

# **THE FOURTEENTH MARCEL GROSSMANN MEETING**

**On Recent Developments in Theoretical and Experimental  
General Relativity, Astrophysics and Relativistic Field Theories**

# THE FOURTEENTH MARCEL GROSSMANN MEETING

On Recent Developments in Theoretical and Experimental  
General Relativity, Astrophysics and Relativistic Field Theories

Proceedings of the MG14 Meeting  
on General Relativity

University of Rome "La Sapienza", Italy      12–18 July 2015

Editors

**Massimo Bianchi**

University of Rome "Tor Vergata"  
Rome, Italy

**Robert T Jantzen**

Villanova University  
Villanova, PA USA

Series Editor

**Remo Ruffini**

International Center for Relativistic Astrophysics (ICRA)  
University of Rome "La Sapienza"  
Rome, Italy

International Center for Relativistic Astrophysics  
Network (ICRANet)  
Pescara, Italy

 **World Scientific**

NEW JERSEY • LONDON • SINGAPORE • BEIJING • SHANGHAI • HONG KONG • TAIPEI • CHENNAI

# THE FOURTEENTH MARCEL GROSSMANN MEETING

On Recent Developments in Theoretical and Experimental  
General Relativity, Astrophysics and Relativistic Field Theories

Proceedings of the MG14 Meeting  
on General Relativity

University of Rome "La Sapienza", Italy      12–18 July 2015

Editors

**Massimo Bianchi**

University of Rome "Tor Vergata"  
Rome, Italy

**Robert T Jantzen**

Villanova University  
Villanova, PA USA

Series Editor

**Remo Ruffini**

International Center for Relativistic Astrophysics (ICRA)  
University of Rome "La Sapienza"  
Rome, Italy

International Center for Relativistic Astrophysics  
Network (ICRANet)  
Pescara, Italy

 **World Scientific**

NEW JERSEY • LONDON • SINGAPORE • BEIJING • SHANGHAI • HONG KONG • TAIPEI • CHENNAI

# THE FOURTEENTH MARCEL GROSSMANN MEETING

On Recent Developments in Theoretical and Experimental  
General Relativity, Astrophysics and Relativistic Field Theories

Proceedings of the MG14 Meeting  
on General Relativity

University of Rome "La Sapienza", Italy      12–18 July 2015

Editors

**Massimo Bianchi**

University of Rome "Tor Vergata"  
Rome, Italy

**Robert T Jantzen**

Villanova University  
Villanova, PA USA

Series Editor

**Remo Ruffini**

International Center for Relativistic Astrophysics (ICRA)  
University of Rome "La Sapienza"  
Rome, Italy

International Center for Relativistic Astrophysics  
Network (ICRANet)  
Pescara, Italy

 **World Scientific**

NEW JERSEY • LONDON • SINGAPORE • BEIJING • SHANGHAI • HONG KONG • TAIPEI • CHENNAI

# THE FOURTEENTH MARCEL GROSSMANN MEETING

On Recent Developments in Theoretical and Experimental  
General Relativity, Astrophysics and Relativistic Field Theories

Proceedings of the MG14 Meeting  
on General Relativity

University of Rome "La Sapienza", Italy      12–18 July 2015

Editors

**Massimo Bianchi**

University of Rome "Tor Vergata"  
Rome, Italy

**Robert T Jantzen**

Villanova University  
Villanova, PA USA

Series Editor

**Remo Ruffini**

International Center for Relativistic Astrophysics (ICRA)  
University of Rome "La Sapienza"  
Rome, Italy

International Center for Relativistic Astrophysics  
Network (ICRANet)  
Pescara, Italy

 **World Scientific**

NEW JERSEY • LONDON • SINGAPORE • BEIJING • SHANGHAI • HONG KONG • TAIPEI • CHENNAI

*Published by*

World Scientific Publishing Co. Pte. Ltd.

5 Toh Tuck Link, Singapore 596224

USA office: 27 Warren Street, Suite 401-402, Hackensack, NJ 07601

UK office: 57 Shelton Street, Covent Garden, London WC2H 9HE

### **Library of Congress Cataloging-in-Publication Data**

Names: Marcel Grossmann Meeting on General Relativity (14th : 2015 : Università degli studi di Roma "La Sapienza") | Bianchi, Massimo (Associate professor of theoretical physics), editor. | Jantzen, Robert T., editor. | Ruffini, Remo, editor.

Title: The Fourteenth Marcel Grossmann Meeting on Recent Developments in Theoretical and Experimental General Relativity, Astrophysics, and Relativistic Field Theories : proceedings of the MG14 Meeting on General Relativity, University of Rome "La Sapienza", Italy, 12–18 July 2015 / editors, Massimo Bianchi (Università degli Studi di Roma "Tor Vergata", Italy), Robert T. Jantzen (Villanova University, USA), Remo Ruffini (International Center for Relativistic Astrophysics Network (ICRANet), Italy & University of Rome "La Sapienza", Italy).

Other titles: Proceedings of the MG14 Meeting on General Relativity

Description: Singapore ; Hackensack, NJ : World Scientific, [2017] | Includes bibliographical references.

