Virgo@TS
Università degli Studi di Trieste

Stefano Ansoldi, Edoardo Milotti, Vittorino Talamini

Expertise dei componenti del gruppo

- Ansoldi: fisico teorico, ricerca nei seguenti ambiti
  - relatività generale (tra le altre attività, ,membro dell'advisory panel di *Classical and Quantum Gravity*
  - fisica astroparticelle (partecipazione a MAGIC e Fermi, contributi ad analisi dati)
- Milotti: fisico sperimentale, ricerca negli ambiti
  - HEP (esperimenti NA1/FRAMM, Aleph)
  - tests QED (esperimenti PVLAS, MUH)
  - test Principio di esclusione di Pauli (esperimento VIP)
  - fisica statistica e processi stocastici
  - biofisica computazionale (esperienza in HPC)
- Talamini: fisico teorico, ricerca nei seguenti ambiti:
  - fisica matematica
  - cosmologia

1. arXiv:1807.04300 [pdf, other] astro-ph.HE

doi 10.3847/2041-8213/aad083 ⌁

The blazar TXS 0506+056 associated with a high-energy neutrino: insights into extragalactic jets and cosmic ray acceleration

Authors: Max Ludwig Ahnen, Stefano Ansoldi, Lucio Angelo Antonelli, Cornelia Arcaro, Dominik Baack, Ana Babić, Biswajit Banerjee, Priyadarshini Bangale, Ulisses Barres de Almeida, Juan Abel Barrio, Josefa Becerra González, Wlodek Bednarek, Elisa Bernardini, Alessio Berti, Wrijupan Bhattacharyya, Adrian Biland, Oscar Blanch, Giacomo Bonnoli, Roberto Carosi, Alessandro Carosi, Giovanni Ceribella, Anshu Chatterjee, Sidika Merve Colak, Pierre Colin, Eduardo Colombo , et al. (121 additional authors not shown)

Abstract: A neutrino with energy of ~ 290 TeV, IceCube-170922A, was detected in coincidence with the BL Lac object TXS~0506+056 during enhanced gamma-ray activity, with chance coincidence being rejected at $\sim 3\sigma$ level. We monitored the object in the very-high-energy (VHE) band with the MAGIC telescopes for ~ 41 hours from 1.3 to 40.4 days after the neutrino detection. Day-timescale variability i... ▽ More

Submitted 11 July, 2018; originally announced July 2018.

Comments: 11 pages, 3 figues, 3 tables, Accepted for publication in ApJL

2. arXiv:1807.02095 [pdf, ps, other] astro-ph.HE

The broad-band properties of the intermediate synchrotron peaked BL Lac S2 0109+22 from radio to VHE gamma rays

Authors: MAGIC Collaboration, S. Ansoldi, L. A. Antonelli, C. Arcaro, D. Baack, A. Babić, B. Banerjee, P. Bangale, U. Barres de Almeida, J. A. Barrio, J. Becerra González, W. Bednarek, E. Bernardini, R. Ch. Berse, A. Berti, J. Besenrieder, W. Bhattacharyya, C. Bigongiari, A. Biland, O. Blanch, G. Bonnoli, R. Carosi, G. Ceribella, A. Chatterjee, S. M. Colak , et al. (176 additional authors not shown)

Abstract: The MAGIC telescopes observed S2 0109+22 in 2015 July during its flaring activity in high energy gamma rays observed by Fermi-LAT. We analyse the MAGIC data to characterise the very high energy (VHE) gamma-ray emission of S2 0109+22, which belongs to the subclass of intermediate synchrotron peak (ISP) BL Lac objects. We study the multi-frequency emission in order to investigate the source classifi... ▽ More

Submitted 5 July, 2018; originally announced July 2018.

Comments: 15 pages, 10 figures, Corresponding authors: Fallah Ramazani, V. (vafara@utu.fi), Hovatta, T. (talvikki.hovatta@utu.fi), Lindfors, E. (elilin@utu.fi) and Nilsson, K. (kani@utu.fi)

8. arXiv:1801.04539 [pdf, other] gr-qc

From Black Holes to Baby Universes: Exploring the Possibility of Creating a Cosmos in the Laboratory

Authors: S. Ansoldi, Z. Merali, E. I. Guendelman

Abstract: We discuss the essential features of baby-universe production, starting from a description of black holes and wormholes, in terms of the causal structure of spacetime, and following a qualitative review of the connection between vacuum decay and inflation in early universe cosmology. Related open questions are also addressed, especially in connection with the possibility that baby universes could... ▽ More

Submitted 14 January, 2018; originally announced January 2018.

