Nathan Berkovits

Scientific Report

2a. Project: ICTP South American Institute for Fundamental Research

2b. Project Coordinator: Nathan Jacob Berkovits

2c. Host Institution: Instituto de Física Teórica-UNESP

2.d Project Team

Professors

Luis Raul Abramo, Associate Researcher (4 hours), IF-USP

Marcus A. M. de Aguiar, Associate Researcher (4 hours), IF-UNICAMP

Nathan Jacob Berkovits, Project Coordinator (20 hours), IFT-UNESP

Gustavo Burdman, Associate Researcher (4 hours), IF-USP

Hilda Cerdeira, Associate Researcher (4 hours), IFT-UNESP

Roberto André Kraenkel, Associate Researcher (4 hours), IFT-UNESP

Gastão Krein, Associate Researcher (4 hours), IFT-UNESP

George E. A. Matsas, Associate Researcher (4 hours), IFT-UNESP

Elisabete Dal Pino, Associate Researcher (4 hours), IAG-USP

Eduardo Pontón, ICTP-SAIFR full professor

Paulo Inácio de Knegt López de Prado, Associate Researcher (4 hours), IB-USP

Victor Rivelles, Associate Researcher (4 hours), IF-USP

Rogerio Rosenfeld, Principal Investigator (20 hours), IFT-UNESP

Daniel Augusto Turolla Vanzella, Associate Researcher (4

hours), IFSC-USP

Postdoctorals associated to ICTP-SAIFR

Carlos Alfonso Ballon Bayona (CAPES)

Nicolás Bernal (FAPESP)

Oscar Chacaltana (CAPES)

Gero von Gersdorff (FAPESP)

Chrysostomos Kalousios (FAPESP)

Fabien Lacasa (FAPESP)

Saeed Mirshekari (FAPESP)

Riccardo Sturani (Young Investigator – FAPESP)

Alberto Tonero (FAPESP)

Administrative support

Danilo Rodrigues Ramos, Computer System Manager (40 hours), ICTP-SAIFR/UNESP

Lilia Faria, Financial Manager (40 hours), ICTP-SAIFR/UNESP

Nadia Rosa Roque, Executive Secretary (40 hours), ICTP-SAIFR/UNESP

2e. Fapesp Project Number: 2011/11973-4

2f. Project Period: 01/12/2011 – 30/11/2016

2g. Period covered by this Report: 31/12/2012 – 30/12/2013

3. Summary of the Project's main goals

Fundamental research in theoretical physics has historically led to developments in all areas of science. In addition to producing technological applications coming from a better understanding of the physical laws of the universe, fundamental research in theoretical physics has led to new methods of problem-solving which has revolutionized areas of mathematics, biology, computer science, economics, and other areas of study.

Throughout the world, the importance of fundamental research has led to the creation of theoretical physics institutes which focus on research, on the training of graduate students and post-docs, and on the organization of schools and workshops. Although these theoretical physics institutes have different structures and many are connected with public universities, they are all disconnected from undergraduate physics departments and have independent hiring policies and academic responsibilities from the rest of the university. Because of this autonomy, these theoretical physics institutes are able to attract the best researchers to their faculty. And because of the prestigious faculty and the organization of schools and workshops, these institutes are able to attract highly qualified graduate students and post-docs. As a result, the academic and research programs at these autonomous theoretical physics institutes increase the international impact of their host universities.

The establishment of a viable South American institute devoted to the fundamental aspects of theoretical physics is an urgent priority. One of the main roles of the International Center for Theoretical Physics (ICTP) in Italy is to promote scientific research in developing countries, and the establishment of such a center in South America has been promoted for several years by the ICTP leadership. In addition to promoting theoretical physics research in Brasil, this center would also have the responsibility of promoting research in less-developed countries of South America by hosting workshops and schools and having an active visiting program for students and researchers from other South American countries. In other words, this regional center would play the role of a mini-ICTP. In 2010, the new management of ICTP made the establishment of this South American regional center a high priority with the direct participation of the ICTP and named it the "ICTP South American Institute for Fundamental Research".

The association of the São Paulo State University (UNESP) with the International Center for Theoretical Physics (ICTP) to establish the ICTP South American Institute for Fundamental Research in São Paulo with funding from FAPESP has grown from the desire of UNESP to increase its international visibility and the ICTP desire to employ its expertise in the organization and running of this new South American regional center for theoretical physics.

The long-term goal for this new institute is to become a South American center of excellence in theoretical physics which will be comparable to theoretical physics institutes in the rest of the world and at the same level as the highly prestigious mathematics institute Instituto Nacional de Matematica Pura e Aplicada (IMPA) in Rio de Janeiro. Through an active visiting program involving Schools and Workshops, this center of excellence will elevate the level of theoretical physics in all of South America. With the assistance of the three institutions, namely ICTP, UNESP and FAPESP, the Steering Committee and Scientific Council and the Director will accomplish this mission through the following steps:

- Hiring five new permanent researchers with a reduced teaching load who will assist in the organization of the schools and workshops;
- Hiring a trained secretarial staff which will handle all non-scientific aspects;
- Supporting an active visiting program for South American students and researchers;
- Offering prestigious postdoctoral positions to highly qualified researchers;
- Organizing schools and workshops on focused topics throughout the year for South American students and researchers.

4. Accomplishments in the period

In this second year of the ICTP-SAIFR, the first of five permanent ICTP-SAIFR faculty members was hired and one Young Investigator position and several postdoctoral positions were filled. All of these positions were filled by outstanding international candidates from outside Brasil, many of whom had competing offers from other institutions. For example, the permanent faculty hiring was of Eduardo Ponton, a tenure-track professor at Columbia University (USA) who accepted the ICTP-SAIFR offer despite a competing tenured offer from IPT Saclay (France). These hirings indicate that the ICTP-SAIFR is successfully functioning as a ``reverse brain-drain'' and is internationalizing the scientific community in Sao Paulo and Brasil.

During 2013, the ICTP-SAIFR organized activities in diverse areas of theoretical physics and complex systems. In addition to three international schools and two workshops on fundamental aspects of high-energy physics (including lectures by John Schwarz, Chris Quigg, Abhay Ashtekar, Joe Lykken, Juan Maldecena and a guest lecture by Nobel Prize laureate David Gross), the ICTP-SAIFR organized three international schools on astrophysics, nanophotonics and mathematical biology as well as two minicourses on complex systems taught by Celso Grebogi (Univ. Aberdeen) and Kevin McCann (Guelph Univ.). In 2014, activities will include a school on electronic structure, two schools on mathematical biology, a school on few-body physics, a school on observational cosmology, a school on random matrices, a minicourse on data analysis, and a workshop on spintronics. Most of these activities are organized by external researchers and will involve distinguished lecturers such as Simon Levin (Princeton) and Stanislas Liebler (IAS/Rockefeller) on mathematical biology, and Amnon Aharony (Ben Gurion and Tel Aviv University) on spintronics.

Since only one of the five permanent ICTP-SAIFR faculty members has been hired, the areas of ``synergy'' of ICTP-SAIFR are still in the process of formation. Nevertheless, there are several research areas at the ICTP-SAIFR which are being intensely investigated. In theoretical physics, three separate ``journal clubs'' met weekly at the ICTP-SAIFR in 2013 in the areas of string theory, particle physics, and cosmology. These three journal clubs discussed current research problems at the frontiers of scientific knowledge and included the participation of students and researchers both from IFT-UNESP and from other nearby universities. Research in mathematical biology also significantly increased in 2013 with the addition of Marcus Aguiar (Unicamp) and Paulo Prado (USP) to the project team of Roberto Kraenkel (IFT-UNESP), and many activities in this subarea are planned for 2014 including two international schools with several distinguished lecturers.

The activities of ICTP-SAIFR in 2013 will be described below in more detail including:

(a) research related to publications;
(b) research related to visitors;
(c) organization of schools, workshops, minicourses, outreach activities, meetings and seminars.

a. Research related to publications

The research conducted at ICTP-SAIFR during this period includes diverse areas of theoretical physics, as indicated by the publication list in item 8. Among the different subjects one finds string theory, particle and astroparticle physics, cosmology, general relativity, astrophysics, dynamical and nonlinear systems and mathematical biology. These publications involved research performed by associate researchers, postdoctoral fellows and visitors of ICTP-SAIFR and will be briefly described below.

a1. String theory

Although the conventional formalism for describing the superstring is the Ramond-Neveu-Schwarz (RNS) formalism developed in the 1970's, the RNS formalism is unable to describe backgrounds necessary for studying the AdS-CFT correspondence which relates weakly coupled gravity theories and strongly coupled gauge theories. The AdS-CFT correspondence is an area of intensive research since it has the potential of solving difficult problems in strongly coupled gauge theory which may have important applications to other areas of physics such as heavy ion physics, condensed matter physics, and hydrodynamics. For this reason, it is crucial to investigate alternative formalisms for the superstring such as the pure spinor formalism (developed by Berkovits in 2000) which can describe backgrounds relevant to the AdS-CFT correspondence.

In publication 9, this pure spinor formalism was investigated in the AdS_5 x S^5 background relevant to studying four-dimensional super-Yang-Mills using the AdS-CFT correspondence. Supergravity vertex operators were explicitly constructed which are dual to corresponding super-Yang-Mills gauge-invariant operators, and the operators were expressed in a harmonic superspace which makes the spacetime supersymmetry manifest. In publications 10 and 11, properties of the b ghost were investigated using the pure spinor formalism. This b ghost is necessary for computing loop amplitudes in the scattering of supergravity states using the pure spinor formalism. Although the structure of the b ghost is somewhat complicated, it was shown in publication 10 how to simplify its structure and it was shown in publication 11 how to construct the b ghost in super-Maxwell backgrounds.

