ICRANet 簡報

十月 – 十一月 2017

1. GRB早期的X射線耀斑 - ICRA / ICRANet小組的一個基本發現

R. Ruffini，Y. Wang，Y. Aimuratov等人的文章“GRB中的早期X射線耀斑”被接受在2017年11月23日的“天體物理學期刊”上發表。

理解伽瑪射線爆發（GRBs）的性質的里程碑，由ICRA / ICRANet的科學家在“Sapienza”大學發表，最具聲望的天體物理學雜誌（見：https：//arxiv.org/pdf/1704.03821.pdf），展示了GRBs如何起源於在物理學和天體物理學方面研究過的最複雜的系統，並且是宇宙中最強大的能量。“僅在100多年前，一顆超新星（SN）被觀察到以緊密結合的二元中子星（NS）伴星以～1 Msun / s的速率超臨界地發生爆炸。 NS在達到其臨界質量之後，依次重力坍縮到發射GRB的黑洞（BH）。 GRB會影響SN噴射，它會產生一個X射線和伽瑪耀斑，並將SN變換成一個超新星。這個名為Binary-driven-hypernova（BdHN）的“宇宙矩陣”是7個GRB子類中最有活力的“。 GRBs是宇宙中最明亮的物體，因此可以在我們過去的光錐中以10億光年距離觀測到：它們的光度等於我們宇宙中所有恆星的總和光度，1000億億太陽的光度！ GRB每隔1億年發生在銀河系，在我們宇宙所有數十億星系中都可以看到：該產物的GRB速率大約為“一天一次”，這是以愛因斯坦理論為基礎揭示其性質的理想速率，見圖1。基本一直是X射線和伽馬射線的觀測，其中包括太空任務（例如BeppoSAX，SWIFT，FERMI）以及歐洲ESO VLT和美國KECK光學觀測站。 ICRANet將天體物理學的意義歸因於這些觀測站從我們的行星系統誕生之前80億年的系統中獲得的觀測到的光子，這是關鍵的一步！上述文章中引用的同一作者的另外25篇論文總結了這一努力。 Ruffini教授多年來一直處於這一研究的前沿：從JA Wheeler（見圖2）的“介紹黑洞”到R. Giacconi（見圖3）發現第一個黑洞，到第一個公告與H. Gursky的GRB發現，以及BdHNe近年來的發展。 C.L。 Bianco，J. Rueda和C. Fryer以及歐洲聯合博士的許多學生。 羅馬大學IRAP博士（見圖4）。

圖1：從左到右A.愛因斯坦，湯川H.，惠勒。

圖2：R. Ruffini與J.A. 惠普在普林斯頓（1971）。

圖3：從左到右H. Gursky，R. Giacconi，R. Ruffini。 海軍研究實驗室，華盛頓特區，1984年。

圖4：參加這一發現的年輕研究人員Ruffini教授的圖片。

2.“中意科技創新周”，中國北京，2017年11月13 - 17日

圖7.在北京舉行的“中意科技創新周”會議 從右到左：教授 中國科學技術部部長ICRANet主任Remo Ruffini，意大利教育，大學與研究部長Wan Gang，Valeria Fedeli。 右五：來自上海天文台

從11月13日到17日，“中意科技創新周”2017版在北京，成都，貴陽三個城市舉行，詳情請見http://www.cittadellascienza.it/cina /中國科技部和意大利政府共同倡導致力於創新科研創業體系中科技合作活動的兩國科技合作活動，由教育，大學和研究部門 - MIUR與外交和國際合作部 - MAECI合作，由那不勒斯Cittàdella Scienza協調。它與經濟發展部，衛生部和環境與土地和海洋保護部協作，並與國家研究委員會Confindustria（意大利企業家意大利協會）和意大利主要大學合作實現，研究中心與坎帕尼亞地區一起進行中意交流活動。

ICRANet主任Remo Ruffini教授11月14日在北京參加了此次活動的開幕儀式，在意大利教育，大學和研究部長Valeria Fedeli和中國科技部部長-萬剛參與下，Ruffini教授和來自上海天文台的韓文標教授簽署了“中意在相對論天體物理學領域的合作協議”。

圖8.中國和意大利合作夥伴簽署的合作協議 常務理事：中國科技部長萬剛和意大利教育部大學與研究部長瓦萊里婭·費德利。 左三和四： 來自ICRANet的Remo Ruffini和來自上海天文台的Wen Biao Han教授。

