4\times10^6 M_\odot$ within the S2 star pericenter. In particular, for a fermion mass of $m\sim50$ keV/c^2 the model is able to explain the DM halos from typical dwarf spheroidal to normal elliptical galaxies, while harboring dark and massive compact objects from $\sim10^3 M_\odot$ up to $\sim10^8 M_\odot$ at their respective centers. The model is shown to be in good agreement with different observationally inferred universal relations, such as the ones connecting DM halos with supermassive dark central objects. Finally, the model provides a natural mechanism for the formation of supermassive BHs as heavy as MBH$\sim$ few $10^8 M_\odot$. We argue that larger BH masses (MBH$\sim10^9-10^{10} M_\odot$) may be achieved by assuming subsequent accretion processes onto the above heavy seeds, depending on accretion efficiency and environment.

8. Upcoming meetings

- **Fifteenth Marcel Grossmann Meeting on General Relativity (MG15), Rome 2018**

The dates of the Fifteenth Marcel Grossmann Meeting on General Relativity and Relativistic Astrophysics to be held on the campus of the University of Rome "La Sapienza" in Rome, Italy in the year 2018 are announced:

Onsite registration Sunday July 1,

Opening Monday July 2,

Closing Saturday July 7, 2018.

Further information will be updated here and available at the website.

Hyperspace announcement: http://hyperspace.uni-frankfurt.de/2017/05/31/fifteenth-marcel-grossmann-meeting-on-general-relativity-mg15-rome/

MG meeting website: http://www.icra.it/mg/

- **The third Landau-Dirac Ph.D training School dedicated to Supernovae Explosions and Gamma-Ray Bursts, Cargese, France**

The Cargese school to be held on 11-15 september 2017, Institut d'Études Scientifiques de Cargèse, is organized with the following preliminary scientific program:

Lectio magistralis: General relativistic transformations in GRBs

Carlo Luciano Bianco (ICRANet & Sapienza University)

Lectio magistralis: On the theory of supernovae explosions

Valery Chechetkin (KIAM, RAS Moscow)

Lectio magistralis: On supernovae classification

Massimo Della Valle (Capodimonte Astronomical Observatory)

Lectio magistralis: On the discovery of gamma-ray bursts

Filippo Frontera (University of Ferrara)

Lectio magistralis: On the theory of stellar evolution

Georges Meynet (University of Geneva and Geneva Observatory)

Lectio magistralis: The transition from a supernova to a hypernova

Marco Muccino (ICRANet & Sapienza University)

Lectio magistralis: On the Induced Gravitational Collapse

Jorge Rueda (ICRANet & Sapienza University)

Lectio magistralis: On the theory of black holes

Remo Ruffini (ICRANet & Sapienza University)

Lectio magistralis: On the theory of inflation

Aleksei A. Starobinsky (Landau Institute for Theoretical Physics)

Advanced seminar: Dawn of the universe and the quest of the first stars

Pascal Chardonnet (USMB & LAPTh Annecy-le-Vieux)

Advanced seminar: Opacity for high energy photons and gamma-gamma scattering

Gregory Vereshchagin (ICRANet & Sapienza University)

Website of the meeting: https://indico.in2p3.fr/event/14604/

Hyperspace Link: http://hyperspace.uni-frankfurt.de/2017/07/31/the-third-landau-dirac-ph-d-training-school-dedicated-to-supernovae-explosions-and-gamma-ray-bursts/

9. Renewal of the agreement with the Universidad Nacional del Sur, Argentine

On the 10th of July, the agreement between ICRANet and the UNS (Universidad Nacional del Sur) has been renewed. This new agreement was signed by Dr. Mario Ricardo Sabbatini, Rector of the UNS, and Prof. Ruffini, Director of ICRANet. This agreement will be valid for 5 years and the joint activities will consist in:

- promotion of theoretical and observational research activities within the field of Relativistic Astrophysics;

- the institutional exchange of faculty members, researchers, post- doctoral fellows and students;

- development of teaching and/or research activities;

- the support of technical-scientific and cultural events and activities open to the public

- the organization of seminars, conferences, workshops or short courses;

- joint publications

The text of the agreement can be found here: http://www.icranet.org/docs/ICRANetUNS.pdf

ICRANet Newsletter

August – September 2017

SUMMARY

1. Two new publications from the Director of ICRANet-Yerevan, prof. Narek Sahakyan, just accepted for publication in ApJ (Impact factor: 5.533) and in A&A (Impact factor: 5.014)

1. D. Zargaryan, S. Gasparyan, V. Baghmanyan, N. Sahakyan, "Comparing 3C 120 jet emission at small and large scales", arXiv:1709.05175, Accepted for publication in Astronomy & Astrophysics.

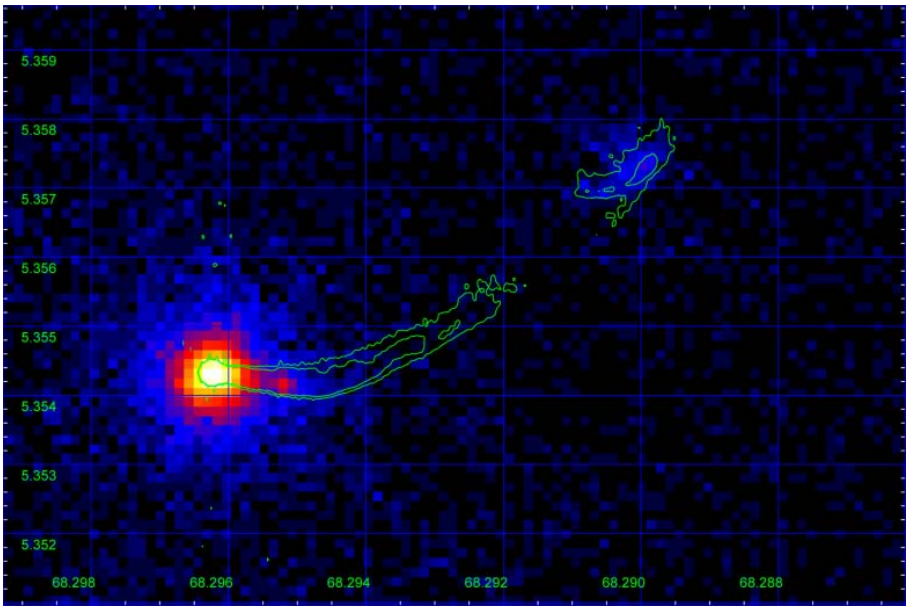


Fig. 1. Smoothed 0.5-10 keV Chandra X-ray image of 3C 120 jet shown with radio contours from a 5 GHz VLA radio map. X-ray emission is detected from the nucleus and several knots.