Identifiers: LCCN 2017019091 | ISBN 9789813226593 (set ; alk. paper) | ISBN 9813226595 (set ; alk. paper) |

ISBN 9789813226623 (v.1 ; alk. paper) | ISBN 9813226625 (v.1 ; alk. paper) |

ISBN 9789813226630 (v.2 ; alk. paper) | ISBN 9813226633 (v.2 ; alk. paper) |

ISBN 9789813226647 (v.3 ; alk. paper) | ISBN 9813226641 (v.3 ; alk. paper) |

ISBN 9789813226654 (v.4 ; alk. paper) | ISBN 981322665X (v.4 ; alk. paper)

Subjects: LCSH: General relativity (Physics)--Congresses. | Gravitation--Congresses. |

Quantum gravity--Congresses. | Cosmology--Congresses.

Classification: LCC QC173.6 .M37 2015 | DDC 523.01--dc23

LC record available at <https://lcn.loc.gov/2017019091>

### **British Library Cataloguing-in-Publication Data**

A catalogue record for this book is available from the British Library.

Copyright © 2018 by the Editors

This is an Open Access proceedings volume published by World Scientific Publishing Company. It is distributed under the terms of the Creative Commons Attribution 4.0 (CC-BY) License. Further distribution of this work is permitted, provided the original work is properly cited.

Desk Editor: Ng Kah Fee

Printed in Singapore

**Rashid Sunyaev (Max Planck Institute for Astrophysics):** Cosmic microwave background radiation: In the directions to clusters of galaxies, recombination of hydrogen in the universe and black-body photosphere of our universe

**Ken'ichi Nomoto (University of Tokyo):** First stars, hypernovae, and superluminous supernovae

**Sachiko Tsuruta (Montana State University):** Temperature of neutron stars

**Samuel C. C. Ting (MIT):** Encounters with modern physics

**Jürgen Renn (Max Planck Institute for the History of Science):** The genesis and renaissance of general relativity

Videos of these talks may be found on YouTube by searching: “Fourteenth Marcel Grossmann Meeting – MG14 – Rome, July 12–18, 2015” or simply “ICRANet”:  
[https://www.youtube.com/playlist?list=PLr5RLbSWSontqAx3\\_u0gt81SpI305QzJr](https://www.youtube.com/playlist?list=PLr5RLbSWSontqAx3_u0gt81SpI305QzJr).

The slides used at the meeting are instead listed with each speaker on the web page of the plenary program:

[http://www.icra.it/mg/mg14/plenary\\_program.htm](http://www.icra.it/mg/mg14/plenary_program.htm).

The full program of the meeting including the organization of the parallel sessions is available at the meeting website:

<http://www.icra.it/mg/mg14/>.

The scientific content of this historic meeting is for the first time widely available as an open access e-book hosted by World Scientific, bringing into the electronic world the Marcel Grossmann Meeting mission of encouraging exchanges among scientists that may deepen our understanding of spacetime structures as well as review the status of ongoing experiments aimed at testing Einstein’s theory of gravitation either from the ground or from space.

These proceedings are divided into two categories spread over a limited number of four print volumes. The first category or first volume contains articles by plenary speakers and Marcel Grossmann Awardees together with review articles from some of the parallel sessions. The second category or remaining three volumes gather articles contributed by participants in the parallel sessions. A select subset of the first category articles have been published in the *International Journal of Modern Physics D* as they were submitted. The e-book may be found at the publisher website: <http://www.worldscientific.com/worldscibooks/10.1142/10614>.

**PART D**  
**PARALLEL SESSIONS**

• **High Energy Astrophysical Neutrinos Detection**

*Chairperson: Antonio Capone*

High-energy neutrinos in IceCube and beyond

*Palczewski, Tomasz J.; IceCube Collaboration . . . . .* 3251

Indirect search for dark matter with neutrino telescopes

*Zornoza, Juan-de-Dios . . . . .* 3257

Flavor ratio at IceCube with the 4 year dataset

*Palladino, Andrea . . . . .* 3262

ANTARES results in the light of the IceCube discoveries

*De Bonis, Giulia; ANTARES Collaboration . . . . .* 3268

High energy neutrino detection with KM3NeT

*Giordano, Valentina; Sapienza, Piera; KM3NeT Collaboration . . . . .* 3274

• **Future Prospects in High Energy Astrophysics**

*Chairperson: Filippo Frontera, Aldo Morselli*

Possible ASTROSAT observation of transient black hole candidates to study spectral and timing properties with TCAF solution

*Debnath, Dipak; Chakrabarti, Sandip K.; Mondal, Santanu; et al. . . . .* 3283

State-of-the-art of the hard X-/soft  $\gamma$ -ray focusing telescopes: The LAUE project status

*Virgilli, Enrico; Frontera, Filippo; Rosati, Piero; et al. . . . .* 3289

The Transient High Energy Sky and Early Universe Surveyor (THESEUS)

*Amati, Lorenzo; THESEUS Collaboration . . . . .* 3295

• **Experiments and Missions in X and Gamma Ray**

*Chairperson: Shuangnan Zhang, Oscar Adriani*

Highlights from the HAWC telescope

*Casanova, Sabrina; HAWC Collaboration . . . . .* 3303

The GAMMA-400 space mission for measuring high-energy gamma rays and cosmic rays

*Topchiev, Nikolai P.; Suchkov, Sergey I.; Galper, Arkady M.; GAMMA-400 Collaboration . . . . .* 3307