3.“塞爾維亞 - 意大利天文學研討會”，塞爾維亞貝爾格萊德，2017年10月31日

圖5-6。 ICRANet與貝爾格萊德大學簽署合作協議儀式。

2017年10月31日，ICRANet主任Ruffini教授參加了貝爾格萊德天文台與意大利駐華大使館合作組織的貝爾格萊德塞爾維亞 - 意大利天文學研討會。 研討會的目的是與意大利著名科學家合作，討論未來的觀測項目，以及分享有關各種天文觀測的經驗，以及其他天文，技術和計算的可能性，其中包括天文學的使用 儀器，減少，存儲和分析觀測資料。 Ruffini教授發表了題為“Collapsar與GRB的BdHN模型之間的分界線的具體例子”的演講。

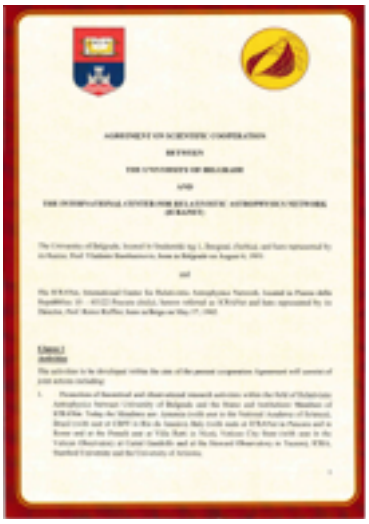
4.波斯尼亞和黑塞哥維那圖茲拉大學講課。 Remo Ruffini於2017年11月27日在圖茲拉大學和ICRANet簽署合作協議

11月27日，ICRANet主任Remo Ruffini教授訪問了波斯尼亞和黑塞哥維那的圖茲拉大學，並發表了題為“GRB 090510，GRB 130603B和GRB 170817A”的演講，見：http：//pmf.untz。BA / 2017年/ 11月27日/公開講座，並且簽署icranet和圖茲拉大學的合作協議。演講結束後，在H.E.意大利共和國大使Nicola Minasi，科學助理Paolo Battinelli博士，大學和教職員工管理人員，眾多學者以及圖茲拉和圖茲拉州政府的學生和代表，圖茲拉大學和ICRANet簽署。

魯菲尼教授說：“這與我的夢想是一致的，即根據愛因斯坦的思想，與來自西巴爾乾地區的所有國家的科學家合作，推動宇宙的聯合研究，促進聯合科學研究地區，這對ICRANet，意大利和整個歐洲都是非常重要的。我們最近已經與貝爾格萊德和諾維薩德的大學簽署了相應的協議，併計劃與西巴爾幹的其他科學機構簽署更多協議。圖茲拉大學自然科學和數學系院長VedadPašić教授補充說：“我們真誠地相信，這代表了我們兩個友好國家之間科學研究的全新篇章，也是第一步波斯尼亞和黑塞哥維那加入ICRANet成員國和機構的更廣泛的家庭“。圖茲拉大學校長NerminaHadžigrahić博士表示誠摯的希望，波斯尼亞和黑塞哥維那將成為西巴爾幹第一個ICRANet成員國。米納西大使表示全力支持圖茲拉大學和ICRANet大學的活動，在簽字儀式後，還進一步討論了波斯尼亞 - 黑塞哥維那和意大利與圖茲拉大學代表之間的學術，文化和經濟合作的各種可能性。

5.新的合作協議：貝爾格萊德大學; 關於中意合作在相對論天體物理學領域的活動的協定; 圖茲拉大學

合作協議ICRANet - 貝爾格萊德大學



在貝爾格萊德的塞爾維亞 - 意大利天文研討會期間，貝爾格萊德大學校長雷·拉菲尼教授和弗拉基米爾·本巴沙雷維奇教授在科學院保羅·巴蒂內利博士的陪同下，簽署了貝爾格萊德大學與ICRANet的合作協議意大利駐貝爾格萊德大使館隨員。

該協議由以下聯合行動組成：在相對論天體物理學領域促進理論和觀測研究活動;教師，研究人員，博士後及學生的機構交流;促進技術發展;為所有波段的天體物理數據開發數據中心;組織培訓和教學課程，發展與本地研究生課程有關的機構間研究領域;組織研討會，會議，講習班或短期課程;聯合出版物。

有關協議的內容，請參閱：http://www.icranet.org/index.php?option=com_content&task=view&id=1158