Important information on the evolution of the jet can be obtained by comparing the physical state of the plasma at its propagation through the broad-line region (where the jet is most likely formed) into the intergalactic medium, where it starts to significantly decelerate. The constraints on the physical parameters in the innermost ($\lesssim$ pc) and outer ($\geq$ kpc) regions of the 3C 120 jet, see Fig. 1., are compared by means of a detailed multiwavelength analysis and theoretical modeling of their broadband spectra. The data collected by Fermi LAT, Swift and Chandra are analyzed together and the spectral energy distributions are modeled using a leptonic synchrotron and inverse Compton model, taking into account the seed photons originating inside and outside of the jet. The model parameters are estimated using the MCMC method. The γ-ray flux from the inner jet of 3C 120 was characterized by rapid variation from MJD 56900 to MJD 57300. Two strong flares were observed on April 24, 2015 when, within 19.0 minutes and 3.15 hours the flux was as high as (7.46±1.56)×10-6 cm−2s−1 and (4.71±0.92)×10−6cm−2s−1 respectively. The broadband emission in the quiet and flaring states can be described as SSC emission while IC scattering of dusty torus photons cannot be excluded for the flaring states. The X-ray emission from the knots can be well reproduced by IC scattering of CMB photons only if the jet is highly relativistic (since even when δ=10 still Ue/UB$\geq$80). These extreme requirements can be somewhat softened assuming the X-rays are from the synchrotron emission of a second population of very-high-energy electrons. The jet power estimated at two scales is consistent, suggesting that the jet does not suffer severe dissipation, it simply becomes radiatively inefficient.

2. V. Baghmanyan, S. Gasparyan, N. Sahakyan, "Rapid Gamma-ray variability of NGC 1275", arXiv:1709.03755v1, Accepted for publication in ApJ.

A detailed analysis of the γ-ray light curve of NGC 1275 is reported using the Fermi large area telescope data accumulated in 2008-2017. Major γ-ray flares were observed in October 2015 and December 2016/January 2017 when the source reached a daily peak flux of (2.21±0.26)×10−6cm−2s−1, achieving a flux of (3.48±0.87)×10−6cm−2s−1 within 3 hours, which corresponds to an apparent isotropic γ-ray luminosity of ≃ 3.84×1045erg s−1. The most rapid flare had e-folding time as short as 1.21±0.22 hours which had never been previously observed for any radio galaxy in γ-ray band. Also γ-ray spectral changes were observed during these flares: in the flux versus photon index plane the spectral evolution follows correspondingly a counter clockwise and a

clockwise loop inferred from the light curve generated by an adaptive binning method. On December 30, 2016 and January 01, 2017 the X-ray photon index softened (ΓX≃ 1.75−1.77) and the flux increased nearly ∼3 times as compared with the quiet state. The observed hour-scale variability suggests a very compact emission region (Rγ≤5.22×1014(δ/4)cm) implying that the observed emission is most likely produced in the subparsec-scale jet if the entire jet width is responsible for the emission. During the active periods the γ-ray photon index hardened, shifting the peak of the high energy spectral component to >GeV, making it difficult to explain the observed X-ray and γ-ray data in the standard one-zone synchrotron self-Compton model.

2. ICRANet and the European Researchers' Night

Also this year ICRANet together with the Municipality of Pescara, through Europe Direct, andin collaboration with the University “G. d’Annunzio” of Chieti-Pescara, organized the “European Researchers' Night”. The event attracts a lot of people every year and offers visitors a unique opportunity to meet researchers and to take part in science activities aiming to showcase both the fascination of research as a career and its significant societal impact. The program of this event can be found here:
http://www.icranet.org/index.php?option=com_content&task=view&id=1146 (in Italian).
During the morning the ICRANet Headquarters in Pescara has hosted 200 students of high schools. On this occasion, the Director of ICRANet, Professor Remo Ruffini, delivered the first "Carlo Pace Awards" in the presence of the Mayor of Pescara Marco Alessandrini and Senator Federica Chiavaroli, Undersecretary of Justice.

This award was given to:

- Francesca Allegrino from Liceo Galileo Galilei, Pescara, for student’s category
- Tiziana Pompa from Liceo Galileo Galilei, Pescara, for professor’s category
- Costantino Sigismondi from Liceo Scientifico Galileo Ferraris, Roma, for professor’s category


"Del Talento e della curiosità. Quando l'aquila e il passero volano insieme"
MIUR – Iniziative per la diffusione della cultura scientifica"
La Notte dei Ricercatori 2017

The Carlo Pace Award

An ICRANet joint activity with the high schools of Abruzzo
Edition 2016/2017

Student Award to

Francesca Allegrino

Liceo Galileo Galilei, Pescara

"For her prolonged, enthusiastic and creative participation in the 2017 program "Alternanza Scuola-Lavoro" significantly expressed in her publication "Quando i sogni diventano realtà" (Il Centro, 20 April 2017)"

Carlo Pace.

Outstanding engineer, active academically in the field of Architecture, Carlo Pace, Mayor of Pescara from 1994 to 2003, has given his best knowledges, energies and thoughts for developing a long lasting program for the city. His decision to realize the ICRANet Coordinating Center, at Piazza della Repubblica 10, has been crucial and his dream of casting Pescara in an international framework of Science, Art and Research came finally true under his governance. Thanks to the law 10 February 2003 n.31, unanimously voted by the Italian Parliament, scientists of ICRANet Member States, under the aegis of MAECI, are now fully operative, doing research in relativistic astrophysics phenomena in the entire Universe. The award in his name promotes the excellences among students and teachers involved to foster self enhancing interaction among science, teaching and learning in Abruzzo.

Con il patrocinio di


"Del Talento e della curiosità. Quando l'aquila e il passero volano insieme"
MIUR – Iniziative per la diffusione della cultura scientifica"
La Notte dei Ricercatori 2017

The Carlo Pace Award

An ICRANet joint activity with the high schools of Abruzzo
Edition 2016/2017

Professor Award to

Tiziana Pompa

Liceo Galileo Galilei, Pescara

"To inspire, motivate and guide high school students to contact the most advanced research on the Universe."

Carlo Pace.

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The Carlo Pace Award

An ICRANet joint activity with the high schools of Abruzzo
Edition 2016/2017

Professor Award to

Costantino Sigismondi

Liceo Scientifico Galileo Ferraris, Roma

"For the discovery of Nova Aquilae 1999 at ICRANet and publication on AAVSO"

Carlo Pace.

Outstanding engineer, active academically in the field of Architecture, Carlo Pace, Mayor of Pescara from 1994 to 2003, has given his best knowledges, energies and thoughts for developing a long lasting program for the city. His decision to realize the ICRANet Coordinating Center, at Piazza della Repubblica 10, has been crucial and his dream of casting Pescara in an international framework of Science, Art and Research came finally true under his governance. Thanks to the law 10 February 2003 n.31, unanimously voted by the Italian Parliament, scientists of ICRANet Member States, under the aegis of MAECI, are now fully operative, doing research in relativistic astrophysics phenomena in the entire Universe. The award in his name promotes the excellences among students and teachers involved to foster self enhancing interaction among science, teaching and learning in Abruzzo.

Con il patrocinio di

After the award ceremony, three lectures were delivered by ICRANet scientists: Dr. Marco Muccino – Faculty at ICRANet - "Visitare l'Universo con i Gamma Ray Bursts (GRBs)"; Prof. Paolo Giommi – ASI, Agenzia Spaziale Italiana – "Osservazioni multimessenger dei nuclei galattici attivi" and Dr. Laura Becerra – Università di Roma "La Sapienza" and ICRANet "*Simulando le Hypernovae all'ICRANet ed a Los Alamos*".