AdS backgrounds are much more complicated that in flat space, and in publications 47 and 48, the classical and quantum description of particles and strings in AdS backgrounds was investigated. In publication 47, the bosonic particle was quantized in AdS x S backgrounds and unitary representations were constructed. And in publication 48, the classical solutions of strings in three-dimensional AdS black holes were investigated. The integrability of these classical solutions makes it possible to solve for their dynamics and several new types of classical solutions were found which may be useful for understanding the gauge theory dual of this three-dimensional gravitational theory.

Besides its applications to other areas of physics, AdS-CFT correspondence has also had important applications to mathematics by relating supergravity theories with the properties of four-dimensional and six-dimensional

superconformal field theories. The classification of these higher-dimensional superconformal field theories is a fascinating problem that is related to problems in group theory and number theory. In publication 43, the techniques of Gaiotto for studying four-dimensional superconformal field theories was applied to extend the classification of these theories to the D_N series. And in publication 44, defects of six-dimensional superconformal field theories were used to analyze the properties of these theories after compactification on a Riemann surface to a four-dimensional superconformal field theory.

a2. Particle and astroparticle physics

The emphasis in this research has been the search for new phenomena beyond the Standard Model (SM). In publications 12 and 13 the so-called quiver models where the SM is extended both with extra symmetries of new strong interactions and new particles, the construction of the fermion spectrum and new resonances were discussed. The manifold consequences of a supersymmetric extensions of the SM where the lepton number is promoted to a $U(1)_R$ approximate symmetry were studied in publications 30 and 31, especially for the case of R-parity violation and the possibility of including Dirac gaugino masses. In publication 32, the possibility that new weak scale vectorlike fermions with order one couplings to the Higgs boson could enhance the loop-induced branching fraction of the Higgs into two photons and also lead to a novel mechanism for a strongly first-order electroweak phase transition was explored. In publication 34 it was shown that Higgs anomalous couplings can lead to huge enhancements in the cross section for the production of 3 and 4 gauge/Higgs bosons at the LHC due to the absence of cancellations in the corresponding amplitudes. In publication 36 it is demonstrated that new resonances decaying into two Higgs bosons and leading to 4 b-quarks in the final state can actually be detected by using powerful recent techniques such as jet substructure. Phenomenological models with warped extra dimensions are very popular since they can ammeliorate the hierarchy problem and the issue of neutrino mixing in these models was studied in publication 45.

The only signal so far of new physics beyond the SM is the astrophysical and cosmological evidences for the existence of dark matter. One generic candidate for dark matter is the so-called hypothetical WIMP (Weakly Interactive Massive Particle). The possibility of detecting neutrinos in the MeV energy range from the annihilation of WIMPs trapped in the Sun was the subject of publication 39. There intriguing possibility of a connection between dark matter and the matter-antimatter asymmetry in the universe was explored in publication 40 and 42. The production and possible detection of a gamma-ray line from the decay of Higgs bosons produced in dark matter annihilation decays was studied in publication 41.

If no new particles are found one could still explore new effects from heavy particles using effective lagrangians containing operators with dimension larger than 4 respecting the symmetries of the SM. This is the subject discussed in publication 46, where a bayesian approach is used to explore the multi-dimensional parameter space of the effective lagrangian.

In the area of hadronic physics at low energies, publication 21 describes elastic D meson-nucleon interaction using a quark model that confines color and realizes dynamical chiral symmetry breaking, supplemented with (σ, ρ, ω, a0) single-meson exchanges.

a3. Cosmology

Gravitational lensing by dark matter is one of the cosmological probes that will become more widely used in future large scale surveys to derive cosmological parameters. The formal derivation of the key equations governing gravitational lensing in arbitrary spacetimes, starting from the basic properties of Jacobi fields and their expressions in terms of the exponential map, were studied in publication 1.

The possibility of decreasing the so-called cosmic variance uncertainty using several different observables (multitracer approach) was studied in publication 2 using a Fisher matrix approach.

The fluctuations in the temperature and polarization of the cosmic microwave background in position space are shown to be related to the probability densities for random flights in publication 3, which can be calculated by a Fourier-Bessel decomposition.

Cosmological information can also be obtained by studying the angular correlation function of galaxies. In publication 37, this was used in the catalogue of the SDSS-III DR8 photometric luminous galaxies and some contraints on cosmological parameters were obtained.

a4. General relativity

General relativity predicts the existence of gravitational waves and these are being searched for in instruments such as Virgo and Ligo. Parameter estimation for compact binary coalescence signals with the first generation gravitational-wave detector network was studied in publication 50 whereas in publication 51 reports on a directed search for continuous gravitational waves from the galactic center.

Modified theories of gravity also predicts gravitational waves that my differ from GR. This was explored in the context of compact binary systems in scalar-tensor gravity in publication 49.

Apparently well-behaved spacetimes may induce the vacuum fluctuations of some nonminimally coupled free scalar fields to go through a phase of exponential growth. In publication 37 this mechanism is discussed in the context of spheroidal thin shells emphasizing the consequences of deviations from spherical symmetry.

a5. Astrophysics

The deepest search to date for giant planets around young moving group stars, the GEMINI/NICI Planet-finding campaign, is described in publication 22, 25 and 26. It is found that the frequency of 1–20 M_{Jup} companions at semi-major axes from 10–50 AU is less than 21% using DUSTY models and less than 7% using COND models.

The nature of the interstellar medium (ISM) of our galaxy, especially its description as an ideal magnetohydrodynamic (MHD) turbulent fluid, is the subject of publication 23. It is found that simple, ideal, isothermal, and non-self-gravitating MHD simulations are sufficient in order to describe the large-scale physical properties of the observed regions. It is well known that star formation occurs in dense globule-like regions inside giant molecular clouds but, in spite of all of the observational and theoretical efforts to date, it is still not yet fully clear how these globules form stars. Two key ingredients are present in the clouds: magnetic fields and turbulence and how they contribute to the formation of stars is described in publication 24. Keplerian disc formation in turbulent, magnetized cloud cores is also the subject of publication 27. Three-dimensional hydrodynamical simulations of radiative cooling of galactic winds generated in M82-like starburst galaxies including winds induced by supernova (SN) explosions was studied in publication 29, where it was found that the mass evolution of the galaxy is not much affected by the starburst events occurring in the nuclear region.

Finally, publication 28 details the concept of the "Cerenkov Telescope Array", a future instrument to search for gamma rays and that has a brazilian participation.

a6. Dynamical and nonlinear systems

In classical mechanics the state of a system is often associated with a point in phase space. The initial condition defined by this point specifies a unique trajectory that guides the evolution of the system. This association, however, is not accurate due to imprecision in assessing the system's state. In these cases it is better to work with probability distributions and the associated Liouville equation than with individual trajectories and Hamilton's equations. In publication 4, it is

derived a continuity equation for the Husimi function evolving under a general non-Hermitian Hamiltonian and the phase space flow associated with it is identified. Explicit formulas for the quantum flow are obtained in a special cases.

The phenomenon of synchronization in chaotic systems has been well studied. One of the best known electronic circuits that presents chaotic behaviour is the Chua's oscillator. In publication 14, the synchronization in this system with an exponential feedback coupling is studied. Another nonlinear system with chaotic dynamics is the so-called Kuramoto model, studied in publication 15. It is shown that stable fixed points in the synchronized region may be obtained with just a small amount of the existent solutions, and for a class of natural frequencies configuration there are analytical expressions for the critical synchronization coupling as a function of the number of oscillators, both exact and asymptotic.

Techniques from nonlinear systems can also be used to analyse the behaviour of the financial markets. In publication 16, it is proposed a new index which permits to distinguish events like financial crises in real time. This index is based on a multifractal measure that was shown to enable the detection of large fluctuations at an early stage. Famous financial market crashes – Black Thursday (1929), Black Monday (1987) and the subprime crisis (2008) – are identified with clear and robust results. It is shown that the apparent crisis of 2011 is of a different nature to the other three.

Publication 17 deals with the description of surface wind-wave growth in water at finite depth, taking nonlinearity and turbulence effects into account. A wind-forced nonlinear Schrdinger equation is derived and the breather solutions for weak wind inputs in finite depth are obtained.

a7. Mathematical biology

Ecological assemblages reflect the direct and indirect interactions that occur in communities of species. The understanding of the evolution of the population of different species is one of the most important topics in this area of research. In publication 5, data from both experiments and mathematical simulations were used to analyze the consequences of the interacting effects of intraguild predation (IGP), cannibalism and parasitism occurring in isolation and simultaneously in trophic interactions (ie, interactions with species in different levels of the food chain) involving two blowfly species under shared parasitism. The experimental results revealed that IGP attenuated the strength of the effects of cannibalism and parasitism between blowfly host species, increasing the probability of persistence of both populations. In these ecological systems, models called predator-prey were developed to study the evolution of 2 different populations. In publication 20, it is obtained exact solutions for a system of two coupled nonlinear partial differential equations describing the spatio-temporal dynamics of a given predator–prey system.

Natural selection is a key process in the adaptation of species to changes in the environment and to changes in other species. Whether it plays an important role in shaping the observed patterns of biodiversity, however, has been questioned. Theories based on drift, migration, and statistical fluctuations in population size without selection, called **neutral theories**, have been very successful in reproducing the observed abundance distributions. Publication 6 discusses the role of sex separation in neutral speciation, showing that speciation occurs under similar conditions, but the number of species generated is lower than in the hermaphroditic case. In publication 7 it is shown that neutral models of speciation can also account for the genetic diversity of a single species in a context in which geographical barriers play a central role in that diversity. Recently, analytical results were derived combining network theory, to model the spatial structure of the population, and an ansatz that accounts for the effect of forbidding mating between individuals that are too different genetically. Publication 8 tests this analytical result by comparing it with numerical simulations for a hermaphroditic

population and for a population whose individuals are explicitly separated into males and females, showing that the analytical formula is indeed a very good overall description of the simulations.