CALET: A high energy astroparticle physics experiment on the ISS

*Marrocchesi, Pier Simone; CALET Collaboration . . . . .* 3315



The protoMIRAX hard X-ray imaging balloon experiment  
*Penacchioni, Ana; Braga, João; D'Amico, Flavio; et al.* . . . . . 3321

• **History of Relativity and Cosmology**

*Chairperson: Christian Bracco, Tilman Sauer*

Noether theorems and reality of motion  
*Palese, Marcella; Winterroth, Ekkehart* . . . . . 3331

Perspectives on Einstein's scientific works in Milan  
*Bracco, Christian; Provost, Jean-Pierre* . . . . . 3337

The Eddington's eclipse replicated with the images of the SOHO coronographs  
*Sigismondi, Costantino* . . . . . 3342

A brief history of the energy-momentum tensor 1912–1915: Einstein physicist's logic in compromising gravitation with relativity  
*Provost, Jean-Pierre* . . . . . 3348

Recognizing Ricci  
*Goodstein, Judy* . . . . . 3354

Early reception of relativity theory by physicists in interwar Czechoslovakia  
*Durnova, Helena* . . . . . 3363

The collaboration between Marcel Grossmann and Albert Einstein as a case of the application of mathematics  
*Rüz, Tim; Sauer, Tilman* . . . . . 3368

The renaissance of general relativity in Rome: Main actors, research programs and institutional structures  
*Bonolis, Luisa; La Rana, Adele; Lalli, Roberto* . . . . . 3372

The beginning of Edoardo Amaldi's interest in gravitation experiments and in gravitational wave detection  
*La Rana, Adele; Bonolis, Luisa* . . . . . 3378

• **Observational Constraints on the Micro and Macroscopic Properties of Compact Stars**

*Chairperson: Jorge A. Rueda, Rodrigo Negreiros*

Quark-nova compact remnants: Observational signatures in astronomical data and implications to compact stars  
*Ouyed, Rachid; Leany, Denis; Koning, Nico; Shand, Zachary* . . . . . 3387

Empirical equation of state for dense nucleonic matter  
*Margueron, Jérôme; Casali, Rudiney* . . . . . 3392

## • New States of Matter and Strong Electromagnetic Fields in the Universe

*Chairperson: César A. Zen Vasconcellos, Aurora Pérez Martínez*

Models of hyperstars and hybrid stars

*Schramm, Stefan; Dexheimer, Veronica; Mallick, Ritam;*

*Negreiros, Rodrigo . . . . . 3399*

## • QCD Phase Diagram: From Nuclear Astrophysics to Heavy Ion Collisions

*Chairperson: Débora Peres Menezes*

Noncongruence of phase transitions in strongly interacting matter

*Hempel, Matthias; Dexheimer, Veronica; Schramm, Stefan;*

*Iosilevskiy, Igor . . . . . 3407*

Relativistic EoS with the quark-meson-coupling model

*Grams, Guilherme . . . . . 3414*

Phase structure of cold quark matter under strong magnetic fields within a generalized SU(2) NJL model

*Allen, Pablo G.; Grunfeld, Ana G.; Pagura, Valeria P.; Scoccola,*

*Norberto N. . . . . 3420*

Effect of symmetry energy on the low-density nuclear matter by quantum molecular dynamics

*Nandi, Rana; Schramm, Stefan . . . . . 3426*

## • Massive Stars

*Chairperson: Pascal Chardonnet*

Main parameters of neutron stars from quasi-periodic oscillations in low mass X-ray binaries

*Boshkayev, Kuantay; Rueda, Jorge A.; Muccino, Marco . . . . . 3433*

Progenitors of ultra-stripped supernovae

*Tauris, Thomas; Langer, Norbert; Podsiadlowski, Philipp . . . . . 3441*

On the origin of  $r$ -process elements from neutron star mergings

*Matteucci, Francesca; Romano, Donatella; Cescutti, Gabriele . . . . . 3448*

The formation of ultraluminous X-ray sources with neutron star accretors

*Fragos, Tassos . . . . . 3454*

• **Highly Magnetized Neutron Stars: Theories, Observations and Connection with Gamma-Ray Bursts**

*Chairperson: Rea Nanda*

The X-ray outburst of the Galactic Centre magnetar during the first 1.5 years

*Coti Zelati, Francesco* . . . . . 3463

• **Tests of Gravity with Atom Interferometers and Clocks**

*Chairperson: Guglielmo Tino*

Prospects for testing general relativity and alternative theories with clocks on satellites in Earth orbit

*Schärer, Andreas; Bondarescu, Ruxandra; Jetzer, Philippe; et al.* . . . . . 3471