These morning public lectures were followed by the evening public lectures at Aurum with the following program:

21.00 - Professor Remo Ruffini - Director of ICRANet and Wang Yu - Student of IRAP Ph.D., "*Esplorando l'Universo con i satelliti SWIFT e FERMI*"
21.45 - Professor Jorge Rueda – ICRANet and Jose Rodriguez Ruiz - Student of IRAP Ph.D., "*Simulando l' emissione di onde gravitazionali*"
22.30 - Professor Paolo Giommi ASI – Agenzia Spaziale Italiana and Carlos Henrique Brandt – Student of IRAP Ph.D., "*Il Centro Dati dell'ICRANet in Brasile (BSDC)*".

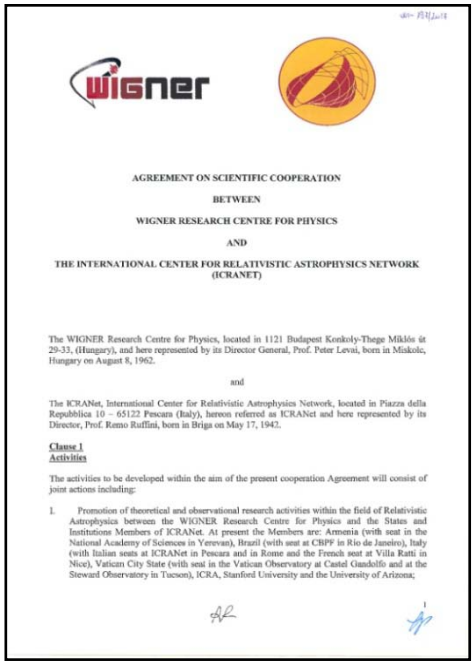
In the evening, ICRANet center in Pescara opened its door to the public . Prof. Vereshchagin, Prof. Belinski, Prof. Xue and some PhD students showed to the visitors the ICRANet building and research activities.

During the evening at Aurum, ICRANet has organized for the first time the exhibition dedicated to the birth of the Relativistic Astrophysics and its major figures such as Einstein, Heisenberg and Fermi, as well as the scientific collaboration between ICRANet and China, centered on Professor Li-Zhi Fang, First President of ICRANet Steering

Committee. This exhibition, which is part of the project: "Of Talent and Curiosity. When the eagle and the sparrow fly together", will be moved in the next months to Rome at the Marco Besso Foundation.

Video from this event is available here: http://www.icranet.org/index.php?option=com_content&task=view&id=1151

3. ICRANet – WIGNER: New cooperation agreement



AGREEMENT ON SCIENTIFIC COOPERATION

BETWEEN

WIGNER RESEARCH CENTRE FOR PHYSICS

AND

THE INTERNATIONAL CENTER FOR RELATIVISTIC ASTROPHYSICS NETWORK (ICRANET)

The WIGNER Research Centre for Physics, located in 1121 Budapest Konkoly-Thege Miklós út 29-33, (Hungary), and here represented by its Director General, Prof. Peter Levai, born in Miskolc, Hungary on August 8, 1962.

and

The ICRANet, International Center for Relativistic Astrophysics Network, located in Piazza della Repubblica 10 – 65122 Pescara (Italy), hereon referred as ICRANet and here represented by its Director, Prof. Remo Ruffini, born in Briga on May 17, 1942.

Clause 1
Activities

The activities to be developed within the aim of the present cooperation Agreement will consist of joint actions including:

1. Promotion of theoretical and observational research activities within the field of Relativistic Astrophysics between the WIGNER Research Centre for Physics and the States and Institutions Members of ICRANet. At present the Members are: Armenia (with seat in the National Academy of Sciences in Yerevan), Brazil (with seat at CBPF in Rio de Janeiro), Italy (with Italian seats at ICRANet in Pescara and in Rome and the French seat at Villa Ratti in Nice), Vatican City State (with seat in the Vatican Observatory at Castel Gandolfo and at the Steward Observatory in Tucson), ICRA, Stanford University and the University of Arizona;

New collaboration agreement has been recently signed between ICRANet, International Center for Relativistic Astrophysics Network, and WIGNER Research Centre for Physics in Budapest, Hungary. This Agreement was signed by Prof. Peter Levai, Director General of WIGNER Research Centre, and Prof. Remo Ruffini, Director of ICRANet. It will consist of joint actions including: promotion of theoretical and observational research activities within the field of Relativistic Astrophysics; the exchange of faculty members, researchers, post-doctoral fellows and students; promotion of technological developments. Special attention will be devoted to space missions and advanced experiments and observations from the ground and underground facilities and observatories. The text of the agreement can be found here: http://www.icranet.org/documents/agreementICRANet-WIGNER.pdf

4. ICRANet seminar on 8th of September by Takahiro Hayashinaka

On September 8, 2017, Takahiro Hayashinaka, of the Research Center for the Early Universe (RESCEU), Department of Physics, Graduate School of Science of the University of Tokyo (Japan), gave a seminar at the ICRANet center in

Pescaratitled: " de Sitter QED and non-perturbative renormalization approach ". This talk was dedicated to show recent activities on the topic. In the first half of the talk it was shown how negative, i.e. unstable, electromagnetic responses have been revealed. Though this phenomenon was repeatedly reported by several groups recently, neither physical origin or interpretation of the phenomenon have been explicitly given up to the present. Inspired by a relevant negative response phenomenon in a specific ferroelectric matter, it was recognized importance of spontaneous symmetry breaking and the effective action or potential of the system. A variation of renormalization group technique, which is called non-perturbative renormalization group (NPRG), was used for evaluation of the effective action. As a result, undesirable behavior of the IR modes in de Sitter spacetime can be virtually suppressed. It was shown how the electric field can change the shape of the scalar effective potential.

5. Recent publications

B. Eslam Panah, G. H. Bordbar, S. H. Hendi, R. Ruffini, Z. Rezaei, R. Moradi, "*Expansion of magnetic neutron stars in an energy (in)dependent spacetime*", arXiv:1707.06460, accepted for publication in Astrophys. J.

Regarding the strong magnetic field of neutron stars and high energy regime scenario which is based on high curvature region near the compact objects, one is motivated to study magnetic neutron stars in an energy dependent spacetime. In this paper, we show that such strong magnetic field and energy dependency of spacetime have considerable effects on the properties of neutron stars. We examine the variations of maximum mass and related radius, Schwarzschild radius, average density, gravitational redshift, Kretschmann scalar and Buchdahl theorem due to magnetic field and also energy dependency of metric. First, it will be shown that the maximum mass and radius of neutron stars are increasing function of magnetic field while average density, redshift, the strength of gravity and Kretschmann scalar are decreasing functions of it. These results are due to a repulsive-like force behavior for the magnetic field. Next, the effects of the gravity's rainbow will be studied and it will be shown that by increasing the rainbow function, the neutron stars could enjoy an expansion in their structures. Then, we obtain a new relation for the upper mass limit of a static spherical neutron star with uniform density in gravity's rainbow (Buchdahl limit) in which such upper limit is modified as Meff<4c2R/9G. In addition, stability and energy conditions for the equation of state of neutron star matter are also investigated and a comparison with empirical results is done. It is notable that the numerical study in this paper is conducted by using the lowest order constrained variational (LOCV) approach in the presence of magnetic field employing AV18 potential.