Still on the topic of Ecology, habitat split is a major force behind the worldwide decline of amphibian populations, causing community change in richness and species composition. In fragmented landscapes, natural remnants, the terrestrial habitat of the adults, are frequently separated from streams, the aquatic habitat of the larvae. An important question is how this landscape configuration affects population levels and if it can drive species to extinction locally and it is addressed in publication 18, where the first theoretical model on habitat split is proposed which is particularly concerned on how split distance – the distance between the two required habitats – affects population size and persistence in isolated fragments. This habitat split model improves the understanding about spatially structured populations and has relevant implications for landscape design for conservation. It puts on a firm theoretical basis the relation between habitat split and the decline of amphibian populations.

Publication 19 deals with the problem of malaria. Two hypothetical mechanisms could play a role in the dynamics of malaria transmission. The first mechanism is the dilution effect caused by presence of wild warm-blooded animals, which can act as dead-end hosts to Plasmodium parasites. The second is diffuse mosquito vector competition, in which vector and non-vector mosquito species compete for blood feeding upon a defensive host. A mathematical model is used to assess those two mechanisms in a pristine tropical rain forest, where the primary vector is present but malaria is absent. It is found that there is a non-linear, unimodal correlation between the mechanism of dead-end transmission of parasites and the risk of malaria transmission, suggesting a protective effect only under certain circumstances (e.g., a high abundance of wild warm-blooded animals).

b. Research related to visitors

During 2012, the ICTP-SAIFR hosted 112 short-term visitors who stayed less than one week and 37 long-term visitors who stayed more than one week. The complete list of short-term and long-term visitors to ICTP-SAIFR can be found on the webpage http://www.ictp-saifr.org/?page_id=1819 and is

Long-Term Visitors in 2013

Visitor	Home Institution	Period of Visit	Room Number	Telephone
Brenno Carlini Vallilo	Univ. Andres Bello, Santiago	December 14-28	107	3393-7887
Diego Correa	Instituto de Física La Plata	December 12-21	112	3393-7846
Fidel Ivan Schaposnik Massolo	Instituto de Física La Plata	December 8-21	112	3393-7846
Cristina Masoller	U. Politècnica Catalunya, Spain	November 30 – December 7	109	3393-7853
Dan Gauthier	Duke University	November 30 – December 6	109	3393-7853
Thorten Ackemann	Univ. of Strathclyde, Scotland	November 24 – December 8	109	3393-7853
Sylvain Fichet	IIP Natal	November 15-29	107	3393-7887
Amit Sever	Perimeter and IAS	November 10-22	112	3393-7846

	Princeton			
Mikhail Vasiliev	Lebedev Institute, Moscow	Nov. 4-9 / Nov. 12-16	109a	3393-7802
Soo-Jong Rey	Seoul National Univ.	November 3-17	107	3393-7887
Irene Balmes	IFUSP	November 1 – December 31	109	3393-7853
Jon Toledo	Perimeter Institute	October 27 – December 19	108	3393-7890
Benjamin Basso	Perimeter Institute	October 22 – December 7	112	3393-7846
Joao Caetano	Perimeter Institute	October 20 – December 19	108	3393-7890
Tianheng Wang	Perimeter Institute	October 31 – December 19	108	3393-7890
Pedro Vieira	Perimeter Institute	October 20 – December 19	102	3393-7882
Michele Redi	INFN, Firenze	Oct 20 – 25 / Oct 29 – Nov 2	109a	3393-7802
Grzegorz Kowal	USP Sao Paulo	October 7 – 18	109	3393-7853
Elisabete Dal Pino	USP Sao Paulo	October 7 – 18	109	3393-7853
Daniel Gomez	Univ. de Buenos Aires	October 6 – 19	109	3393-7853
Gary Steigman	Ohio State Univ.	October 1 – December 31	109	3393-7853
Marcelo Botta Cantcheff	Univ. de La Plata	September 30 – October 10	108	3393-7890
Kellog Stelle	Imperial College London	September 4-18	109	3393-7853
Fabio Iocco	OKC, Stockholm Univ.	July 23 – 29	102	3393-7882
Per Anders Sundell	Univ. Andres Bello, Santiago	July 21 – August 3	104	3393-7848
Lotfi Boubekeur	Univ. de Valencia	June 5 – 19	111	3393-7842
Andrei Starinets	University of Oxford	May 26 – June 7	109	3393-7802
Luiz Santos	Perimeter Institute	May 22 – June 1	106	3393-7834
Neelima Gupte	Indian Inst. of Tech., Madras	May 11- June 15	102	3393-7882
Muruganadam Paulsamy	Bharathidasan Univ., India	May 8 – July 1	102	3393-7882
Edward Corrigan	University of York	April 6 – 20	409	3393-7817
Mahdi Torabian	University of Hamburg	April 1 – May 30	104	3393-7848
Maryam Tavakoli Kashi	University of Hamburg	April 1 – May 30	104	3393-7848
Jean-Bernard Bru	U. del País Vasco, Bilbao	March 11 – 22	109	3393-7802
Mohab Abou Zeid	ITP, Leibniz Univ. Hannover	Feb. 25- March 29	111	3393-7842
Christina Cobbold	University of	Jan. 20 – Feb. 2	109	3393-7802

	Glasgow			
Niclas Wyllard	Univ. of Gotenborg	Jan. 2- March 20	106	3393-7834

Short-Term Visitors in 2013

Visitor	Home Institution	Period of Visit
Jean-Bernard Bru	U. del País Vasco, Bilbao	December 9
Vanderlei Bagnato	Univ. de São Paulo, Sao Carlos	December 6-7
Mario Molina	Universidad de Chile	December 1-7
Alexander Gaeta	Cornell University	December 1-4
Michal Lipson	Cornell University	December 1-3
Sergei Turitsyn	Aston University, UK	November 24 – December 6
Cid de Araujo	Universidade Federal de Pernambuco	November 24-29
Marcel Clerc	Universidad de Chile	November 24-30
Miguel C. Soriano	Universitat Illes Balear, Spain	November 23-30
Yuri Kivshar	Australia National University	November 23-30
Jose Pacheco	Univ. of Nice, France	November 19
Carlos Mafra	University of Cambridge	November 7
Claudio Bunster	CECs Valdivia	November 5-7
Max Banados	Pontificia Universidad Católica de Chile	November 5-7
Massimo Porrati	New York Univ.	November 4-10
Ricardo Troncoso	CECs, Valdivia	November 4-7
Jorge Zanelli	CECs, Valdivia	November 3-12
Alexander Zhiboedov	Princeton Univ.	November 4-7
Daniel Grumiller	Vienna Univ. of Technology	November 3-9
Rakibur Rahman	Univ. of Bruxelles and Solvay Institutes	November 3-10
Massimo Taronna	Max-Planck-Institut für Gravitationsphysik	November 3-9
Jan Rosseel	Vienna Univ. of Technology	November 3-9
Dimitri Sorokin	INFN, Padova	November 3-9
Eric Bergshoeff	Groningen Univ.	November 3-8
Ergin Sezgin	Texas A+M University	November 3-8
Marc Henneaux	Univ. of Bruxelles and Solvay Institutes	November 3-7
Gaston Giribet	Univ. of Buenos Aires & Conicet	November 3-7
Alejandra Castro	Harvard Univ.	November 3-7
Andrea Campoleoni	Univ. of Bruxelles and Solvay Institutes	November 2-9
Matthias Gaberdiel	ITP, ETH Zürich	November 2-9
Glenn Barnich	Univ. of Bruxelles and Solay Institutes	November 2-9
Juan Jottar	Univ. of Amsterdam	November 2-8
Nicolas Boulanger	Unive. de Mons	November 2-8
Per Sundell	UNAB, Santiago	November 2-8
Irene Balmes	Ecole Normale, Paris	October 24 – 31
Axel Brandenburg	Nordita, Stockholm	October 15 – October 22

Pablo Dmitruk	Univ. Buenos Aires	October 13 – October 18
Matías Zaldarriaga	IAS Princeton	October 8 – October 11
Alejandro Raga	UNAM, Mexico City	October 6 – October 12
Alejandro Esquivel	UNAM, Mexico City	October 6 – October 10
Luis Felipe Rodriguez	UNAM, Mexico City	October 5 – October 12
Claudia Frugiuele	Fermilab	September 26 – October 3
Jorge Morfin	Fermilab	September 26
José Fontanari	Univ. de São Paulo, Sao Carlos	September 24-25
Camilo Rodriguez Neto	USP Leste	September 24
Fernando F. Fagundes	USP Leste	September 24
Roland Koberle	USP São Carlos	September 24
Iberé Caldas	USP São Paulo	September 24
Marcus Aguiar	Unicamp	September 24
Elbert Macau	INPE, São Paulo	September 23-24
Celso Grebogi	University of Aberdeen	September 21-25
Dmitry Melnikov	IIP, UFRN Natal	September 16-17
Brenno Vallilo	Univ. Andres Bello, Santiago	September 16-20
Jorge Zanelli	CECS Valdivia	September 8-10
Carmen Nunez	Universidade de Buenos Aires and IAFE	September 7-10
Juan Maldacena	IAS Princeton	September 7-9
Olivera Miskovic	Pontificia Universidad Católica de Valparaíso	September 6-10
Daniel Sudarsky	UNAM, Mexico City	September 5-10
Abhay Ashtekar	IGC, Penn State	September 5-10
Martin Reuter	I. Physics, U. Mainz	September 1-10
Erik Verlinde	U. Amsterdam	September 1-7
Alejandro Perez	CPT, AMU Marseille	September 1-7
John Schwarz	California Institute of Technology	August 31 – September 5
William Unruh	Univ. of British Columbia	August 30
Eliezer Rabinovici	Hebrew Univ., Jerusalem	August 20-22
Orfeu Bertolami	Universidade do Porto	August 16
Robert Brandenberger	McGill Univ., Montreal	August 13
Bum-Hoon Lee	Sogang Univ., Seoul	August 4-6
Jock McOrist	Univ. of Surrey	July 15
Kevin McCann	Guelph Univ., Canada	June 17 – 21
Tereza Mendes	USP Sao Carlos	May 27 – June 7
Aneesh Manohar	University of California, San Diego	May 27 – May 31
Kostas Sfetsos	Univ. of Surrey	May 27
Christopher Lee	Los Alamos National Laboratory	May 26 – June 1
Carlos Schat	University of Buenos Aires	May 26 – May 31
Thomas Cohen	University of Maryland	May 25 – June 1
Andreas Kronfeld	Fermilab	May 24 – June 6
Camille Bonvin	University of Cambridge	May 19 – 24
Peter Ouyang	Purdue University	May 12 – 15
Jorge Alfaro	Pontificia Universidad Católica de	April 23 – 27