Gravity detection by cold atom interferometer

*Li, Nan; Xu, Zhouxiang; Ying, Hao; Huang, Kaikai; Lu, Xuanhui* . . . . . 3476

• **Theory of Light Propagation in Gravitation Fields**

*Chairperson: Volker Perlick*

Light GR tests maintain flat material space

*Bulyzhenkov, Igor E.* . . . . . 3485

Testing the Kerr paradigm with the black hole shadow

*Bambi, Cosimo* . . . . . 3494

Shadow size for the supermassive black hole at the Galactic Center

*Zakharov, Alexander F.* . . . . . 3500

Non-gravitational deflection of light by a neutron star

*Kim, Jin Young; Lee, Taekoon* . . . . . 3506

Alternatives to Schwarzschild in the weak field limit

*Bozza, Valerio; Postiglione, Adriana* . . . . . 3511

A geometrical approach to gravitational lensing magnification

*Werner, Marcus C.* . . . . . 3515

Light from the supermassive black hole in the Galactic Center

*Moscibrodzka, Monika; Falcke, Heino; Noble, Scott* . . . . . 3519

Electromagnetic and observational signatures of the Kerr-Taub-NUT spacetime

*Younsi, Ziri; Grenzebach, Arne* . . . . . 3525

Electromagnetic shift arising from the Heisenberg-Euler dipole

*Bonetti, Luca; Perez Bergliaffa, Santiago E.; Spallicci, Alessandro* . . . . . 3531

Angular diameter of the shadow of black holes

*Grenzebach, Arne; Perlick, Volker; Lämmerzahl, Claus* . . . . . 3537

Shadows of rotating black holes in alternative theories <i>Amarilla, Leonardo; Eiroa, Ernesto F.</i> . . . . .	3543
Relativistic light tracing in the GAIA era <i>Crosta, Mariateresa; Lattanzi, Mario G.; Vecchiato, Alberto; de Felice, Fernando</i> . . . . .	3549
• <b>Experimental Gravitation</b>	
<i>Chairperson: Claus Lämmerzahl, Angela Di Virgilio</i>	
GINGER: An array of ring lasers for testing fundamental physics <i>Ortolan, Antonello; Belfi, J.; Bosi, F.; et al.</i> . . . . .	3557
Stochastic space-time and laser interferometry <i>Consoli, Maurizio</i> . . . . .	3563
RadioAstron gravitational redshift experiment: Status update <i>Litvinov, Dmitry, Bach, U.; Bartel, N.; et al.</i> . . . . .	3569
Probing deformed commutators with micro- and nano-oscillators <i>Bawaj, Mateusz; Biancofiore, Ciro; Bonaldi, Michele; et al.</i> . . . . .	3576
Experimental tests of local cosmological expansion rates <i>Widom, Allan; Swain, John; Srivastasa, Yogendra N.</i> . . . . .	3582
Testing the equivalence principle with the MICROSCOPE space mission: The data analysis challenges <i>Baghi, Quentin; Métris, Gilles; Bergé, Joël; et al.</i> . . . . .	3586
mSTAR: Testing Lorentz invariance in a low Earth orbit with high performance optical frequency standards <i>Saraf, Shailendhar; Buchman, Sasha; Cutler, Grant D.; et al.</i> . . . . .	3591
Light: A perfect probe for gravity <i>Tartaglia, Angelo</i> . . . . .	3600
Next-generation laser retroreflectors for precision tests of general relativity <i>Ciocci, Emanuele; Martini, Manuele; dell’Agnello, Simone; et al.</i> . . . . .	3606
Testing gravitation with satellite laser ranging and the LARASE experiment <i>Lucchesi, David M.; Anselmo, Luciano; Bassan, Massimo; et al.</i> . . . . .	3612
Archimedes: A feasibility study of an experiment to weigh the electromagnetic vacuum <i>Calloni, Enrico; De Laurentis, Martina; Esposito, Giampiero; et al.</i> . . . . .	3627
Higher order test of Lorentz invariance with an optical ring cavity <i>Michimura, Yuta; Guscott, Jake; Mewes, Matthew; et al.</i> . . . . .	3632
Modelling of in-orbit disturbances for Earth satellites <i>List, Meike; Bremer, Stefanie; Rievers, Benny; Selig, Hanns</i> . . . . .	3638

## Glitch entomology

*Fusco, Adele; Mejuto-Villa, Elena; Pinto, Innocenzo M.; Principe, Maria; Troiano, Luigi* . . . . . 3645

• **Variation of Fundamental Constants**

*Chairperson: Victor Flambaum, Julian Berengut*

White dwarf constraints on a secularly varying gravitational constant

*García-Berro, Enrique; Torres, Santiago; Althaus, Leandro G.; Córscico, Alejandro H.* . . . . . 3651

Fundamental constants as monitors of the universe

*Thompson, Rodger* . . . . . 3657

Evolution of the fine-structure constant in runaway dilaton models

*Martinelli, Matteo; Calabrese, Erminia; Martins, Carlos J. A. P.* . . . . . 3664

Variation of fundamental constants and  $^{229}\text{Th}$

*Feldmeier, Hans; Litvinova, Elena; Flambaum, Victor; Dobaczewski, Jacek* . . . . . 3670

• **GR in the Solar System**

*Chairperson: Roberto Peron, Agnes Fienga*

The Solar Lense-Thirring effect: Perspectives for a future measurement

*Iorio, Lorenzo* . . . . . 3679

Geoids in general relativity: Geoid quasilocal frames

*Oltean, Marius; Epp, Richard J.; McGrath, Paul L.; Mann, Robert B.* . . . . 3682

Transits of Venus 2004 and 2012 and solar diameter from ground:

Method, results and perspectives for Mercury transit of 2016

*Sigismondi, Costantino; Ayiomamitis, Anthony; Wang, Xiaofan; et al.* . . . . . 3688