6. IRAP PhD 2017 call extension

The International Relativistic Astrophysics Ph.D. (IRAP PhD) – Joint Doctorate Program sponsored by ICRANet.
A deadline for eight positions open internationally and directly sponsored by the participating institutions has been extended to 25th of October 2017.
Please see the poster: http://www.icranet.org/images/stories/poster-irap2017R.pdf
The coordinated effort of many international organizations such as the National Aeronautics and Space Administration (NASA), the European Center for Nuclear Research (CERN), the European Space Agency (ESA), the European Southern Observatory (ESO), has led to an unprecedented amount of scientific information from the microphysical world all the way to the entire Universe. To harvest the results of these scientific missions, a specific Ph. D. program has been envisaged in order to involve the students in the analysis and modeling of the above observational data within the theory of general relativity and relativistic quantum and classical field theories.

The students will also be involved in innovative experimental programs in relativistic astrophysics. The program provides expertise in the most advanced topics of experimental, mathematical and theoretical physics relevant to the context of astronomy, astrophysics and cosmology. These activities, being necessarily international, the scientific and academic institutions, indicated below, participate with their own specific scientific specialties and a joint degree is delivered, at the end of the program.

The Institutions participating in the IRAP PhD are: the international organization ICRANet as coordinating institution and the University of Nice Sophia Antipolis as the host Institution; the Albert Einstein Institute, Potsdam (Germany); Indian Centre for Space Physics, Kolkata (India); Observatoire de la Cote D'Azur, Nice (France); University of Ferrara (Italy); University of Rome, la Sapienza (Italy); University of Savoie, Annecy (France).
The Final Ph.D. degree will be jointly delivered by the Academic Institutions participating in the program.
We encourage applications from the best candidates worldwide, independent of nationality, gender or background.
The Courses are listed on the website. Each student will have to follow 180 hours of courses during the three years of the Ph.D. program. There is also a possibility to follow courses from other Physics, Mathematics, Astronomy and Astrophysics Ph.D. programs in each participating institution, after approval by the Faculty.

7. Upcoming meetings

a. Fifteenth Marcel Grossmann Meeting on General Relativity (MG15), Rome, Italy

The Fifteenth Marcel Grossmann Meeting on General Relativity and Relativistic Astrophysics will be held at the campus of the University of Rome La Sapienza in Rome (Italy) on July 1-7, 2018, celebrating the 50th anniversary of the first neutron star discovery marking the birth of relativistic astrophysics.

There will be four satellite meetings of MG15 in 2018:

- Third Zeldovich meeting, at the National Academy of Sciences of Belarus in Minsk (Belarus), 23-27 April 2018;
- First Markarian meeting, at the National Academy of Sciences inYerevan (Armenia), 21-25 May 2018;
- Second Julio Garavito Armero meeting on Relativistic Astrophysics, in Bucaramanga (Colombia), 30 July – 3 August, 2018;
- Third Cesar Lattes Meeting, in Rio de Janeiro (Brazil), 6-10 August 2018.

Further information will be available on the website: http://www.icra.it/MG/mg15/

b. The Third Zeldovich meeting, Minsk, Belarus

The International Center for Relativistic Astrophysics Network (ICRANet) together with the National Academy of Sciences of Belarus will organize an international conference to be held in Minsk, Belarus, on April 23-27, 2018. Participation from neighboring countries such as Estonia, Latvia, Lithuania, Poland, Russia and Ukraine as well as from Balkan countries, Eastern and Western Europe and the Americas is expected. 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 the conference:

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

Many speakers at the conference will be the members of the world-famous scientific school in astrophysics and cosmology, founded by Ya. B. Zeldovich, who now became leading scientists in these fields in many countries worldwide including Germany, Italy, USA and Russia.

This conference will follow a very successful international conferences in honor of Ya. B. Zeldovich, held in Minsk in 2009 and in 2014.

Conference website: http://www.icranet.org/zeldovich3

ICRANet Newsletter

October – November 2017

SUMMARY

1. Early X-ray Flares in GRBs - a fundamental discovery by the ICRA/ICRANet group

The article "Early X-ray Flares in GRBs" by R. Ruffini, Y. Wang, Y. Aimuratov et al., is accepted for publication in the Astrophysical Journal on 23 of November 2017.

The milestone of understanding the nature of Gamma Ray Bursts (GRBs), presented today in the most prestigious Astrophysical Journal by scientists of ICRA/ICRANet at the University "Sapienza" (see: https://arxiv.org/pdf/1704.03821.pdf), show how GRBs originates in the most complex system ever studied in physics and astrophysics and energetically the most powerful in the Universe. "In only 100s a supernova (SN) is observed to explode and hypercritically accrete at a rate ~1 Msun/s on a tightly bound binary neutron star (NS) companion. In sequence, the NS, after reaching its critical mass, gravitationally collapse to a Black Hole (BH) emitting a GRB. The GRB impacts on the SN ejecta, it originates an X-ray and gamma Flare and transforms the SN in a hypernova. This "cosmic matrix", named Binary-driven-hypernova (BdHN), is the most energetic of seven GRB subclasses". GRBs are the most luminous objects in the Universe and can consequently be observed at 10 billions light year of distance in our past light cone: their luminosities equal the summed luminosities of all the stars of our Universe, the luminosity of 100 billions of billions of Suns! A GRB occurs every 100 million years in a galaxy and is visible in all the billions of galaxies of our Universe: the product gives a GRB rate of circa "one a day", an ideal rate for unveiling their nature on the ground of Einstein theory, see Figure 1. Essential has been the observational effort in the X and gamma rays, with space missions (e.g. BeppoSAX, SWIFT, FERMI) with vigorous European presence and with the European ESO VLT and the US KECK optical observatories. Crucial has been the ICRANet theoretical effort in attributing the astrophysical meaning to the observed photons received by these observatories from systems which preceded by 8 billion years the birth of our planetary system! This effort is well summarized in 25 additional papers by the same authors, quoted in the above article. Professor Ruffini has been for many years on the forefront of this research: from "introducing the Black hole" with J. A. Wheeler (see Figure 2) to the discovery of the first BH with R. Giacconi (see Figure 3), to the first announcement of the GRB discovery with H. Gursky, to the developments in the recent years of the BdHNe with Profs. C.L. Bianco, J. Rueda and C. Fryer and the many students of the joint European Ph.D. Program, the IRAP PhD, at the University of Rome (see Figure 4).

Figure 1: Left to right A. Einstein, H. Yukawa, J.A. Wheeler.

Figure 2: R. Ruffini discussing with J.A. Wheeler in Princeton (1971).

Figure 4: Picture of Prof. Ruffini with young researchers who partecipated in this discovery.

Figure 3: From left to right H. Gursky, R. Giacconi, R. Ruffini. Naval Research Laboratory, Washington D.C., 1984.