關於中意合作在相對論天體物理學領域的活動的協議

在這份協議中，SHAO，ASI，ASI-Ceni Geodesia Spaziale G. Colombo Matera，ICRA / ICRANet，INFN，University Campus Biomedico in Rome，那不勒斯大學“l'Orientale”，意大利羅馬大學Sapienza同意合作開展聯合活動在2018年至2019年期間，包括研討會和研討會，如：第十五屆馬塞爾·格羅斯曼會議將於2018年7月1日至7日在羅馬舉行MGXV（http://www.icra.it/mg/mg15），第六屆伽利略 - 許光啟會見GX6（http://www.icranet.org/GXMeetings），該會議將在意大利佩斯卡拉和羅馬（意大利）的ICRA / ICRANet在那不勒斯的L'Orientale大學舉行。此外，同意ASI，ICRA / ICRANet，INFN研究人員將訪問中國機構，同樣，中國研究人員將訪問ASI，ICRA / ICRANet，INFN。研究課題為相對論天體物理領域：伽馬射線爆發，引力波，中子星，活躍的星系核，類星體，中微子天體物理學，黑洞物理學和天體物理學，暗物質，量子引力和彎曲空間量子場論以及核天體物理學。

有關協議的內容，請參閱：http：//www.icranet.org/documents/Chinese-Italian_activities.pdf

合作協議ICRANet - 圖茲拉大學

2017年11月27日，ICRANet主任Remo Ruffini教授和圖茲拉大學校長Nermina Hadzigrahic教授簽署了雙方科研合作協議。 該協議有效期為5年，聯合活動將包括：在相對論天體物理學領域推動理論和觀測研究活動; 教職人員，研究人員，博士後及學生的機構交流; 教學和/或研究活動的發展; 支持向公眾開放的科技文化活動和活動; 組織研討會，會議，講習班或短期課程; 聯合出版物。

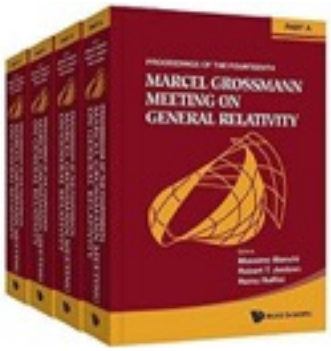
有關簽字儀式的文字和照片，請參閱：

http://www.icranet.org/index.php?option=com_content&task=view&id=1163

協議的文本可以在這裡找到：

http://www.icranet.org/documents/Agreement_ICRANet-University%20of_Tuzla.pdf

6.第十四屆馬塞爾·格羅斯曼會議論文在線發表和印刷版

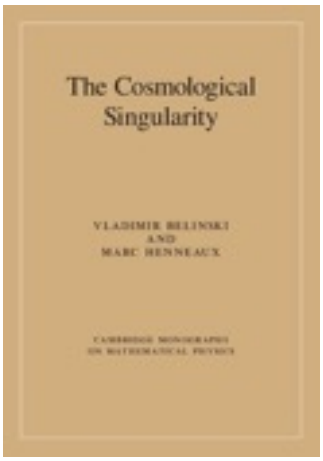


我們高興地宣布出版第十四屆馬塞爾·格羅斯曼廣義相對論會議（Robert T Jantzen，Remo Ruffini，Massimo Bianch，World Scientific，新加坡，2017年）出版。

開放源代碼的電子書，可以讓廣泛的國際觀眾免費觀看其內容，現在可以在以下鏈接中找到：http://www.worldscientific.com/worldscibooks/10.1142/10614#t=toc

2017年12月，出版了四期約4400頁的MG14會議文件。

9. 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 $M_{\odot}$ NS-WD, 1.3 - 1.3 $M_{\odot}$ NS-NS, and 0.25 - 0.50 $M_{\odot}$ 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, $\lesssim 10^{44} \mathrm{ergs/sec}$, 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 (~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.祝賀Ronald Cintra Shellard被提名到巴西科學院

2017年5月9日，CBPF主任Ronald Cintra Shellard教授被提名為巴西科學院（Academia Brasileira deCiências - ABC）在自然科學領域的正式成員。 儀式在里約熱內盧市的埃斯科拉海軍舉行，包括巴西科學，技術，創新和傳播部部長的出席。 吉爾伯托·卡薩布

ABC的使命是通過對巴西頂尖研究人員的優點的認可以及通過加強所有知識領域的科學活動來促進巴西的科學，技術和創新。

Shellard教授一直在積極推動ICRANet和CBPF的合作。

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

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