Comments: To appear in the proceedings for the Bahamas Advanced Study Institute and Conferences 2017, Stella Maris, the Bahamas, and the "Big Bang in a Little Room" event, University of the Bahamas, Nassau, the Bahamas

28. arXiv:1607.07863 [pdf, other] astro-ph.CO   doi 10.1103/PhysRevD.95.023521 ⇗

Constraining f(R) Gravity with Planck Sunyaev-Zel'dovich Clusters

Authors: Simone Peirone, Marco Raveri, Matteo Viel, Stefano Borgani, Stefano Ansoldi

Abstract: Clusters of galaxies have the potential of providing powerful constraints on possible deviations from General Relativity. We use the catalogue of Sunyaev-Zel'dovich sources detected by Planck and consider a correction to the halo mass function for a f(R) class of modified gravity models, which has been recently found to reproduce well results from N-body simulations, to place constraints on the sc... ▽ More

Submitted 26 July, 2016; originally announced July 2016.

Comments: 7 pages, 2 figures

Journal ref: Phys. Rev. D 95, 023521 (2017)

68. arXiv:1209.4758 [pdf, ps, other] `gr-qc`

Unified Dark Energy-Dark Matter model with Inverse Quintessence

Authors: Stefano Ansoldi, Eduardo I. Guendelman

Abstract: We consider a model where both dark energy and dark matter originate from the coupling of a scalar field with a non-conventional kinetic term to, both, a metric measure and a non-metric measure. An interacting dark energy/dark matter scenario can be obtained by introducing an additional scalar that can produce non constant vacuum energy and associated variations in dark matter. The phenomenology i... ▽ More

Submitted 24 January, 2013; **v1** submitted 21 September, 2012; **originally announced** September 2012.

Comments: 13 pages; minor changes with references added

69. arXiv:1209.3950 [pdf, ps, other] `gr-qc`

Multihorizon regular black holes

Authors: Stefano Ansoldi, Lorenzo Sindoni

Abstract: We discuss a general procedure to generate a class of (everywhere regular) solutions of Einstein equations that can have an (a-priori fixed) arbitrary number of horizons. We then report on work currently in progress i) to find a suitable classification scheme for the maximal extension of these solutions and ii) to interpret the source term in Einstein equations as an effective contribution arising... ▽ More

Submitted 21 September, 2012; **v1** submitted 18 September, 2012; **originally announced** September 2012.

Comments: To appear in the proceedings of the 13th Marcel Grossmann Meeting, Stockholm 1-7 July 2012 (3 pages, 1 figure); references added

Report number: AEI-2012-083 **MSC Class:** 83-02; 83C15

77. **arXiv:1101.2760**   [pdf, ps, other]   `hep-th`   doi   10.1016/j.physletb.2011.06.005 ⧉

Regular black holes in UV self-complete quantum gravity

Authors: Euro Spallucci, Stefano Ansoldi

Abstract: In this letter we investigate the role of regular (curvature singularity-free) black holes in the framework of UV self-complete quantum gravity. The existence of a minimal length, shielding the trans-Planckian regime to any physical probe, is self-consistently included into the black hole probe itself. In this way we obtain to slightly shift the barrier below the Planck Length, with the UV self-co... ▽ More

Submitted 3 June, 2011; **v1** submitted 14 January, 2011; **originally announced** January 2011.

Comments: 11 pages, 3 figures, new comments and references, final version accepted for publication in PLB

Journal ref: Phys.Lett.B701:471-474,2011

78. **arXiv:0802.0330**   [pdf, ps, other]   `gr-qc`

Spherical black holes with regular center: a review of existing models including a recent realization with Gaussian sources

Authors: Stefano Ansoldi

Abstract: We review, in a historical perspective, some results about black hole spacetimes with a regular center. We then see how their properties are realized in a specific solution that recently appeared; in particular we analyze in detail the (necessary) violation of the strong energy condition.

Submitted 3 February, 2008; **originally announced** February 2008.

Comments: LaTeX, 36 pages, 10 figures. To appear in the proceedings of "BH2, Dynamics and Thermodynamics of Blackholes and Naked Singularities", May 10-12 2007, Milano, Italy (conference website: http://www.mate.polimi.it/bh2)

Report number: KUNS-2108

80. arXiv:0709.2741 [pdf, ps, other] gr-qc

Vacuum and semiclassical gravity: a difficulty and its bewildering significance

Authors: Stefano Ansoldi

Abstract: We review a long-standing difficulty in some semiclassical models of vacuum and vacuum decay. Surprisingly enough these models, careless of their transparent formulation, are affected by, both, technical and conceptual issues. After proving some general results that are relevant for, both, the Euclidean and Lorentzian sectors of their dynamics, we briefly highlight their importance in connection... ▽ More

Submitted 17 September, 2007; **originally announced** September 2007.