Tests of GR with INPOP15a planetary ephemerides: Estimations of possible supplementary advances of perihelia for Mercury and Saturn

*Fienga, Agnès; Laskar, Jacques; Manche, Hervé; Gastineau, Mickael* . . . . 3694

Optical deformations in solar glass filters for high precision solar astrometry with astrolabes and heliometers

*Sigismondi, Costantino; Andrei, Alexandre H.; Boscardin, Sergio; Penna, Jucira L.; Reis-Neto, Eugenio.* . . . . . 3696

On the determination of post-Newtonian parameters with Bepi-Colombo radio science experiment

*Imperi, Luigi; Schettino, Giulia; Iess, Luciano* . . . . . 3702

Gravitational astrometry from within the solar system <i>Crosta, Mariateresa</i> . . . . .	3707
<b>• Dynamics of Extended Test Objects: Equations of Motion and their Solution</b>	
<i>Chairperson: Eva Hackmann, Dirk Puetzfeld</i>	
Spin-induced changes in the parameters of ISCO in Kerr spacetime <i>Jefremov, Paul I.; Tsupko, Oleg Yu.; Bisnovatyi-Kogan, Gennady S.</i> . . . . .	3715
Ghost images in Bardeen and ABG spacetimes <i>Schee, Jan; Stuchlík, Zdeněk</i> . . . . .	3722
Extended bodies with structure up to the quadrupole in black hole spacetimes <i>Bini, Donato; Geralico, Andrea</i> . . . . .	3727
On geodesic deviation in static spherically symmetric situations <i>Philipp, Dennis; Puetzfeld, Dirk; Lämmerzahl, Claus</i> . . . . .	3731
<b>• Quantum Spacetime</b>	
<i>Chairperson: Gherardo Piacitelli</i>	
A quantum Friedmann flat spacetime: Uncertainty relations, thermodynamics and some cosmological consequences <i>Viaggiu, Stefano</i> . . . . .	3739
Canonical star product for the $\kappa$ -Minkowski space-time <i>Vitale, Patrizia; Pachol, Anna</i> . . . . .	3744
<b>• Quantum Field Theory on Curved Spacetime</b>	
<i>Chairperson: Gerardo Morsella</i>	
Thermodynamic phase transition based on the nonsingular temperature <i>Gim, Yongwan; Eune, Myungseok; Kim, Wontae</i> . . . . .	3753
Quantum resolution of classical timelike singularities in a class of spherically-symmetric, self-similar spacetimes <i>Konkowski, Deborah A.; Williams, Jon; Hellwell, Thomas M.</i> . . . . .	3757
The influence of boundaries on radiative processes of uniformly accelerated entangled atoms <i>Menezes, Gabriel</i> . . . . .	3761
On the creation of spin 1/2 particles and renormalization in FLRW spacetime <i>Ghosh, Suman</i> . . . . .	3767
A calculation of the zeta-function in a quantum field theory in curved space <i>Kamath, Gopinath</i> . . . . .	3773

A non-geometric representation of the Dirac equation in curved spacetime <i>Vassiliev, Dmitri</i> . . . . .	3779
Towards quantum field theory on spacetimes with boundaries <i>Nosari, Gabriele</i> . . . . .	3785
Properties of the thermal two-point functions in curved spacetimes for a self-interacting scalar field <i>Rutili, Samuel</i> . . . . .	3791
Gauge anomaly for V-A fields in 4 and 6 dimensional curved space <i>Yajima, Satoshi; Eguchi, Kohei; Fukuda, Makoto; Oka, Tomonori; Yamashita, Shinji</i> . . . . .	3796
Asymptotically thermal responses for smoothly switched detectors <i>Fewster, Christopher J.; Juárez-Aubry, Benito A.; Louko, Jorma</i> . . . . .	3801
Lifshitz black holes and vacuum polarization <i>Quinta, Gonçalo M.; Flachi, Antonino; Lemos, José P. S.</i> . . . . .	3807
General boundary treatment of the Unruh effect <i>Colosi, Daniele</i> . . . . .	3812
Quantum gravitational perturbations in static de Sitter space: Infrared-finite two-point function <i>Bernar, Rafael P.; Crispino, Luís C. B.; Higuchi, Atsushi</i> . . . . .	3818
Absorption cross section of a massive scalar field by a Reissner-Nordström black hole <i>Benone, Carolina L.; de Oliveira, Ednilton S.; Crispino, Luís C. B.; Dolan, Sam R.</i> . . . . .	3822
Non-perturbative corrections to the gravitational effective action induced by a scalar field at finite and zero temperatures <i>Kalinichenko, Igor S.; Kazinski, Peter O.</i> . . . . .	3828
Spectral analysis of the massless Dirac operator on a 3-manifold <i>Fang, Yan-Long</i> . . . . .	3834
<b>• Operator Algebras and Quantum Field Theory</b> <i>Chairperson: Gandalf Lechner, Giuseppe Ruzzi</i>	
Operator algebras and vertex operator algebras <i>Carpi, Sebastiano</i> . . . . .	3843
An algebraic condition for the Bisognano-Wichmann property <i>Morinelli, Vincenzo</i> . . . . .	3849
Hadamard states vs. modular nuclearity: A comparison for free scalar fields <i>Sanders, Ko</i> . . . . .	3855