2. The "China-Italy Science, Technology & Innovation Week", Beijing, China, 13-17 November 2017

Figure 7. The meeting "China-Italy Science, Technology & Innovation Week" in Beijing. From right to left: prof. Remo Ruffini, Director of ICRANet, the Chinese Minister of Science and Technology, Wan Gang, Italian Minister of Education, University and Research, Valeria Fedeli. Fifth from right: Prof. Wen Biao Han, from the Shanghai Astronomical Observatory.

From the 13th to 17th of November the "China-Italy Science, Technology & Innovation Week" 2017 Edition has been held in three different cities across China: Beijing, Chengdu and Guiyang, see: http://www.cittadellascienza.it/cina/ The initiative, dedicated to the science and technology cooperation activities between the two countries with the aim of creating scientific, technological and commercial partnerships in the innovative research-entrepreneurial system, is promoted by the Ministry of Science and Technology of China and from the Italian side by the Ministry of Education, University and Research – MIUR in cooperation with the Ministry of Foreign Affairs and International Cooperation – MAECI and it is coordinated by Città della Scienza of Naples. It is realized in synergy with the Ministry of Economic Development, the Ministry of Health and the Ministry of Environment and Land and Sea Protection and in cooperation with the National Research Council, Confindustria (the Italian association of Italian entrepreneurs) and the main Italian Universities and Research Centers, together with the Campania Region for the Sino-Italian Exchange Event.

Professor Remo Ruffini, Director of ICRANet, has participated at the opening institutional ceremony of the event, launched in Beijing on November 14th in presence of the Italian Minister of Education, University and Research, Valeria Fedeli, and the Chinese Minister of Science and Technology, Wan Gang. In this occasion, Prof. Ruffini and Prof. Wen Biao Han, from the Shanghai Astronomical Observatory (SHAO) signed the "Agreement on joint Chinese-Italian activities in the field of relativistic astrophysics".

Figure 8. The signature of collaboration agreements by Chinese and Italian partners. Standing: the Chinese Minister of Science and Technology, Wan Gang and Italian Minister of Education, University and Research, Valeria Fedeli. Third and forth from left: prof. Remo Ruffini from ICRANet, and Prof. Wen Biao Han, from the Shanghai Astronomical Observatory.

3. The “Serbian-Italian Astronomical Workshop”, Belgrade, Serbia, 31 October 2017

Figure 5-6. Ceremony of signing of the cooperation agreement between ICRANet and the University of Belgrade.

On October 31 2017 Professor Ruffini, Director of ICRANet, participated in the Serbian-Italian Astronomical Workshop in Belgrade, organized by the Astronomical Observatory of Belgrade in collaboration with the Embassy of Italy. The purpose of the workshop was to discuss, in collaboration with the prominent scientist from Italy, the future observing projects, as well as to share the experiences related to various astronomical observations, and other astronomical and technical and computational possibilities which include the usage of astronomical instruments, reductions, storage and analysis of the observing material. Prof. Ruffini delivered the talk “Specific examples of separatrix between the collapsar and the BdHN models of GRBs”.

4. Lecture at the University of Tuzla in Bosnia and Herzegovina by prof. Remo Ruffini in occasion of the signature of collaboration agreement between the University of Tuzla and ICRANet, 27 November 2017

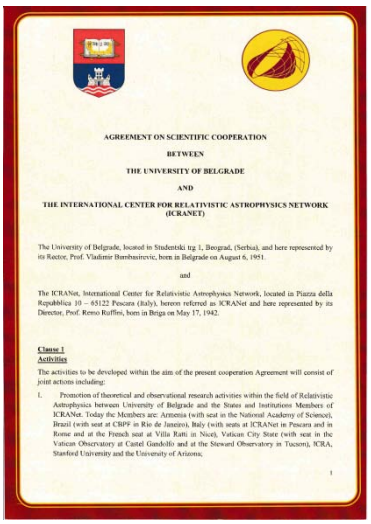
On the 27th of November Prof. Remo Ruffini, Director of ICRANet, visited University of Tuzla in Bosnia and Herzegovina and delivered a talk "The Puzzle of GRB 090510, GRB 130603B and GRB 170817A", see: http://pmf.untz.ba/2017/11/27/public-lecture-by-the-director-of-icranet-and-official-signing-of-agreement-of-collaboration-at-the-university-of-tuzla/

After the lecture, in the presence of H.E. the Ambassador of the Republic of Italy, Nicola Minasi, the Scientific Attache Dr Paolo Battinelli, the university and faculty management, numerous academics as well as students and representatives of the government of Tuzla and Tuzla Canton, an Agreement of collaboration between the University of Tuzla and ICRANet was signed.

Prof. Ruffini said: "This corresponds to my dream, which is to promote the joint study of the Universe, based on the ideas of Einstein, in collaboration with scientists from all the countries of the Western Balkan region, promoting joint scientific endeavors in the region, which is very important to ICRANet, Italy and Europe as a whole. We have already recently signed the corresponding Agreement with the universities in Belgrade and Novi Sad, with plans on signing more agreements with other scientific institutions in the Western Balkans". Prof. Dr Vedad Pašić, the Dean of the Faculty of natural Sciences and Mathematics at the University of Tuzla added: "We sincerely believe that this represents a whole new chapter of scientific research between our two friendly countries, as well as the first step of Bosnia and Herzegovina joining the broader family of ICRANet member States and Institutions". The Rector of the University of Tuzla, Prof. Dr Nermina Hadžigrahić expressed her sincere hope that Bosnia and Herzegovina will become the first member State of ICRANet from the Western Balkans. Ambassador Minasi stated his full support to the activities of the University of Tuzla and ICRANet and after the signing ceremony further discussed the various possibilities of academic, cultural as well as economic collaborations between Bosnia and Herzegovina and Italy with the representatives of the University of Tuzla.

5. New collaboration agreements: University of Belgrade; Agreement on joint Chinese-Italian activities in the field of relativistic astrophysics; University of Tuzla

Cooperation Agreement ICRANet - University of Belgrade



AGREEMENT ON SCIENTIFIC COOPERATION
BETWEEN
THE UNIVERSITY OF BELGRADE
AND
THE INTERNATIONAL CENTER FOR RELATIVISTIC ASTROPHYSICS NETWORK (ICRANET)

The University of Belgrade, located in Studentski trg 1, Beograd, (Serbia), and here represented by its Rector, Prof. Vladimir Bumbasirevic, born in Belgrade on August 6, 1951.

and

The ICRANet, International Center for Relativistic Astrophysics Network, located in Piazza della Repubblica 10 – 65122 Pescara (Italy), hereon referred as ICRANet and here represented by its Director, Prof. Remo Ruffini, born in Brga on May 17, 1942.

Clause 1
Activities

The activities to be developed within the aim of the present cooperation Agreement will consist of joint actions including:

1. Promotion of theoretical and observational research activities within the field of Relativistic Astrophysics between University of Belgrade and the States and Institutions Members of ICRANet. Today the Members are: Armenia (with seat in the National Academy of Science), Brazil (with seat at CBPF in Rio de Janeiro), Italy (with seats at ICRANet in Pescara and in Rome and at the French seat at Villa Ratti in Nice), Vatican City State (with seat in the Vatican Observatory at Castel Gandolfo and at the Steward Observatory in Tucson), ICRA, Stanford University and the University of Arizona;

During the Serbian-Italian Astronomical Workshop in Belgrade Prof. Remo Ruffini and Prof. Dr. Vladimir Bumbasirevic, Rector of the Belgrade University, signed the agreement of cooperation between the University of Belgrade and ICRANet, in the presence of Dr. Paolo Battinelli, Science Attaché of the Embassy of Italy in Belgrade.