	Chile	
Sebastian Guttenberg	Instituto Superior Tecnico, Lisboa	April 22 – 28
Zackaria Chacko	Maryland	April 10 – 12
Marcela Carena	Fermilab	April 7 – 11
Alexander Belyaev	Southampton	April 6 – 12
Stefan Zohren	PUC, Rio de Janeiro	April 4 – 5
Joseph Lykken	Fermilab	April 3 – 10
Chris Quigg	Fermilab	April 1 – 5
Daniel de Florian	University of Buenos Aires	April 1 – 3
Aldo Deandrea	Lyon	April 1 – 12
Giacomo Cacciapaglia	Lyon	April 1 – 12
Michael Berry	Univ. of Bristol	March 25 – 27
Joe Zuntz	Oxford University	March 3-5
Gary Steigman	Ohio State	Feb. 27, March 8
Robbert Dijkgraaf	IAS Princeton	Feb. 22
Giovanni Vasconcelos	UFPE	Feb. 21-23
Bjoern Penning	Fermilab	Feb. 21
Marcela Carena	Fermilab	Feb. 17-21
Jacob Palis	IMPA	Feb. 18
Matias Zaldarriaga	IAS Princeton	Feb. 18-19
Alberto Palomo-Losano	Univ. Austral, Valdivia	February 18-22
Fernando Quevedo	ICTP Trieste	Feb. 17-20
Juan Maldacena	IAS Princeton	Feb. 17-18
Daniel Sudarsky	UNAM, Mexico City	Feb. 15-20
Seif Randjbar-Daemi	ICTP Trieste	Feb. 15-21
Peter Goddard	IAS Princeton	Feb. 15-19
Luca Amendola	University of Heidelberg	February 8
Márcio Cardoso	U. F. Rio Grande do Norte	Jan. 28 – Feb. 2
Claudia Pio Ferreira	UNESP Botucatu	Jan. 28 – Feb. 2
Gabriela Gomes	Instituto Gulbenkian, Portugal	Jan. 27 – Feb. 2
Cristina Banks-Leite	Imperial College, London	Jan. 27 – Feb. 2
Ana Bento	Imperial College, London	Jan. 27 – Feb. 2
Robert Wald	University of Chicago	January 24-27
Stefanella Boatto	UFRJ	Jan. 21 – 28

The research of some of the long-term visitors is described below:

Nicolas Wyllard (2/1-20/3):
* Continuation/extension/generalisation of a previous project concerned with the relation between 2d N=2 CFTS and 4d N=2 gauge theories.
* Studies of the connection between topological strings and 5d/4d N=2 gauge theories. In particular for "generalised quivers", i.e. non-conventional gauge theories.
* Initial studies of a proposal of Vafa that there should exist a 4d string theory whose amplitudes should reproduce the partition functions of the 5d version of the generalised quivers.

Mohab Abou-Zeid (25/2-29/3):
Both the relation between self-dual Yang-Mills theory and integrable systems and

that between self- dual Yang-Mills theory and N = 2 strings can be deformed and generalised in several ways. One possible deformation is supersymmetry. Various supersymmetric versions of self-dual Yang-Mills theory in 2+2 dimensions can be constructed, both with ordinary and with twisted supersymmetry [the latter was defined in my work with Hull, where twisted forms of the two-dimensional (p,q) supersymmetry algebra were considered, and superspace formulations of the (p,q) heterotic sigma models with twisted or untwisted supersymmetry were given]. Dimensional reduction of these theories to 2+1 and 1+1 dimensions arise on the world-volumes of Dirichlet branes in the Marcus-Ooguri-Vafa N = 2 string and its generalisations, and yield versions of the supersymmetric Ward and sine-Gordon systems as well as many other new integrable models. In particular, new integrable models can be expected to arise on the world-volumes of supersymmetric Dirichlet brane configurations in target space supersymmetric generalisations of the Marcus-Ooguri-Vafa N = 2 string or in the Berkovits string in Siegel superspace. In my work in progress (which I reported in the first of the two seminars I gave at ICTP-SAIFR during my visit), I follow two complementary approaches to the study of D-branes in the space-time supersymmetric theories: the first is to study the space-time supersymmetry algebras in 2+2 dimensions including central charges, and the second is to study open string boundary conditions in the Berkovits self-dual string theory. A second possible deformations is noncommutativity. In the Seiberg-Witten limit, string theory with D-branes and non-trivial background magnetic fields gives rise to noncommutative field theory on the branes. For the Marcus-Ooguri-Vafa open strings with N = 2 worldsheet supersymmetry, the tree-level target-space dynamics is described by a noncommutative 2+2 dimensional string theory.

Jean Bernard-Bru (11/3-22/3):
My stay in the ICTP-SAIFR has been an opportunity to work with W. de Siqueira Pedra on the project related to the AC--conductivity measure of fermions systems. In fact, it has been very fruitful as we were able to finish a paper of 58 pages submitted in Communication in Pure and Applied Mathematics at the very end of my ICTP-SAIFR visit. In this paper, we have mathematically defined and analyzed the heat production of free fermions in disordered media. More precisely, we have investigated the heat production of the non-autonomous C^{*}--dynamical system obtained from the fermionic second quantization of a discrete Schrödinger operator with random potential in presence of an electric field that is time-- and space--dependent. It is a first preliminary step towards a mathematical description of transport properties of fermions from thermal considerations. This program will be carried out in several papers. The regime of small and slowly varying in space electric fields is important in this context, and is studied this paper. We have also verified the 1st law of thermodynamics for the system under consideration. This is, among other things, technically convenient. Our final aim is indeed to derive Ohm and Joule's laws for interacting fermion systems in disordered media.

Edward Corrigan (6/3-20/3):
My visit to Sao Paulo was for two weeks and had two purposes: (1) to give a short set of lectures (four, each approximately two hours) as an introduction to integrable classical and quantum field theory; (2) to discuss my work on integrable defects with members of your group, especially Aguirre Roa, Gomes and Zimerman. As a consequence, Alexis Aguirre Roa decided to come to York for a year from 1st October 2013. So far, no preprints or other publications have arisen from the work I did during this visit though I did start thinking about a couple of new ideas with the aim of finding a complete classification of integrable defects and boundary conditions. So far this goal has remained elusive.

Muruganadam Paulsamy (8/5–1/7):
Many of the static and dynamic properties of an atomic Bose-Einstein condensate (BEC) are usually studied by solving the mean-field Gross-Pitaevskii (GP) equation,

a nonlinear partial differential equation for short-range atomic interaction. More recently, BEC of atoms with long-range dipolar atomic interaction are used in theoretical and experimental studies. These studies have revealed various interesting properties of dipolar BECs, such as the dependence of stability on the trap geometry, new dispersion relations of elementary excitations, peculiar equilibrium shapes, and novel quantum phases. For dipolar atomic interaction, the GP equation is a partial integro-differential equation, requiring complex algorithm for its numerical solution. We have efficient developed numerical algorithms and computer codes for both stationary and non-stationary solutions of the full three-dimensional (3D) GP equation for a dipolar BEC. Particularly, we employ a combined split-step Crank-Nicolson method and fast Fourier Transform based scheme for the numerical solution of the GP equation and study the dynamic and static properties of a dipolar BEC.

Neelman Makhukar Gupte (11/5-15/6):
We set up a coupled oscillator network on a small world geometry and studied its evolution for different values of the coupling parameter and nonlinearity parameter, using random initial conditions. Regions which show mixed or chimera states were identified, As the system evolves, we finally end up with a synchronised state. There are clustering transitions on the way between the chimera and the synchronised states. The nature of these transitions is under exploration. Collaboration with Prof. Hilda Cerdeira and P. Murugandam is gratefully acknowledged. The transition to synchronisation on branching hierarchical networks was also explored. The role of different geometries in the nature o synchronisation was under exploration. The question under exploration is whether there are special geometries under which the transition can change from the usual second order to first order (i.e. whether explosive synchronisation can be seen). Programmes to explore the cluster synchronisation were set up. Both parts above are expected to result in publications in about a year. These are complicated extended systems and many details remain to be worked out. Prof. Cerdeira and I hope to submit a project on the Chimera states and their properties to funding agencies in a few months time, as this exploration can lead to a variety of interesting problems. We hope to use some of the tools discussed in my talk at ICTP-SAIFR (Crisis and unstable dimension variability in an extended system).