Quantum energy inequalities in integrable quantum field theories <i>Cadamuro, Daniela</i> . . . . .	3860
Towards construction of integrable QFT with bound states <i>Tanimoto, Yoh</i> . . . . .	3866
A quantum distance between von Neumann algebras and applica- tions to quantum field theory <i>Guido, Daniele; Marotta, Nunzia; Morsella, Gerardo; Suriano, Luca</i> . . . . .	3870
<b>• Loop Quantum Gravity, Quantum Geometry, Spin Foams</b> <i>Chairperson: Jerzy Lewandowski</i>	
Physical Hilbert spaces in quantum gravity <i>Malkiewicz, Przemysław</i> . . . . .	3879
Critical line of the Ising model on 2-dimensional CDT and its dual <i>Napolitano, George M.; Turova, Tatyana S.</i> . . . . .	3885
Recent results in CDT quantum gravity <i>Ambjorn, Jan; Coumbe, Daniel; Gizbert-Studnicki, Jakub; Jurkiewicz, Jerzy</i> . . . . .	3891
Recent developments in quantum dynamics of loop quantum gravity <i>Assanioussi, Mehdi; Lewandowski, Jerzy; Mäkinen, Ilkka</i> . . . . .	3897
Exploring gravitational statistics not based on quantum dynamical assumptions <i>Mandrin, Pierre A.</i> . . . . .	3902
On the “spin connection foam” picture of quantum gravity from precanonical quantization <i>Kanatchikov, Igor V.</i> . . . . .	3907
Implementation of conformal scaling in loop quantum gravity via the Barbero-Immirzi parameter <i>Wong, Patrick J.</i> . . . . .	3916
Loop quantum gravity with a free scalar field: A physical Hamil- tonian operator <i>Alesci, Emanuele; Assanioussi, Mehdi; Lewandowski, Jerzy; Mäkinen, Ilkka</i> . . . . .	3920
<b>• Quantum Gravity Phenomenology</b> <i>Chairperson: Giovanni Amelino-Camelia</i>	
Hamilton geometry: Phase space geometry from modified disper- sion relations <i>Pfeifer, Christian; Barcaroli, Leonardo; Brunkhorst, Lukas; Gu- bitosi, Giulia; Loret, Niccoló</i> . . . . .	3929



New constraints on quantum foam models from X-ray and gamma-ray observations of distant quasars <i>Perlman, Eric S.; Rappaport, Saul A.; Ng, Y. Jack; et al.</i> . . . . .	3935
Modified dark matter <i>Ng, Y. Jack; Edmonds, Doug; Farrah, Duncan; et al.</i> . . . . .	3942
Singularity avoidance in rainbow cosmology <i>Santos, Grasiela; Amelino-Camelia, Giovanni; Gubitosi, Giulia</i> . . . . .	3948
Purity is not eternal at the Planck scale <i>Arzano, Michele</i> . . . . .	3954
What is dimensional reduction really telling us? <i>Coumbe, Daniel</i> . . . . .	3960
If detected, would hypothetical gravitational Casimir effects prove gravity quantization? <i>Pinto, Fabrizio</i> . . . . .	3966
Phenomenology of causal dynamical triangulations <i>Mielczarek, Jakub</i> . . . . .	3974
On the fate of Birkhoff's theorem in Shape Dynamics <i>Mercati, Flavio</i> . . . . .	3978
Causal set theory, non-locality and phenomenology <i>Belenchia, Alessio</i> . . . . .	3993
CPT symmetry, quantum gravity, and entangled neutral K mesons <i>Di Domenico, Antonio</i> . . . . .	3999
Geometric picture of DSR-relativistic theories with de Sitter and anti-de Sitter momentum spaces <i>Lobo, Iarley P.; Palmisano, Giovanni</i> . . . . .	4005
Quantum gravity phenomenology and metric formalism <i>Loret, Niccoló; Barcaroli, Leonardo; Gubitosi, Giulia</i> . . . . .	4011
From loop-quantum-gravity-deformed hypersurface-deformation algebra to DSR-relativistic symmetries <i>da Silva, Malú Maira; Ronco, Michele</i> . . . . .	4017
Gravitational lensing by self-dual black holes in loop quantum gravity <i>Lochan, Kinjalk.; Sahu, S.; Narasimha, D.</i> . . . . .	4023
Macroscopic systems, dual gravity lensing and other emerging topics in quantum-gravity phenomenology <i>Amelino-Camelia, Giovanni</i> . . . . .	4029

• **Loop Quantum Gravity: Cosmology and Black Holes**

*Chairperson: Jorge Pullin, Parampreet Singh*

Phenomenology of inflationary scenario in loop quantum cosmology  
*Gupt, Brajesh; Bonga, Béatrice . . . . . 4037*

Local rotational symmetry Gowdy model in loop quantum Gravity  
*Olmedo, Javier; Martín-de Blas, Daniel; Pawłowski, Tomasz . . . . . 4043*

Emergence of product of constant curvature spaces in loop quantum cosmology  
*Dadhich, Naresh; Joe, Anton; Singh, Parampreet . . . . . 4048*

Polymerization, the problem of access to the saddle point approximation, and thermodynamics  
*Morales-Técolt, Hugo A.; Orozco-Borunda, Daniel H.; Rastgoo, Saeed . . . . . 4054*