The agreement consist of joint actions including: the promotion of theoretical and observational research activities within the field of Relativistic Astrophysics; the institutional exchange of faculty members, researchers, post-doctoral fellows and students; the promotion of technological developments; the development of Data Centers for Astrophysical data in all wavebands; the organization of training and teaching courses, and the development of inter-institutional research areas associated to local graduate programs; the organization of seminars, conferences, workshops or short courses; joint publications.

For the text of the Agreement, see: http://www.icranet.org/index.php?option=com_content&task=view&id=1158

Agreement on joint Chinese-Italian activities in the field of relativistic astrophysics

Agreement on joint Chinese-Italian activities in the field of relativistic astrophysics

On the occasion of the solemn ceremony of the joint meeting "CHINA-ITALY SCIENCE, TECHNOLOGY & INNOVATION WEEK" (13-15 November 2017, Beijing), in the presence of the Italian Minister of Education, Universities and Research (MIUR), Valeria Fedeli, and of the Chinese Minister of Science and Technology, Wan Gang,

the following institutions in China and Italy agree to collaborate on joint activities in the period 2018 - 2019, including seminars and workshops.

In particular:

1. the Fifteenth Marcel Grossman Meeting to be held in Rome from 1 to 7 July 2018 MGXV (http://www.icra.it/mg/mg15),

2. the Sixth Galileo-Xu Guangqi Meeting - GX6 (http://www.icranet.org/GXMeetings) to be held in Italy: in Pescara and Rome at ICRA/ICRANet, in Naples at the University "L'Orientale", and in Matera at the "Centro di Geodesia Spaziale Giuseppe Colombo" in 2019,

3. ASI, ICRA/ICRANet, INFN researchers will visit Chinese Institutions and, analogously, Chinese researchers will visit ASI, ICRA/ICRANet, INFN.

The research topics, in the field of Relativistic Astrophysics, to be covered by these joint activities, include: Gamma-Ray Bursts, Gravitational waves, Neutron Stars, Active Galactic Nuclei, Quasars, Neutrino astrophysics, Black Hole physics and astrophysics, Dark Matter, Quantum Gravity and Curved Space Quantum Field Theory as well as Nuclear Astrophysics.

The Chinese Institution:

Shanghai Astronomical Observatory (SHAO)
Chinese Academy of Science (CAS)
(e-mail: wbhan@shao.ac.cn)

The Italian Institutions are:

ASI (e-mail: presidenza@asi.it)
ASI – Centro Geodesia Spaziale G. Colombo Matera (e-mail: giuseppe.bianco@asi.it)
ICRA/ICRANet
(e-mail: ruffini@icra.it; secretariat@icranet.org)
INFN (presidenza@presid.infn.it)
University Campus Biomedico in Rome
(e-mail: s.filippi@unicampus.it)
University "l'Orientale" in Naples
(e-mail: retrivz.morfichie@uniori.it)
University of Rome "Sapienza"
(e-mail: rettore@uniroma1.it)

Chinese Representative signature in Beijing

Prof. Wenhua Han
e-mail: wbhan@shao.ac.cn

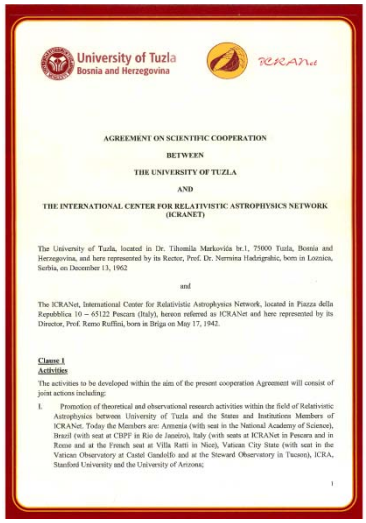
Italian Representative signature in Beijing

Prof. Remo Ruffini
e-mail: ruffini@icra.it

In this agreement SHAO, ASI, ASI – Centro Geodesia Spaziale G. Colombo Matera, ICRA/ICRANet, INFN, University Campus Biomedico in Rome, University "l'Orientale" in Naples, University of Rome "Sapienza, agree to collaborate on joint activities in the period 2018 - 2019, including seminars and workshops such as: the Fifteenth Marcel Grossman Meeting to be held in Rome from 1 to 7 July 2018 MGXV (http://www.icra.it/mg/mg15), the Sixth Galileo-Xu Guangqi Meeting - GX6 (http://www.icranet.org/GXMeetings) to be held in Pescara and Rome (Italy) at ICRA/ICRANet, in Naples at the University "L'Orientale", and in Matera at the "Centro di Geodesia Spaziale Giuseppe Colombo" in 2019. In addition, it was agreed that ASI, ICRA/ICRANet, INFN researchers will visit Chinese Institutions and, analogously, Chinese researchers will visit ASI, ICRA/ICRANet, INFN. The research topics, in the field of Relativistic Astrophysics, to be covered by these joint activities, include: Gamma-Ray Bursts, Gravitational waves, Neutron Stars, Active Galactic Nuclei, Quasars, Neutrino astrophysics, Black Hole physics and astrophysics, Dark Matter, Quantum Gravity and Curved Space Quantum Field Theory as well as Nuclear Astrophysics.

For the text of the Agreement, see: http://www.icranet.org/documents/Chinese-Italian_activities.pdf

Cooperation Agreement ICRANet - University of Tuzla



University of Tuzla
Bosnia and Herzegovina

AGREEMENT ON SCIENTIFIC COOPERATION
BETWEEN
THE UNIVERSITY OF TUZLA
AND
THE INTERNATIONAL CENTER FOR RELATIVISTIC ASTROPHYSICS NETWORK (ICRANET)

The University of Tuzla, located in Dr. Tihomila Markovića br.1, 75000 Tuzla, Bosnia and Herzegovina, and here represented by its Rector, Prof. Dr. Nermina Hadzigrahic, born in Loznica, Serbia, on December 13, 1962

and

The ICRANet, International Center for Relativistic Astrophysics Network, located in Piazza della Repubblica 10 – 65122 Pescara (Italy), hereon referred as ICRANet and here represented by its Director, Prof. Remo Ruffini, born in Briga on May 17, 1942.

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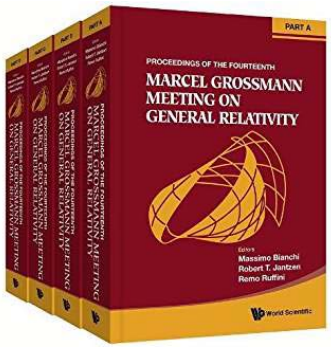
1

On 27 of November 2017 Prof. Remo Ruffini, Director of ICRANet and Prof. Nermina Hadzigrahic, Rector of the University of Tuzla signed a collaboration agreement on scientific cooperation between their institutes. This agreement will be valid for 5 years and the joint activities will consist in: promotion of theoretical and observational research activities within the field of Relativistic Astrophysics; institutional exchange of faculty members, researchers, post- doctoral fellows and students; development of teaching and/or research activities; support of technical-scientific and cultural events and activities open to the public; organization of seminars, conferences, workshops or short courses; joint publications.