Luiz H. Santos (22/5-1/6):
I was investigating effective field theories on the boundary of (2+1) dimensional symmetry protected topological (SPT) states. This research project was at an early stage while I was visiting ICPT-SAIFR. The work was subsequentially posted at http://arxiv.org/abs/1310.8291

Lotfi Boubekeur (5/6 – 19/6):
During my visit to the ICTP-SAIFR i worked on a project on inflationary cosmology. Thanks to the warm hospitality and productive atmosphere at ICTP-SAIFR i was able to make significant progress on that project. The result are now summarized in the arxiv paper 1312.4768. For more details, I include below the abstract. Abstract: Effective field theory is a powerful organizing principle that allows to describe physics below a certain scale model-independently. Above that energy scale, identified with the cutoff, the EFT description breaks down and new physics is expected to appear, as confirmed in many familiar examples in quantum field theory. In this work, we examine the validity of effective field theory methods applied to inflation. We address the issue of whether Planck-suppressed non-renormalizable interactions are suppressed enough to be safely neglected when computing inflationary predictions. We focus on non-derivative non-renormalizable operators and estimate the cutoff that should suppress them using two independent approaches: (i) the usual unitarity and perturbativity argument, (ii) by computing the UV-divergent part of the inflaton entropy, known to scale as the square of the

UV-cutoff. We find that in the absence of gravity (decoupling limit) the cutoff appears to depends linearly on the total inflaton excursion. On the other hand, once gravity is restored, the cutoff is brought back to the Planck scale. These results suggest that inflationary scenarios with super-Planckian excursion are not natural from the EFT viewpoint. Also i gave a seminar where i reported on a previous work on inflation as well Title: Theoretical bounds on the tensor-to-scalar ratio in the cosmic microwave background Authors: Lotfi Boubekeur (ICTP, Trieste). Published in Phys.Rev. D87 (2013) 6, 061301

Kellog Stelle (4/9-18/9):
I participated in the School on approaches to quantum gravity and the conference in Maresias. Particularly useful were conversations with Nathan Berkovits, Sergei Kuzenko and Martin Reuter. Two papers are in preparation that will have had useful influences from contacts during the visit. One is on spherically symmetric solutions to quadratic curvature gravity, where solutions displaying Yukawa corrections to the Einstein theory solution prove to have no horizon. Another is on braneworld solutions with noncompact symmetries, on background spacetimes with noncompact higher dimensions. Nonetheless a mass gap is possible provided the Laplacian in the noncompact dimensions has a mixture of discrete and continuous eigenvalues. Talks were given at the University of Sao Paulo and at the Maresias conference. The former on quadratic curvature gravity; the latter on ultraviolet infinities in maximal and half-maximal supergravities.

Gary Steigman (1/10-31/12):
I am in Brasil since the end of September 2013 as a Visiting Professor in the Astronomy Department of IAG at the University of Sao Paulo. I have overlapping scientific interests with several of the ICTP-SAIFR staff, including ITP faculty and postdocs. The ICTP-SAIFR has kindly provided me with a desk and internet access when I visit, typically one day a week. However, it should be noted that the ICTP-SAIFR does not provide financial support of my visit to Brazil. In my visits to ICTP-SAIFRI have interacted with Rogerio Rosenfeld (faculty) and Nicolas Bernal (postdoc) on issues related to cosmological tests of models of particle physics beyond the standard model. Most recently we have been discussing "FIMP" (Feebly Interacting Massive Particles) models, extending them to the case where the FIMP is either massless or, it freezes in when it is still extremely relativistic (T >> m). After I began visiting IFT (ICTP-SAIFR), several postdocs, namely Nicolas Bernal and Saeed Mirshekari, began organizing a series of bi-weekly Particle Physics/Cosmology journal clubs. I have participated in them and plan to discuss two papers at the next one, on Monday, 9 December. I am in Brazil until early February, 2014 when I return to the U.S. I plan to return to Sao Paulo (IAG/USP) in August 2014 and will likely stay (with a visit to the KITP in Santa Barbara, California in October and November, to participate in a workshop on Neutrino Physics) through the end of 2014. I am very appreciative of the hospitality offered me by the ICTP-SAIFR during my stay in Sao Paulo.

Michele Redi (20/10-2/11):
During my visit at ICTP I delivered 4 lectures on composite Higgs models and presented 2 seminars (a public one on the status of particle physics after the first run of the LHC and a research one on axions). I had the pleasure to discuss with Rogerio Rosenfeld and Eduardo Ponton and Gero Von Gersdorff on various subjects in particular the question on minimal coupling and the S parameter in composite Higgs models

Joao Caetano (20/10-19/12):
I have collaborated with a ICTP/IFT researcher (Thiago Fleury) on the projected of computing three-point functions in the theory N=4 Super Yang-Mills at two first orders in perturbation theory in the planar limit. The operators considered there

involved fermions and some integrability techniques were done to solve the problem efficiently. The results of this collaboration are in the very final stage and the paper should come out in a few days.

Mikhail Vasiliev (4/11-16/11):
During my visit I was working in collaboration with Olga Gelfond on the higher-rank Sp(2M) invariant field equations and currents in higher-spin theory. As a result, all Sp(2M) invariant field equations associated with various tensor products of the Fock (singleton) representation of Sp(2M) were found. An infinite set of new higher-spin conserved currents is built from multilinears of rank-one fields and represented by (r M-f{r(r-1)}{2})-dimensional differential forms that are closed by virtue of the rank-2r field equations. Obtained results are applied to the construction of d=4 higher-spin currents of all spins built from massless fields of any spin.

Sylvain Fichet (15/11-29/11):
A piece of the project with Gero von Gersdorff got finalized during the visit. We worked on triple and quartic anomalous gauge couplings from a generic, effective Lagrangian perspective, and from the perspective of strongly-interacting Higgs models and warped extra dimensions. A theory-oriented paper got posted on the Arxiv. A more experiment -oriented paper in collaboration with ATLAS people of the future Forward Proton Detector has been posted recently and submitted to PRL. The next project with Gero von Gersdorff is to study the properties of the strongly-interacting radion/dilaton generically arising in composite Higgs models and warped extra dimensions with naturally large conformal breaking. Besides, the visit also triggered a new project with Rogerio Rosenfeld about the implementation of the effective Lagrangian in the LanHEP/CalcHEP particle physics software.

c. Organization of activities

During the year of 2013, the ICTP-SAIFR organized six São Paulo International Schools for Theoretical Physics, two workshops, seven minicourses, two outreach events, the annual meeting of the steering committee and scientific council, and weekly seminars, colloquia and journal clubs. The complete list of 2013 activities is on the webpage http://www.ictp-saifr.org/?page_id=2269, the list of weekly seminars and colloquia is on the webpage http://www.ictp-saifr.org/?page_id=1814, and the weekly journal clubs on particle physics and cosmology are on the webpages http://www.ift.unesp.br/users/matheus/partJC/ and https://sites.google.com/site/ictpsaifrjc/. Many of the activities were filmed using equipment donated by the ICTP in Trieste and the vídeos are available online on the associated webpages.

c1. São Paulo International Schools

The six São Paulo International Schools each lasted two weeks and were on the subjects of Mathematical Biology (January 21 - February 2), Particle Physics (April 1-12), Non-Perturbative QCD (May 27 – June 7), Quantum Gravity (Sept. 2-9), Astrophysics (October 7-18) and Nanophotonics (November 25 – December 6). The schools were for mostly masters and PhD students, and those students not from São Paulo where housed in a "pousada" in shared rooms. The students were asked to anonymously evaluate the schools, and the links to view their evaluations are http://ictp-saifr.org/sis/bioViewAvaliacao.php,
http://www.ictp-saifr.org/sis/LHCViewAvaliacao.php,
http://www.ictp-saifr.org/sis/QCDViewAvaliacao.php,
http://www.ictp-saifr.org/sis/quantumViewAvaliacao.php,

http://www.ictp-saifr.org/sis/astroviewAvaliacao.php, and http://www.ictp-saifr.org/sis/nonlinearviewAvaliacao.php. All lectures of the schools were filmed and the videos are available online on the school webpage.

c1A. Mathematical Biology (Jan. 21 – Feb. 2)

The II Southern-Summer School on Mathematical Biology is described on the webpage http://www.ictp-saifr.org/?page_id=2363, and involved 5 lecturers and 60 students. The school was aimed at graduate students in Physics, Mathematics, Ecology and Epidemiology, having at least a basic knowledge of calculus and differential equations. The first week was a basic course on population biology, which also includes modelling exercises. The second week was an advanced school on up-to-date topics in ecology and epidemiology.

Topic and Lecturers:

Roberto Kraenkel - Institute for Theoretical Physics – São Paulo State University - Introduction to Population Biology

Christina Cobbold - School of Mathematics and Statistics – University of Glasgow (Scotland) - Spatial models in ecology

Gabriela Gomes – Instituto Gulbenkian de Ciência (Oeiras-Portugal) - Mathematical Models and Control Strategies of Infectious Disease

Cristina Banks-Leite and Ana I. Bento – Imperial College (London, UK) – Advanced topics in population and community ecology and conservation

c1B. Particle Physics (April 1-12)

The School on Particle Physics in the LHC Era is described on the webpage http://www.ictp-saifr.org/?page_id=2365 and involved 7 lecturers and 62 participants. With the recent results from the 2011-2012 LHC runs, including the discovery of a new Higgs-like particle, it was timely to review what was learned and what can be learned in the near future about the High Energy Frontier. The purposes of the School was to provide students with an in-depth understanding of the Standard Model, to familiarize them with aspects of collider physics, to explore what may lay beyond the Standard Model, and to give them the necessary tools to test different models with the newest data.

Topics and Lecturers:

Standard Model @ LHC – Chris Quigg (Fermilab) .