Stress energy tensor renormalization for a spherically symmetric massive scalar field on a quantum space-time  
*Barrios, Nahuel; Gambini, Rodolfo; Pullin, Jorge . . . . . 4060*

The vertex expansion in the consistent histories formulation of spin foam loop quantum cosmology  
*Craig, David; Singh, Parampreet . . . . . 4065*

• **Strong (EM) Field Physics and Astrophysics**

**AND Ground Experiments and Astrophysical**

**Observations in Strong Field Physics**

*Chairperson: Sang Pyo Kim, She-Sheng Xue*

Synchrotron radiation and pair creation of massless charges in magnetic fields  
*Gal'tsov, Dmitry . . . . . 4073*

Scalar QED action density and Schwinger pair production in (A)dS<sub>2</sub>  
*Kim, Sang Pyo . . . . . 4079*

General relativistic plasma magnetospheres of slowly rotating and oscillating magnetized neutron stars  
*Morozova, Viktoriya; Ahmedov, Bobomurat; Zanotti, Olindo . . . . . 4087*

Radiation by an Unruh-DeWitt detector in oscillatory motion  
*Lin, Shih-Yuin . . . . . 4095*

Pair creation in the early universe  
*Stahl, Clément; Strobel, Eckhard; Xue, She-Sheng . . . . . 4103*

**• Supernova Explosions and Neutron Stars Dynamics AND Numerical Simulations, SN, and GRB, Connecting with Massive SN**

*Chairperson: Kostas Kokkotas, Valeri Chechetkin, Alexey Aksenov*

Dynamics and gravitational-wave emission of neutron-star merger remnants  
*Bauswein, Andreas; Clark, James; Stergioulas, Nikolaos; Janka, Hans-Thomas . . . . .* 4115

Identifications of quasi-periodic oscillations observed in soft-gamma repeaters with crustal torsional oscillations  
*Sotani, Hajime . . . . .* 4121

Numerical models for superfluid neutron stars and application to pulsar glitches  
*Sourie, Aurélien; Oertel, Micaela; Novak, Jérôme . . . . .* 4125

Saturation of the *f*-mode instability in neutron stars  
*Pnigouras, Pantelis; Kokkotas, Kostas D.; Doneva, Daniela D. . . . .* 4131

**• Branes and Instantons in String Theory**

*Chairperson: Alberto Lerda*

Resumming instantons in  $N = 2^*$  theories with arbitrary gauge groups  
*Billò, Marco; Frau, Marialuisa; Fucito, Francesco; Morales, José F.; Lerda, Alberto . . . . .* 4139

A topologically twisted index for three-dimensional gauge theories  
*Benini, Francesco . . . . .* 4151

On the soft limit of tree-level string amplitudes  
*Bianchi, Massimo; Guerrieri, Andrea L. . . . .* 4157

On non-geometric fluxes and mixed-symmetry potentials  
*Bergshoeff, Eric A.; Riccioni, Fabio . . . . .* 4164

Branes, weights and duality orbits  
*Riccioni, Fabio; Romano, Luca . . . . .* 4170

Instanton corrections to the effective action of  $\mathcal{N} = 4$  SYM  
*Bianchi, Massimo; Morales, José F.; Wen, Congkao . . . . .* 4175

**• Black Holes in String Theory**

*Chairperson: Gianguido Dall’Agata*

Freudenthal duality and black holes: From groups of type  $E_7$  to pre-homogeneous spaces  
*Marrani, Alessio . . . . .* 4185

Rhology, black holes and Scherk-Schwarz <i>Gnecchi, Alessandra</i> . . . . .	4193
Is entropy really proportional to area? <i>Mathur, Samir D.</i> . . . . .	4199
Hairy black holes in $N = 2$ gauged supergravity <i>Faedo, Federico; Klemm, Dietmar; Nozawa, Masato</i> . . . . .	4204
<b>• Gauge/Gravity and Related Correspondences</b> <i>Chairperson: Rubik Poghossian</i>	
Resolved warped deformed conifolds and large- $N$ thermal QCD via black M3-branes <i>Misra, Aalok</i> . . . . .	4211
WAdS <sub>3</sub> /CFT <sub>2</sub> correspondence in presence of bulk massive gravi- tons <i>Donnay, Laura; Giribet, Gaston</i> . . . . .	4216
Logarithmic corrections in the entanglement entropy <i>Park, Chanyong</i> . . . . .	4222
Some aspects of the T-duality symmetric string sigma model <i>Pezzella, Franco</i> . . . . .	4228
<b>• String Phenomenology &amp; Cosmology</b> <i>Chairperson: Gianfranco Pradisi</i>	
Supergravity and the cosmological constant <i>Bergshoeff, Eric; Freedman, Dan; Kallosh, Renata; Van Proeyen, Antoine</i> .	4237
Neutron-antineutron transitions from exotic instantons: How fast they might be and further implications <i>Addazi, Andrea</i> . . . . .	4243
A flux-scaling scenario for moduli stabilization and axion inflation in string theory <i>Font, Anamaría</i> . . . . .	4249
Evidence for Planck-scale resonant particle production during inflation from the CMB power spectrum <i>Mathews, Grant; Gangopadhyay, Mayukh; Ichiki, Kiyotomo;</i> <i>Kajino, Toshitaka</i> . . . . .	4256
Gravitational waves in $\alpha$ -attractors <i>Kumar, Korumilli Sravan; Marto, João; Moniz, Paulo Vargas;</i> <i>Das, Suratna</i> . . . . .	4262
<b>• The Status of Magnetic White Dwarfs AND White Dwarfs in Binaries and the Role of Gravitational Waves</b> <i>Chairperson: Enrique García-Berro; Oliveira Kepler Souza; Mukremin Kilic</i>	