For articles, photos and videos of the signing ceremony see: http://www.icranet.org/index.php?option=com_content&task=view&id=1163

The text of the agreement can be found here: http://www.icranet.org/documents/Agreement_ICRANet-University%20of_Tuzla.pdf

6. Fourteenth Marcel Grossmann meeting proceedings published online and in hard copy



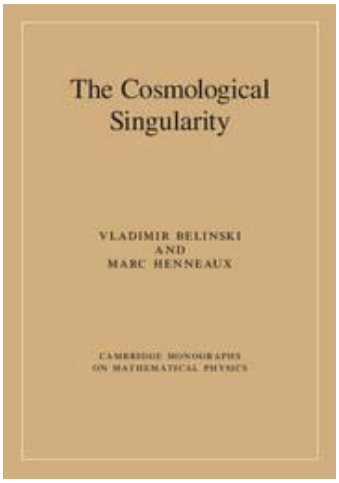
It is our pleasure to announce the publication of the Proceedings of the Fourteenth Marcel Grossman Meeting on General Relativity edited by Massimo Bianchi, Robert T Jantzen, Remo Ruffini, World Scientific, Singapore, 2017.

The open source e-book, allowing its content to be viewed by a wide international audience free of charge, is now available at the following link:

http://www.worldscientific.com/worldscibooks/10.1142/10614#t=toc

The four volume paper edition of some 4400 pages of the proceedings of MG14 is published in December 2017.

7. Recent publications



V.Belinski and M.Henneaux, "The Cosmological Singularity" (Cambridge University Press). The book (in hard copy) has been published on 26 October 2017.

Available here: https://www.cambridge.org/core/books/cosmological-singularity/652DFD197ED573BAC18EBB0778BD0886

Written for researchers focusing on general relativity, supergravity, and cosmology, this is a self-contained exposition of the structure of the cosmological singularity in generic solutions of the Einstein equations, and an up-to-date mathematical derivation of the theory underlying the Belinski-Khalatnikov-Lifshitz (BKL) conjecture on this field. Part I provides a comprehensive review of the theory underlying the BKL conjecture. The generic asymptotic behavior near the cosmological singularity of the gravitational field, and fields describing other kinds of matter, is explained in detail. Part II focuses on the billiard reformulation of the BKL behavior. Taking a general approach, this section does not assume any simplifying symmetry conditions and applies to theories involving a range of matter fields and space-time dimensions, including supergravities. Overall, this book will equip theoretical and mathematical physicists with the theoretical fundamentals of the Big Bang, Big Crunch, Black Hole singularities, the billiard description, and emergent mathematical structures.

Gabriel L. Gómez, and Jorge A. Rueda, "*Dark matter dynamical friction versus gravitational wave emission in the evolution of compact-star binaries*", Physical Review D, Volume 96, Issue 6, id.063001 (2017), published on 6 September 2017 and available here: http://adsabs.harvard.edu/abs/2017PhRvD..96f3001G

The measured orbital period decay of relativistic compact-star binaries, with characteristic orbital periods ˜0.1 days , is explained with very high precision by the gravitational wave (GW) emission of an inspiraling binary in a vacuum predicted by general relativity. However, the binary gravitational binding energy is also affected by an usually neglected phenomenon, namely the dark matter dynamical friction (DMDF) produced by the interaction of the binary components with their respective DM gravitational wakes. Therefore, the inclusion of the DMDF might lead to a binary evolution which is different from a purely GW-driven one. The entity of this effect depends on the orbital period and on the local value of the DM density, hence on the position of the binary in the Galaxy. We evaluate the

DMDF produced by three different DM profiles: the Navarro-Frenk-White (NFW) profile, the nonsingular-isothermal-sphere (NSIS) and the Ruffini-Argüelles-Rueda (RAR) DM profile based on self-gravitating keV fermions. We first show that indeed, due to their Galactic position, the GW emission dominates over the DMDF in the Neutron star (NS)-NS, NS-(White Dwarf) WD and WD-WD binaries for which measurements of the orbital decay exist. Then, we evaluate the conditions (i.e. orbital period and Galactic location) under which the effect of DMDF on the binary evolution becomes comparable to, or overcomes, the one of the GW emission. We find that, for instance for 1.3 - 0.2 M⊙ NS-WD, 1.3 - 1.3 M⊙ NS-NS, and 0.25 - 0.50 M⊙ WD-WD, located at 0.1 kpc, this occurs at orbital periods around 20-30 days in a NFW profile while, in a RAR profile, it occurs at about 100 days. For closer distances to the Galactic center, the DMDF effect increases and the above critical orbital periods become interestingly shorter. Finally, we also analyze the system parameters (for all the DM profiles) for which DMDF leads to an orbital widening instead of orbital decay. All the above imply that a direct/indirect observational verification of this effect in compact-star binaries might put strong constraints on the nature of DM and its Galactic distribution.

F. Cipolletta, C. Cherubini, S. Filippi, J.A. Rueda and R. Ruffini, "*Equilibrium Configurations of Classical Polytropic Stars with a Multi-Parametric Differential Rotation Law: A Numerical Analysis*", Communications in Computational Physics, vol. 22, issue 03, pp. 863-888 (2017), published on 21 September 2017 and available here: http://adsabs.harvard.edu/abs/2017CCoPh..22..863C

In this paper we analyze in detail the equilibrium configurations of classical polytropic stars with a multi-parametric differential rotation law of the literature using the standard numerical method introduced by Eriguchi and Mueller. Specifically we numerically investigate the parameters' space associated with the velocity field characterizing both equilibrium and non-equilibrium configurations for which the stability condition is violated or the mass-shedding criterion is verified.

Soroush Shakeri, Mansour Haghighat, She-Sheng Xue, "*Nonlinear QED effects in X-ray emission of pulsars*", JCAP (2017) no.10,014, and available here: http://adsabs.harvard.edu/abs/2017JCAP...10..014S

In the presence of strong magnetic fields near pulsars, the QED vacuum becomes a birefringent medium due to nonlinear QED interactions. Here, we explore the impact of the effective photon-photon interaction on the polarization evolution of photons propagating through the magnetized QED vacuum of a pulsar. We solve the quantum Boltzmann equation within the framework of the Euler-Heisenberg Lagrangian to find the evolution of the Stokes parameters. We find that linearly polarized X-ray photons propagating outward in the magnetosphere of a rotating neutron star can acquire high values for the circular polarization parameter. Meanwhile, it is shown that the polarization characteristics of photons besides photon energy depend strongly on parameters of the pulsars such as magnetic field strength, inclination angle and rotational period. Our results are clear predictions of QED vacuum polarization effects in the near vicinity of magnetic stars which can be tested with the upcoming X-ray polarimetric observations.