Collider Physics – Joe Lykken (Fermilab) .

QCD – Daniel de Florian (University of Buenos Aires) .

Beyond SM @ LHC (Weakly coupled extensions) – Zackaria Chacko (Maryland) and Marcela Carena (Fermilab) .

Beyond SM @ LHC (Strongly coupled extensions) – Eduardo Ponton (ICTP-SAIFR and IFT-UNESP) .

Numerical Tools for Physics @ LHC – Alexander Belyaev (Southampton)

c1C. Nonperturbative QCD

The School on Nonperturbative QCD: Hadronic Structure and Hadronic Matter is described on the webpage http://www.ictp-saifr.org/?page_id=3423 and involved 8 lecturers and 75 participants. The school was geared towards advanced graduate students and young postdocs, and intended to bring them in contact with vibrant ideas at the core of the current research on strong interactions.

Topics and Lecturers:

QCD at large Nc
Thomas Cohen (Univ. Maryland) and Carlos Schat (Univ. Buenos Aires)

Effective field theories and soft collinear effective theory
Aneesh Manohar (UC San Diego) and Christopher Lee (Los Alamos)

Lattice QCD
Andreas Kronfeld (Fermilab) and Tereza Mendes (Univ. São Paulo)

Gauge/string duality and the quark-gluon plasma
Andrei Starinets (Univ. Oxford) and Diego Trancanelli (Univ. São Paulo)

c1D. Quantum Gravity

The School on Approaches to Quantum Gravity is described on the webpage http://www.ictp-saifr.org/?page_id=2371 and involved 7 lecturers and 110 participants. Although quantum mechanics and general relativity are among the most successful theories ever constructed in physics, complications arise when these two theories are combined to describe quantum gravity. This school discussed several approaches to resolving the complications of quantum gravity which involve different communities of physicists. In addition to lectures by leaders of the different approaches, there were daily discussion sessions on selected topics.

Topics and Lecturers:

Abhay Ashtekar (IGC, Penn State) – The Very Early Universe

Juan Maldacena (IAS Princeton) – AdS-CFT

Alejandro Perez (CPT, AMU Marseille) – Loop Quantum Gravity

Martin Reuter (Mainz) – Asymptotic Safety

John Schwarz (Caltech) – String Theory

Erik Verlinde (Amsterdam) – Entropic Gravity

L. Raul Abramo (USP Sao Paulo) – guest lecture on inflation

c1E. Astrophysics

The School on Fundamental Astrophysics is described on the webpage http://www.ictp-saifr.org/?page_id=2373 and involved 9 lecturers and 52 participants. Theoretical Astrophysics addresses the physics of the Universe and studies the fundamental properties of astronomical objects and their mutual interaction. Our goal during this School was to provide a comprehensive view of the fundamental problems in Theoretical Astrophysics, along with an up-to-date overview on current trends on Observational Astrophysics. Numerical methods were introduced through hands-on activities in the computer lab. The course was intended for graduate students and young postdoctoral researchers, who were expected to present their recent results in a poster session.

Topics and Lecturers:

Elisabete de Gouveia Dal Pino (USP, Brazil) - Plasma astrophysics

Alejandro Raga (UNAM, México) – Heating, cooling and ionization in astrophysical flows

Matías Zaldarriaga (IAS Princeton, USA) – Cosmic microwave background radiation: theory and observations

Daniel Gómez (UBA, Argentina) - MHD flows in astrophysics and space physics

Pablo Dmitruk (UBA, Argentina) – Turbulent flows in astrophysics

Axel Brandenburg (Nordita, Sweden) – Astrophysical dynamos

Luis Felipe Rodriguez (UNAM, México) – Observational astrophysics

Alejandro Esquivel (UNAM, México) – Numerical astrophysics

Grzegorz Kowal (USP, Brazil) – Particle acceleration in astrophysics

c1F. Nanophotonics

The School on Nonlinear Optics and Nanophotonics is described on the webpage http://www.ictp-saifr.org/?page_id=3616 and involved 9 lecturers and 42 participants. This school on Nonlinear Optics and Nanophotonics covered the physics of nonlinear optical systems including photonic cyrstals and photonic lattices; Nonlinear optics at the nanoscale; Active optical media and laser dynamics; Nonlinear effects in optical communication systems; Metamaterials; and Complex dynamics of quantum optical systems.

Topics and Lecturers:

- Thorsten Ackemann (University of Strathclyde, Scotland, UK) Laser solitons, VCSEL, patterns and dynamics

- Cid de Araujo (Universidade Federal de Pernambuco, Brazil) Nonlinear optical processes in condensed matter

- Marcel Clerc (Universidad de Chile) Spatiotemporal chaotic localized states in optics

- Alexander Gaeta (Cornell University, USA) Nonlinear photonics in chips

- Dan Gauthier (Duke University, USA) Tailoring the group velocity and group velocity dispersion

- Michal Lipson (Cornell University, USA) Nanophotonic structures for extreme nonlinearities on-chip

- Mario Molina (Universidad de Chile) Discrete photonics in waveguide arrays

- Miguel C. Soriano (Universitat IIles Balear, Spain) Dynamics and applications of delay-coupled semiconductor lasers

- Sergei Turitsyn (Aston University, UK) Nonlinear effects and technologies in optical communication systems

c2. Workshops

ICTP-SAIFR organized two workshops in 2013. The first workshop was the sixth version of the Quantum Gravity in the Southern Cone workshop which is held every three years in South America. This sixth version of the Quantum Gravity in the Southern Cone workshop was held from September 11-14 in Maresias immediately following the School on Approaches to Quantum Gravity. The webpage of the workshop is http://www.ictp-saifr.org/?page_id=3519 and speakers included

Gerardo Aldazabal (CA Bariloche), Jorge Alfaro (PUC, Santiago), Abhay Ashtekar (Penn State U.), Max Banãdos (PUC, Santiago), Nathan Berkovits (ICTP-SAIFR/IFT-UNESP), Steven Carlip (U. Calif. at Davis), Marc Casals (CBPF Rio de Janeiro), Diego Correa (U. La Plata), Bianca Dittrich (Perimeter & MPI Potsdam), Jose Edelstein (Santiago de Compostela U.), Gaston Giribet (U. Buenos Aires), Alejandro Perez (CPT Marseille), Aleksandr Pinzul (U. Brasilia), Martin Reuter (I. Physics, U. Mainz), Jorge Russo (ICREA, Barcelona), Kelly Stelle (Imperial College), Daniel Sudarksy (UNAM, Mexico City), Diego Trancanelli (USP Sao Paulo), and Olivera Miskovic (Pontificia Universidad Catolica de Valparaiso).

The second workshop was on recent advances in Higher Spin and Higher Curvature Gravity. This workshop was held in the IFT-UNESP auditorium from November 4-7 and is described on the webpage http://www.ictp-saifr.org/?page_id=2375 . Speakers and topics included:

Review Speakers:

Andrea Campoleoni (Univ. de Bruxelles and Solvay Institutes), "Higher spins in D=3: a metric-like perspective"

Alejandra Castro (Harvard Univ.), "Holographic entanglement entropy in higher spin

gravity”

Matthias Gaberdiel (ITP, ETH Zürich), “Minimal model holography”

Misha Vasiliev (Lebedev Institute, Moscow), “Higher spin theories and multiparticle symmetries”

Sasha Zhiboedov (Princeton Univ.), “Causality and unitarity constraints on gravitational theories in AdS”

Seminar Speakers:

Max Banados (Univ. Catolica, Santiago), “Building black holes with higher spin”

Glenn Barnich (Univ. de Bruxelles and Solvay Institutes), “Holographic current algebras and BMS4”

Nicolas Boulanger (Univ. de Mons), “A higher-spin Chern-Simons model with fractional-spin fields”

Daniel Grumiller (Vienna Univ. of Tech.), “Holography and phase transition of flat space”

Juan Jottar (Univ. of Amsterdam), “Entanglement entropy in three-dimensional higher spin theories”

Carlos Mafra (Cambridge Univ.), “The superstring 3-loop amplitude”

Massimo Porrati (New York Univ.), “On a canonical quantization of pure AdS_3 gravity”

Rakibur Rahman (Univ. de Bruxelles and Solvay Institutes), “Gravitational Interactions of Higher-Spin Fermions”

Soo-Jong Rey (Seoul National Univ.), “Tensionless String in N*=2 SUSY Gauge Theory”

Jan Rosseel (Vienna Univ. of Tech.), “Three-dimensional flat space higher-spin theory”

Ergin Sezgin (Texas A+M Univ.), “Critical Prokushkin-Vasiliev Theory and

Topologically Massive Higher Spins”

Dmitri Sorokin (INFN, Padova), “Higher Spins in Hyperspace”

Per Sundell (UNAB, Santiago), “Vasiliev’s equations, deformed oscillators and topological open strings”

Massimo Taronna (MPI, Potsdam), “Cubic-Interaction-Induced deformations of higher-spin symmetries”

Ricardo Troncoso (CECs, Valdivia), “Higher spin gravity in 3D: Asymptotic structure, black holes and thermodynamics”

Pedro Vieira (Perimeter Institute), “Tailoring Spin Operators and Integrability”

c3. Minicourses

The ICTP-SAIFR organized seven minicourses in 2013 with invited lectures on different topics including integrability, food webs, gravitational waves, complex systems, twistors, particle physics, and scattering amplitudes. The topics, lecturers and webpages for these minicourses are:

1) April 9-18, Classical and Quantum Integrability

   Edward Corrigan (York Univ.)

   http://www.ictp-saifr.org/?page_id=3164

2) June 17-21, Energetic Approach to Food Webs

   Kevin McCann (Guelph Univ.)