Comments: 11 pages, LaTeX, 4 figure; talk given at the workshop "From Quantum to Emergent Gravity: Theory and Phenomenology", June, 11-15 2007, Trieste, Italy (http://www.sissa.it/app/QGconference); submitted to the "Proceedings of Science" (http://pos.sissa.it)

Report number: KUNS-2094

Journal ref: PoSQG-Ph:004,2007

81. arXiv:0706.1233 [pdf, ps, other] gr-qc   doi   10.1143/PTP.120.985 ⧉

Universes out of almost empty space

Authors: Stefano Ansoldi, Eduardo I. Guendelman

Abstract: Baby universes (inflationary or non--inflationary) are regions of spacetime that disconnect from the original ambient spacetime, which we take to be asymptotically flat spacetime. A particular kind of baby universe solution, involving string--like matter, is studied to show that it can be formed by ``investing'' an arbitrarily small amount of energy, i.e. it can appear from an almost flat space... ▽ More

Submitted 17 September, 2007; **v1** submitted 8 June, 2007; **originally announced** June 2007.

Comments: LaTeX (RevTeX), 4 pages, 1 figure. A few typos corrected and some references added; structure streamlined (changes reflected in a slightly modified abstract); small, non-substantial modifications in the figure

Report number: KUNS-2095

Journal ref: Prog.Theor.Phys.120:985-993,2008

Quantum fluctuations of the gravitational field and propagation of light: a heuristic approach

Edoardo Milotti[1] and Stefano Ansoldi[2]

[1] Dipartimento di Fisica, Università di Udine and INFN, Sezione di Trieste, Via delle Scienze, 208-I-33100 Udine, Italy
[2] Dipartimento di Fisica Teorica, Università di Trieste and INFN, Sezione di Trieste, Strada Costiera, 11-I-34014 Trieste, Italy

E-mail: milotti@trieste.infn.it and ansoldi@trieste.infn.it

Abstract
Quantum gravity is quite elusive at the experimental level; thus a lot of interest has been raised by recent searches for quantum gravity effects in the propagation of light from distant sources, such as gamma ray bursters and active galactic nuclei, and also in Earth-based interferometers, such as those used for gravitational wave detection. Here we propose a simple heuristic picture of the quantum fluctuations of the gravitational field and use it to set up a mathematical framework to estimate quantum gravity effects in interferometers. We also discuss some other developments suggested by these heuristics.

PACS numbers: 0490, 0480C, 9880E, 0460

Exact numerical simulation of power-law noises

Edoardo Milotti[*]

Dipartimento di Fisica, Università di Udine and INFN Sezione di Trieste, Via delle Scienze, 208, I-33100 Udine, Italy

Many simulations of stochastic processes require colored noises: I describe here an exact numerical method to simulate power-law noises: the method can be extended to more general colored noises, and is exact for all time steps, even when they are unevenly spaced [as may often happen for astronomical data; see, e.g., N. R. Lomb, Astrophys. Space Sci. **39**, 447 (1976)]. The algorithm has a well-behaved computational complexity, it produces a nearly perfect Gaussian noise, and its computational efficiency depends on the required degree of noise Gaussianity.

Model-based fit procedure for power-law-like spectra

Edoardo Milotti

Dipartimento di Fisica, Università di Trieste and Istituto Nazionale di Fisica Nucleare – Sezione di Trieste, Via Valerio, 2 – I-34127 Trieste, Italy

Abstract

In dielectrics, glasses and networked liquids it is very common to study noise spectra with extended power-law regions to gather useful information. Experimental noise spectra are often characterized by $1/f^\alpha$ regions with different α and other features such as very wide resonances. Because of the overall power-law behavior these spectra are extremely difficult to fit with standard methods. Here I propose a model-based fit procedure that performs well on spectra obtained in a molecular dynamics simulation.

PLNoise: a package for exact numerical simulation of power-law noises ☆

Edoardo Milotti *

Dipartimento di Fisica, Università di Trieste and I.N.F.N., Sezione di Trieste Via Valerio, 2, I-34127 Trieste, Italy

Abstract

Many simulations of stochastic processes require colored noises: here I describe a small program library that generates samples with a tunable power-law spectral density: the algorithm can be modified to generate more general colored noises, and is exact for all time steps, even when they are unevenly spaced (as may often happen in the case of astronomical data, see e.g. [N.R. Lomb, Astrophys. Space Sci. 39 (1976) 447]. The method is exact in the sense that it reproduces a process that is theoretically guaranteed to produce a range-limited power-law spectrum $1/f^{1+\beta}$ with $-1 < \beta \leqslant 1$. The algorithm has a well-behaved computational complexity, it produces a nearly perfect Gaussian noise, and its computational efficiency depends on the required degree of noise Gaussianity.