B. Eslam Panah, G. H. Bordbar, S. H. Hendi, R. Ruffini, Z. Rezaei and R. Moradi, "*Expansion of Magnetic Neutron Stars in an Energy (in)Dependent Spacetime*", The Astrophysical Journal, Volume 848, Issue 1, article id. 24, 11 pp. (2017), published on 6 October 2017 and available here: http://adsabs.harvard.edu/abs/2017ApJ...848...24E

Regarding the strong magnetic field of neutron stars and the high-energy regime scenario that is based on the high-curvature region near the compact objects, one is motivated to study magnetic neutron stars in an energy-dependent spacetime. In this paper, we show that such a strong magnetic field and energy dependency of spacetime have considerable effects on the properties of neutron stars. We examine the variations of maximum mass and related radius, Schwarzschild radius, average density, gravitational redshift, Kretschmann scalar, and Buchdahl theorem due to the magnetic field and energy dependency of the metric. First, it will be shown that the maximum mass and radius of neutron stars are increasing functions of the magnetic field, while average density, redshift, strength of gravity, and

Kretschmann scalar are decreasing functions of it. These results are due to a repulsive-like force behavior for the magnetic field. Next, the effects of gravity's rainbow will be studied, and it will be shown that by increasing the rainbow function, the neutron stars could enjoy an expansion in their structures. Then, we obtain a new relation for the upper mass limit of a static spherical neutron star with uniform density in gravity's rainbow (Buchdahl limit) in which such an upper limit is modified as $M_{eff} < 4c^2R/9G$. In addition, stability and energy conditions for the equation of state of neutron star matter are investigated, and a comparison with empirical results is done. It is notable that the numerical study in this paper is conducted by using the lowest-order constrained variational approach in the presence of a magnetic field employing AV_{18} potential.

S.H.Hendi, B.Eslam Panah, S.Panahiyan M.Momennia, "*Three dimensional magnetic solutions in massive gravity with (non)linear field*", Physics Letters B 775 (2017) 251–261, available online at: http://www.sciencedirect.com/science/article/pii/S0370269317308651

The Noble Prize in physics 2016 motivates one to study different aspects of topological properties and topological defects as their related objects. Considering the significant role of the topological defects (especially magnetic strings) in cosmology, here, we will investigate three dimensional horizonless magnetic solutions in the presence of two generalizations: massive gravity and nonlinear electromagnetic field. The effects of these two generalizations on properties of the solutions and their geometrical structure are investigated. The differences between de Sitter and anti de Sitter solutions are highlighted and conditions regarding the existence of phase transition in geometrical structure of the solutions are studied.

S. H. Hendi, B. Eslam Panah, S. Panahiyan, M. Momennia, "*Dilatonic black holes in gravity's rainbow with a nonlinear source: the effects of thermal fluctuations*", Eur. Phys. J. C (2017) 77:647, available online at: http://adsabs.harvard.edu/abs/2017EPJC...77..647H

This paper is devoted to an investigation of nonlinearly charged dilatonic black holes in the context of gravity's rainbow with two cases: (1) by considering the usual entropy, (2) in the presence of first order logarithmic correction of the entropy. First, exact black hole solutions of dilatonic Born-Infeld gravity with an energy dependent Liouville-type potential are obtained. Then, thermodynamic properties of the mentioned cases are studied, separately. It will be shown that although mass, entropy and the heat capacity are modified due to the presence of a first order correction, the temperature remains independent of it. Furthermore, it will be shown that divergences of the heat capacity, hence phase transition points are also independent of a first order correction, whereas the stability conditions are highly sensitive to variation of the correction parameter. Except for the effects of a first order correction, we will also present a limit on the values of the dilatonic parameter and show that it is possible to recognize AdS and dS thermodynamical behaviors for two specific branches of the dilatonic parameter. In addition, the effects of nonlinear electromagnetic field and energy functions on the thermodynamical behavior of the solutions will be highlighted and dependency of critical behavior, on these generalizations will be investigated.

D. Bini, A. Geralico, J. Vines, "*Hyperbolic scattering of spinning particles by a Kerr black hole*", Physical Review D, Volume 96, Issue 8, id.084044 (2017), available online at: http://adsabs.harvard.edu/abs/2017PhRvD..96h4044B

We investigate the scattering of a spinning test particle by a Kerr black hole within the Mathisson-Papapetrou-Dixon model to linear order in spin. The particle's spin and orbital angular momentum are taken to be aligned with the black hole's spin. Both the particle's mass and spin length are assumed to be small in comparison with the characteristic length scale of the background curvature, in order to avoid backreaction effects. We analytically compute the modifications due to the particle's spin to the scattering angle, the periastron shift, and the condition for capture by the black hole, extending previous results valid for the nonrotating Schwarzschild background. Finally, we discuss how to generalize the present analysis beyond the linear approximation in spin, including spin-squared corrections in the case of a black-hole-like quadrupolar structure for the extended test body.

B. Punsly, "*A Jet Source of Event Horizon Telescope Correlated Flux in M87*", accepted for publication in Astrophysical Journal, available online: https://arxiv.org/abs/1710.08355

Event Horizon Telescope (EHT) observations at 230 GHz are combined with Very Long Baseline Interferometry (VLBI) observations at 86 GHz and high resolution Hubble Space Telescope optical observations in order to constrain the broadband spectrum of the emission from the base of the jet in M87. The recent VLBI observations of Hada et al provide much stricter limits on the 86 GHz luminosity and component acceleration in the jet base than was available to previous modelers. They reveal an almost hollow jet on sub-mas scales. Thus, tubular models of the jet base emanating from the innermost accretion disk are considered within the region responsible for the EHT correlated flux. There is substantial synchrotron self absorbed opacity at 86 GHz. A parametric analysis indicates that the jet dimensions and power depend strongly on the 86 GHz flux density and the black hole spin, but weakly on other parameters such as jet speed, 230 GHz flux density and optical flux. The entire power budget of the M87 jet, $\lesssim 10^{44}$ergs/sec, can be accommodated by the tubular jet. No invisible, powerful spine is required. Even though this analysis never employs the resolution of the EHT, the spectral shape implies a dimension transverse to the jet direction of 12-21 μas ($\sim$24-27μas) for $0.99>a/M>0.95$ ($a/M\sim0.7$), where M is the mass and a is the angular momentum per unit mass of the central black hole.

8. Congratulation to Ronald Cintra Shellard for his nomination to the Brazilian Academy of Sciences

On May 9, 2017, Prof. Ronald Cintra Shellard, Director of CBPF, has been nominated full member of the Brazilian Academy of Sciences (Academia Brasileira de Ciências - ABC) in the field of Physical Sciences. The ceremony was held at Escola Naval, in the city of Rio de Janeiro and included the presence of the Minister of Science, Technology, Innovation and Communication of Brazil, Min. Gilberto Kassab.

Professors Ronald Cintra Shellard and Remo Ruffini.

ABC mission is to promote Science, Technology and Innovation in Brazil through the recognition of merit of top Brazilian researchers, as well as through the enhancement of scientific activities in all the fields of knowledge.

Prof. Shellard has been actively promoting the collaboration between ICRANet and CBPF.

See: http://www.abc.org.br/centenario/?Ronald-Cintra-Shellard

SBF website (in portuguese): http://www.sbfisica.org.br/v1/home/index.php/pt/acontece/364-fisicos-tomam-posse-como-membros-da-academia-brasileira-de-ciencias