   http://www.ictp-saifr.org/?page_id=3695

3) August 1-22, Gravitational Waves

   Riccardo Sturani (ICTP-SAIFR)

   http://www.ictp-saifr.org/?page_id=4372

4) September 23-24, Complex Systems

Celso Grebogi (Aberdeen Univ.)

http://www.ictp-saifr.org/?page_id=4313

5) October 8 – November 15, Twistor Theory

Alexander Rosly (ITEP, Moscow) and Andrei Mikhailov (IFT-UNESP)

http://www.ictp-saifr.org/?page_id=4797

6) October 23-25, Composite Higgs

Michele Redi (INFN, Florence)

http://www.ictp-saifr.org/?page_id=4891

7) October 20 – December 20, Amplitudes and Correlation Functions

Pedro Vieira (Perimeter), Benjamin Basso (Perimeter) and Amit Sever (Perimeter and IAS)

http://www.ictp-saifr.org/?page_id=4790

c4. Outreach Events

The ICTP-SAIFR organized two outreach events in 2013. The first was a competition for undergraduate physics students held on October 26 in which winners were determined by a 3-hour exam. The title of the competition is 2013 Premio IFT-ICTP para Jovens Físicos and the webpage with the names of the 5 winners is http://www.ictp-saifr.org/?page_id=5218

The second outreach event was an informal discussion session on November 12 with Nobel Prize laureate David Gross. The discussion was open to the general public and the recorded video is on the webpage http://www.ictp-saifr.org/?page_id=5128

c5. Annual meeting of ICTP-SAIFR councils

The annual meeting of the ICTP-SAIFR Steering Committee and Scientific Council was held from February 17-19 and included closed meetings of the two councils as well as a scientific workshop with invited seminars by

· Daniel Sudarsky (UNAM, Mexico)
· Nicolas Wyllard (ICTP-SAIFR)

· Fernando Quevedo (ICTP Trieste)
· Eduardo Ponton (ICTP-SAIFR)
The webpages of this meeting is http://www.ictp-saifr.org/?page_id=3310

The names of the members of these councils are

Members of the Steering Committee:

Fernando Quevedo (chair) - ICTP director
Julio Cezar Durigan - UNESP rector
Carlos Brito Cruz - FAPESP scientific director
Jacob Palis - Brazilian Academy of Science president
Juan Maldacena - Representing South America

Members of the Scientific Council:

Peter Goddard (chair) - IAS Princeton
Seifallah Randjbar-Daemi - ICTP vice-director
Juan Montero - IFT-UNESP director
Marcela Carena - Fermilab, Batavia
Marcel Clerc - Univ. de Chile, Santiago
Luiz Davidovich - UFRJ, Rio de Janeiro
Daniel Sudarsky - UNAM, Mexico City
Matias Zaldarriaga - IAS, Princeton
Anthony Zee - Univ. of California, Santa Barbara
Barton Zwiebach - MIT, Cambridge

c6. Weekly seminars, colloquia and journal clubs

During 2013, weekly seminars and colloquia were regularly organized on Monday and Wednesday afternoons. There were 130 seminars and colloquia in 2013 and the complete list is on the webpage http://www.ictp-saifr.org/?page_id=1814 There were also weekly journal club meetings in particle physics and in cosmology, and the webpages for these journal club meetings are http://www.ift.unesp.br/users/matheus/partJC/ and https://sites.google.com/site/ictpsaifrjc/

5. Description of Institutional Support

The ICTP-SAIFR received generous support from both the Instituto de Física Teórica (IFT) and from the Universidade Estadual Paulista (UNESP).

From the IFT, the ICTP-SAIFR obtained space on the first floor for both its visitor offices and a large discussion room. Using the institutional reserva técnica, the IFT installed air-conditioning for all ICTP-SAIFR offices and supplied several desktop computers and office furniture. The IFT auditorium has also been reformed and is available whenever necessary for ICTP-SAIFR activities. All professors and secretarial staff of the IFT have been extremely supportive of all ICTP-SAIFR activities, and the ICTP-SAIFR frequently uses the services of the IFT-UNESP driver and car.

From UNESP, the university is paying for three ICTP-SAIFR secretaries including our executive secretary, our accountant, and our computer systems manager. Based on

the accomplishments of this staff, UNESP gave them a salary raise in 2013. UNESP also agreed to hire 5 permanent ICTP-SAIFR researchers within five years and the first permanent researcher (Eduardo Ponton) was hired in 2013 at the top researcher level.

6. Activity plan for the next period

In 2014, the ICTP-SAIFR plans to hire its second permanent researcher as well as fill the remaining three postdoctoral FAPESP fellowships approved on the grant. It will also organize international schools and workshops on various topics including mathematical biology, spintronics, dynamical systems in biology, random matrices, electronic structure, observational cosmology, few-body systems, and particle physics. Most of these schools will be organized by external researchers, and several of the topics are areas in which the ICTP-SAIFR would like to increase its research.

Although ICTP-SAIFR has strong research groups in high-energy theory, it has few researchers in observational cosmology which is an extremely active area because of many new experiments. The ICTP-SAIFR is currently searching for a permanent researcher in cosmology, and will organize several minicourses and schools on observational cosmology in 2014 including a minicourse in January by Felipe Abdalla (Univ. College, London) and a school organized together with ICTP Trieste in December.

A second area in which the ICTP-SAIFR would like to expand its research is the area of nonlinear systems and its applications in biology. A school and minicourse will be organized in 2014 on this topic, and confirmed lecturers include Simon Levin (Princeton) and Stanislas Liebler (IAS/Rockefeller). In addition, there will be a school on random matrices and a minicourse on few-body physics, which have many applications in the study of nonlinear systems.

A third area in which the ICTP-SAIFR will be expanding its activities is the area of nanophysics. In addition to a school recently organized in December 2013 on Nanophotonics and a school on Electronic Structure and Quantum Transport to be organized in October 2014 together with ICTP Trieste, Amnon Aharony (Ben Gurion University) and Ora Entin (Ben Gurion University) will be visiting ICTP-SAIFR from February 24 – March 25, 2014 and will organize a two-day workshop on Nanophysics and Spintronics.

The list of 2014 activities confirmed up to now are on the webpage http://www.ictp-saifr.org/?page_id=4718 and include the activities

São Paulo International Schools on Theoretical Physics

III Southern-Summer School on Mathematical Biology
February 3-15, 2014
School on Random Geometry and Random Matrices
August 25 – September 5, 2014
School on Electronic Structure and Quantum Transport Methods
October 13-24, 2014
School on Observational Cosmology
December 1 – December 12, 2014

Meetings and Programs/Workshops

2014 Meeting of Scientific Council and Steering Committee
February 17-19, 2014

Program on Nanophysics and Spintronics (Workshop March 13-14)
March 2014
Program on Particle Physics (Workshop August 11-15)
August 2014

Minicourses

Filipe Abdalla Minicourse on Data Analysis in Cosmology
January 27-31, 2014
Minicourse on Dynamical Systems in Biology
May 5-9, 2014
Minicourse on Few-Body Physics
October 6-10, 2014

7. Use of Reserva Tecnica Funds

In 2013, reserva tecnica funds were used for the following purposes:

a) Reform of first floor (door, office furniture, electrical wiring): 9,905 reais

b) Installation of cables in auditorium: 600 reais

c) Purchase of equipment (1 laptop, 2 printers, 1 camera): 7,394.42 reais

d) Business-class airfare of Simon Levin to be Distinguished Lecturer at mathematical biology school (approved in solicitation): 15,368.16 reais

e) Per diem and airfare for research visit of ICTP-SAIFR member Oscar Chacaltana to Univ. of Texas at Austin: 2500 reais

8a. Articles in refereed scientific journals

8a1. Articles by ICTP-SAIFR Associate Researchers – they are presented following the order of the Project Team (item 2d)

1. The Jacobi map for gravitational lensing: the role of the exponential map.
P.H.F. Reimberg, L.R. Abramo, Classical and Quantum Gravity, v. 30, p. 065020, 2013.

2. Why multitracer surveys beat cosmic variance.
L.R. Abramo, K.E. Leonard, Royal Astronomical Society. Monthly Notices, v. 431, p. 1, 2013.

3. CMB and random flights: temperature and polarization in position space.
P.H.F. Reimberg, L.R. Abramo, Journal of Cosmology and Astroparticle

Physics, v. 2013, p. 043-043, 2013.

4. Phase space flow in the Husimi representation
Matheus Veronez and M.A.M. de Aguiar,
J. Phys. A: Math. Theor. 46 (2013) 485304.

5. Impacts of enemy-mediated effects and the additivity of interactions in an insect trophic system.
C. Reigada, S.B.L. Araujo, M.A.M. Aguiar, J.Z. Gião, P.R.Guimarães, L.A. Trinca, W.A.C. Godoy, Population Ecology, v. 55, p. 11-26, 2013.

6. The role of sex separation in neutral speciation.
E.M. Baptestini, M.A.M. Aguiar, Y. Bar-Yam, Theoretical Ecology, v. 6, p. 213-223, 2013.

7. Evolution and stability of ring species.
A.B. Martins, M.A.M. Aguiar, Y. Bar-Yam, Proceedings of the National Academy of Sciences of the United States of America, v. 110, p. 5080-5084, 2013.

8. Conditions for neutral speciation via isolation by distance.
E.M. Baptestini, M.A.M. Aguiar, Y. Bar-Yam, Journal of Theoretical Biology, v. 335, p. 51-56, 2013.

9. Harmonic Superspace from the $AdS_5 \times S^5$ Pure Spinor Formalism.
Nathan Berkovits, Thiago Fleury, JHEP 1303 (2013) 022.