Artifacts with uneven sampling of red noise

Edoardo Milotti[*]

Dipartimento di Fisica, Università di Trieste and INFN-Sezione di Trieste Via Valerio, 2-I-34127 Trieste, Italy

The vast majority of sampling systems operate in a standard way: at each tick of a fixed-frequency master clock a digitizer reads out a voltage that corresponds to the value of some physical quantity and translates it into a bit pattern that is either transmitted, stored, or processed right away. Thus signal sampling at evenly spaced time intervals is the rule: however, this is not always the case, and uneven sampling is sometimes unavoidable. While periodic or quasiperiodic uneven sampling of a deterministic signal can reasonably be expected to produce artifacts, it is much less obvious that the same happens with noise: here I show that this is indeed the case only for long-memory noise processes, i.e., power-law noises $1/f^\alpha$ with $\alpha > 2$. The resulting artifacts are usually a nuisance although they can be eliminated with a proper processing of the signal samples, but they could also be turned to advantage and used to encode information.

Non-Gaussianity as a data analysis artifact

Edoardo Milotti[*]

Dipartimento di Fisica, Università di Trieste, and I. N. F. N.-Sezione di Trieste, Via Valerio 2, I-34127 Trieste, Italy

Non-Gaussian effects are important features in many fields of physics, and the search for non-Gaussianity motivates several new experiments. Here I show that an insidious form of non-Gaussianity can easily arise as a finite-size effect in a data analysis tool that is guaranteed to be asymptotically Gaussian. This means that experimental searches for non-Gaussianity should also include an extremely careful scrutiny of the statistical tools used to analyze data.

REGULAR ARTICLE

Trajectories of Brownian particles with space-correlated noise[†]

EDOARDO MILOTTI*

Physics Department, University of Trieste, Via Valerio 2, I-34127 Trieste, Italy
Email: milotti@units.it

Abstract.   The Langevin equation used to model Brownian motion includes a stochastic process that is routinely assumed to be a Gaussian white noise. Spatial correlations of the noise are usually ruled out, and the paths traced by the random walkers are statistically independent. In this study, I consider instead noise which is white in time and has a Gaussian correlation in space, and by means of numerical simulation, I show how the spatial correlation determines the time evolution of the spatial separation of random walkers.

Keywords.   Stochastic processes; fluctuations; random walks.

Programma di lavoro preliminare relativo alla partecipazione all'analisi dati di Virgo (da definire)

- partecipazione ai test della pipeline coherent WaveBurst (cWB) nella versione che sarà rilasciata per le analisi delle osservazioni del run O3

- partecipazione alla rotazione degli esperti della ricerca di transienti durante il run O3 (da gennaio 2019)

- sviluppo di metodi di stima delle caratteristiche dei segnali transienti di onde gravitazionali utilizzando ipotesi minimali e selezione di modelli di emissione della sorgente (parecchi science cases specifici, ad es. stato di polarizzazione dell'onda, sue caratteristiche tempo-frequenza, consistenza dell'emissione da buchi neri con General Relativity, stima emissione quadrupolare e di ordine superiore, ..)

- studio della correlazione del rumore di Virgo con canali ausiliari di monitoraggio dell'interferometro e dei disturbi ambientali, finalizzato alla cancellazione parziale del rumore in ampiezza dell'onda gravitazionale

Attività specifiche a Trieste

- Ansoldi:
  - inizialmente partecipazione ad analisi dati
  - previsti contatti con altri teorici in Virgo per partecipazione a studi templates
- Milotti:
  - analisi dati
- Talamini:
  - inizialmente analisi dati, attività future da definire

VIRGO @ TS

	Nome	Contratto	Qualifica	Aff.	%
1	**Ansoldi Stefano**	Associato	Ricercatore	CSN IV	**40**
2	**Milotti Edoardo**	Associato	Prof. Ordinario	CSN II	**80**
3	**Talamini Vittorino**	Associato	Ricercatore	CSN IV	**30**

Richieste finanziarie: solo missioni

2 keuro (missioni Milotti , Padova + Trento, 10 missioni costo medio 200 euro/missione)
2 keuro (missioni Milotti partecipazione run O3, 4 missioni costo medio 500 euro/missione)
3 keuro (missioni Ansoldi e Talamini, Torino?, Milano BI? 6 missioni costo medio 500 euro/missione)
3 keuro (riunioni di collaborazione principalmente missioni a Cascina, durata > 1 giorno, 6 missioni costo medio 500 euro/missione)

Totale 10 keuro