Observational properties of magnetic white dwarfs <i>Ferrario, Lilia</i> . . . . .	4271
Magnetic fields and crystallizing white dwarfs <i>Isern, Jordi; Külebi, Baybars; García-Berro, Enrique</i> . . . . .	4281
Mass-radius relations of white dwarfs at finite temperatures <i>Boshkayev, Kuantay; Rueda, Jorge A.; Ruffini, Remo; et al.</i> . . . . .	4287
Induced compression by angular momentum loss in fast-rotating, magnetized super-Chandrasekhar white dwarfs <i>Becerra, Laura M.; Rueda, Jorge A.; Lorén-Aguilar, Pablo; García-Berro, Enrique</i> . . . . .	4291
Highly super-Chandrasekhar white dwarfs in an extensive GRMHD framework <i>Das, Upasana; Mukhopadhyay, Banibrata</i> . . . . .	4297
<b>• Origin and Physics of Soft Gamma-Ray Repeaters and Anomalous X-Ray Pulsars</b>	
<i>Chairperson: Manuel Malheiro</i>	
Explaining radio emission of magnetars via rotating and oscillating magnetospheres of neutron stars <i>Morozova, Viktoriya; Ahmedov, Bobomurat; Zanotti, Olindo</i> . . . . .	4305
SGRs/AXPs as white dwarf pulsars: Sources of ultra-high energetic photons with $E \sim 10^{21}$ eV <i>Lobato, Ronaldo Vieira; Malheiro, Manuel; Coelho, Jaziel</i> . . . . .	4313
The importance of general relativity for the radius of super- Chandrasekhar white dwarfs <i>Carvalho, Geanderson A.; Marinho, Rubens M.; Malheiro, Manuel</i> . . . . .	4319
Soft gamma-ray repeaters and anomalous X-ray pulsars as highly magnetized white dwarfs <i>Mukhopadhyay, Banibrata; Rao, A. R.</i> . . . . .	4325
Gravitomagnetic approach for Mercury perihelion advance <i>Rocha, Flavia; Malheiro, Manuel; Marinho, Rubens M.</i> . . . . .	4331
Application of modern neutron star equations of state in the study of SGRs and AXPs properties <i>de Lima, Rafael C. R.; Coelho, Jaziel G.; Cáceres, Diego L.; Rueda, Jorge A.; Ruffini, Remo</i> . . . . .	4337
On the spin-down and X-ray luminosity of anomalous X-ray pulsars and soft gamma repeaters as white dwarfs <i>Caceres, Diego L.; Rueda, Jorge A.</i> . . . . .	4344

Effects of rotation in magnetic white dwarfs <i>Otoniel, Edson; Malheiro, Manuel; Weber, Fridolin</i> . . . . .	4350
Two-component theory of classical Proca fields in curved spacetimes with torsionless affinities <i>Santos, Samuel; Cardoso, J. G.</i> . . . . .	4356
Ultra-magnetized white dwarfs are stable? <i>Malheiro, Manuel; Marinho, Rubens M.; Lobato, Ronaldo V.; Coelho, Jaziel G.</i> . . . . .	4363
<p>• <b>Proceedings of the Fourteenth Italian-Korean Meeting on Relativistic Astrophysics (IK14) July 20–24, 2015 ICRANet, Pescara, Italy</b> <i>Chairperson: Hyung Won Lee, Gregory Vereshchagin and She-Sheng Xue</i></p>	
On the integrability of $N = 2$ supergravity <i>Belinski, Vladimir</i> . . . . .	4375
Induced compression of white dwarfs by angular momentum loss <i>Boshkayev, Kuantay; Rueda, Jorge A.; Ruffini, Remo; Zhami, Bakytzhan</i> . . . . .	4379
Equation of state of strange quark matter in a nonuniform magnetic field <i>Isayev, A. A.</i> . . . . .	4385
Pair production, vacuum polarization and anomaly in (A)dS and charged black holes <i>Kim, Sang Pyo</i> . . . . .	4392
Instability of strong magnetic field and neutrino magnetic dipole moment <i>Lee, Hyun Kyu</i> . . . . .	4400
Entropy preference of black holes in Dilatonic Einstein-Gauss-Bonnet theory of gravitation <i>Ahn, Wha-Keun; Gwak, Bogeun; Lee, Bum-Hoon; Lee, Wonwoo</i> . . . . .	4408
The spherical perfect fluid collapse with pressure in the cosmological background <i>Moradi, Rahim; Firouzjaee, Javad T.; Mansouri, Reza</i> . . . . .	4414
Holographic hadrons in the nuclear medium <i>Park, Chanyong</i> . . . . .	4425
Cosmological fractal matter with an upper cutoff <i>Ruffini, Remo; Stahl, Clément</i> . . . . .	4433
List of Participants . . . . .	4441