10. Dynamical twisting and the b ghost in the pure spinor formalism.
Nathan Berkovits, JHEP 1306 (2013) 091

11. Pure Spinor b-ghost in a Super-Maxwell Background.
Ilya Bakhmatov, Nathan Berkovits, JHEP 1311 (2013) 214.

12. Full-hierarchy Quiver Theories of Electroweak Symmetry Breaking and Fermion Masses.
Gustavo Burdman, Nayara Fonseca, Leonardo de Lima, JHEP 1301 (2013) 094

13. Resonances from Quiver Theories at the LHC.
Gustavo Burdman, Nayara Fonseca, Gabriela Lichtenstein,
Phys.Rev. D88 (2013) 116006

14. Effective Synchronization of a Class of Chua's Chaotic Systems Using an Exponential Feedback Coupling
P. Loudon, H. Fotsin, E.B.M Ngouonkadi, S. Bowong, H.A. Cerdeira,
Abstract and Applied Analysis, Volume 2013 (2013)

15. Local attractors, degeneracy and analyticity: Symmetry effects on the locally coupled Kuramoto model.

P.F.C. Tilles, H.A. Cerdeira, F.F. Ferreira,
Chaos, Solitons and Fractals, v. 49, p. 32-46, 2013.

16. Identifying financial crises in real time.
E.L. da Fonseca, F.F. Ferreira, P. Muruganandam, H.A. Cerdeira,
Physica. A, v. 392, p. 1386-1392, 2013.

17. Wind-wave amplification mechanisms: possible models for steep wave events in finite depth.
P. Montalvo, R.A. Kraenkel, M.A. Manna, C. Kharif,
Natural Hazards and Earth System Sciences, v. 13, p. 2805-2813, 2013.

18. Modeling Habitat Split: Landscape and Life History Traits Determine Amphibian Extinction Thresholds.
C.R. Fonseca, R.M. Coutinho, F. Azevedo, J.M. Berbert, G. Corso, R.A. Kraenkel,
Plos One, v. 8, p. e66806, 2013.

19. Biodiversity Can Help Prevent Malaria Outbreaks in Tropical Forests.
R.A. Kraenkel, R.M. Coutinho, I.P. Prado, G.Z. Laporta, M.A.M. Sallum,
PLoS Neglected Tropical Diseases, v. 7, p. e2139, 2013.

20. On certain new exact solutions of a diffusive predator prey system.
R.A. Kraenkel, K. Manikandan, M. Senthilvelan
Communications in Nonlinear Science & Numerical Simulation, v.18, p. 1269, 2013.

21. D-N interaction in a color-confining chiral quark model.
C.E.Fontoura, G. Krein, V.E. Vizcarra,
Physical Review. C., v. 87, p. 025206, 2013.

22. THE GEMINI/NICI PLANET-FINDING CAMPAIGN: THE FREQUENCY OF PLANETS AROUND YOUNG MOVING GROUP STARS.
Elisabete de Gouveia Dal Pino et al,
THE ASTROPHYSICAL JOURNAL, v. 777, p. 160, 2013.

23. MAGNETIC FIELD COMPONENTS ANALYSIS OF THE SCUPOL 850 μm POLARIZATION DATA CATALOG.
F. Poidevin, D. Falceta-Gonçalves, G. Kowal, E. M. de Gouveia Dal Pino, A.M. Magalhães,
THE ASTROPHYSICAL JOURNAL, v. 777, p. 112, 2013.

24. THE COLLAPSE OF TURBULENT CORES AND RECONNECTION DIFFUSION.
M. R. M. Leão, E. M. de Gouveia Dal Pino, R. Santos-Lima, A. Lazarian,
THE ASTROPHYSICAL JOURNAL, v. 777, p. 46, 2013.

25. THE GEMINI NICI PLANET-FINDING CAMPAIGN: THE FREQUENCY OF GIANT PLANETS AROUND YOUNG B AND A STARS.
E. M. de Gouveia Dal Pino et al,
The Astrophysical Journal, v. 776, p. 4, 2013.

26. THE GEMINI PLANET-FINDING CAMPAIGN: THE FREQUENCY OF GIANT PLANETS AROUND DEBRIS DISK STARS.
E. M. de Gouveia Dal Pino et al,
The Astrophysical Journal, v. 773, p. 179, 2013.

27. Disc formation in turbulent cloud cores: is magnetic flux loss necessary to stop the magnetic braking catastrophe or not?
R. Santos-Lima, E.M. de Gouveia Dal Pino, A. Lazarian,

Royal Astronomical Society. Monthly Notices, v. 429, p. 3371-3378, 2013.

28. Introducing the CTA concept.
B.S. Charya et al. (including E.M. de Gouveia Dal Pino) ,
Astroparticle Physics, v. 43, p. 3-18, 2013.

29. Evolution of M82-like starburst winds revisited: 3D radiative cooling hydrodynamical simulations.
C. Melioli, E.M. de Gouveia Dal Pino, F.G. Geraissate,
Monthly Notices of the Royal Astronomical Society, v. 430, p. 1-14, 2013.

30. L=R $U(1)_R$ as the Origin of Leptonic 'RPV'.
C. Frugiuele, T. Gregoire, P. Kumar, E. Pontón, JHEP 1303 (2013) 156

31. L=R $U(1)_R$ Lepton Number at the LHC.
C. Frugiuele, T. Gregoire, P. Kumar, E. Pontón, JHEP 1305 (2013) 012

32. Electroweak Phase Transition, Higgs Diphoton Rate, and New Heavy Fermions.
H. Davoudiasl, I. Lewis, E. Pontón, Phys.Rev. D87 (2013) 093001

33. Non Abelian Fields in Very Special Relativity.
Jorge Alfaro, Victor O. Rivelles, Phys.Rev. D88 (2013) 085023

34. Multi Higgs and Vector boson production beyond the Standard Model.
A. Belyaev, A.C.A. Oliveira, R. Rosenfeld, M.C. Thomas, JHEP 1305 (2013) 005

35. Chameleonic inflation.
K. Hinterbichler, J. Khoury, H. Nastase, R. Rosenfeld, JHEP 08 (2013) 053

36. Scale-invariant resonance tagging in multijet events and new physics in Higgs pair production.
M. Gouzevitch, A.C.A. Oliveira, J. Rojo, R. Rosenfeld, G.P. Salam, V. Sanz,
JHEP 1307 (2013) 148

37. Large-scale analysis of the SDSS-III DR8 photometric luminous galaxies angular correlation function.
F. de Simoni, F. Sobreira, A. Carneiro, A.J. Ross, H.O. Camacho, R. Rosenfeld, M. Lima, L.A.N. da Costa, M.A.G. Maia,
MNRAS 435, 3017–3027 (2013)

38. Awaking the vacuum with spheroidal shells.
W.C.C. Lima, R.F.P. Mendes, G.E.A. Matsas, D.A.T. Vanzella,
Phys.Rev. D87 (2013) 104039

8a2. Articles by ICTP-SAIFR Postdoctoral Associates

39. A novel way of constraining WIMPs annihilations in the Sun: MeV neutrinos.
N. Bernal, J. Martín-Albo, Sergio Palomares-Ruiz, JCAP 1308 (2013) 011

40. Phenomenology of WIMPy baryogenesis models.
N. Bernal, F.-X. Josse-Michaux, L. Ubaldi, JCAP 1301 (2013) 034

41. Observing Higgs boson production through its decay into gamma-rays: A messenger for Dark Matter candidates.
N. Bernal, C. Boehm, S. Palomares-Ruiz, J. Silk .T. Toma,
Phys.Lett. B723 (2013) 100-106

42. On baryogenesis from dark matter annihilation.
N. Bernal, S. Colucci, F.-X. Josse-Michaux, J. Racker, L. Ubaldi,
JCAP 1310 (2013) 035

43. Tinkertoys for the D_N series.
Oscar Chacaltana, Jacques Distler, JHEP 1302 (2013) 110

44. Nilpotent orbits and codimension-two defects of 6d N=(2,0) theories.
Oscar Chacaltana, Jacques Distler, Yuji Tachikawa,
Int.J.Mod.Phys. A28 (2013) 1340006

45. Neutrino Mixing from Wilson Lines in Warped Space.
Gero von Gersdorff, Mariano Quiros, Michael Wiechers, JHEP 1302 (2013) 079.

46. A Bayesian view of the Higgs sector with higher dimensional operators.
Beranger Dumont, Sylvain Fichet, Gero von Gersdorff, JHEP 1307 (2013) 065.

47. Quantization of AdS x S particle in static gauge.
George Jorjadze, Chrysostomos Kalousios, Zurab Kepuladze,
Class.Quant.Grav. 30 (2013) 025015.

48. Generating string solutions in BTZ.
Justin R. David, Chrysostomos Kalousios, Abhishake Sadhukhan,
JHEP 1302 (2013) 013.

49. Compact binary systems in scalar-tensor gravity: Equations of motion to 2.5 post-Newtonian order.
Saeed Mirshekari, Clifford M. Will, Phys.Rev. D87 (2013) 084070.

50. Parameter estimation for compact binary coalescence signals with the first generation gravitational-wave detector network
LIGO and Virgo Collaborations (J. Aasi (Caltech) et al. – Riccardo Sturani is included), Phys.Rev. D88 (2013) 062001.

51. A directed search for continuous Gravitational Waves from the Galactic Center.
LIGO Scientific and Virgo Collaborations (J. Aasi et al. – Riccardo Sturani is included). Phys.Rev. D88 (2013) 102002.

9. First page of publications

See two annexed files for publications of professors and postdocs on ICTP-SAIFR research team.

12. Scientific reports of postdocs

See annexed file for scientific reports of

Nicolás Bernal, Gero von Gersdorff, Chrysostomos Kalousios, Saeed Mirshekari, and Alberto Tonero.