COST CA18108 Fourth Annual Conference - Rijeka (Croatia)

Registrants Book

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Hassan Abdalla #71

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Would you like to contribute a presentation?

Title: Investigating the Lorentz Invariance Violation effect using different cosmological backgrounds

Abstract: Several quantum-gravity theories predict that familiar concepts such as Lorentz Invariance can be broken at energies approaching the Planck energy scale. Such extreme energies are currently unreachable by experiments on Earth, but for photons traveling over cosmological distances, the accumulated deviations from Lorentz Invariance may be measurable using current and future Cherenkov telescope facilities. In this work, we investigate whether the LIV signature is significantly different when assuming alternatives to the ΛCDM cosmological model. Specifically, we considered cosmological models with a non-trivial dark-energy equation of state ($w \neq -1$), such as the standard Chevallier-Polarski-Linder (CPL) parameterisation, the quadratic parametrisation of the dark-energy equation of state, and Pade Parameterizations.

Giovanni Amelino-Camelia #62

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Would you like to contribute a presentation?

Title: Are we now really at the dawn of quantum-gravity phenomenology?

Abstract: Quantum-gravity phenomenology is entering a more mature phase, especially thanks to the advent of multimessenger astrophysics. For in-vacuo dispersion by photons the CTA and multisatellite gamma-ray telescopes will soon provide data probing higher values of the magnitude of the effects and also suitable for discriminating between different models of the redshift dependence of the effects. IceCube has opened a window on in-vacuo dispersion by neutrinos and tangible improvements in sensitivity will be achieved with KM3NeT, Baikal-GVD and IceCube-Gen2. For the study of Planck-sale-induced threshold anomalies telescopes such as LHAASO should ensure significant progress, by investigating indirectly the inconsistencies presently found among different estimates of the cosmic far-infrared background. The coming years should also bring about meaningful tests of phenomenological models of IR-UV mixing, thanks to improved astrophysics data and even higher accuracy of cold-atom interferometers.

DAVID BENISTY #8

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Would you like to contribute a presentation?

Title: Dark energy in two body problem and future tests for quantum gravity

Abstract: General Theory of Relativity needs at least one modification - the Cosmological Constant. Yet there are possibilities for other modified theories of gravity to explain the accelerated expansion. In this talk I'm going to discuss the impact of Modified Gravity on the two-body problem. In particular, with the latest observational constraints from the galactic center, binary pulsars and the Milky and Andromeda dynamics. I will demonstrate the future tests for QG from these systems.

Jahmall Matteo Bersini #74

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Would you like to contribute a presentation?

Title: The ultraviolet limit of the power spectrum and Lagrangian perturbation theory

Abstract: Understanding the non-linear evolution of Large Scale Structure (LSS) is a key challenge in contemporary cosmology. To this end, it is important to combine both numerical simulations and analytical approaches, such as perturbation theory of LSS. Recently, it has been understood that the power spectrum in a cold dark matter dominated Universe can be investigated via an expansion in inverse powers of the wavenumber. In this talk, I will discuss various aspects of this novel expansion. In particular, I will show how it relates to Lagrangian perturbation theory and use it to derive powerful constraints on the structure of the effective field theory of LSS.

Julien Bolmont #24

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Would you like to contribute a presentation?

Title: Source-intrinsic energy dependent time-delays in AGNs and search for Lorentz invariance violation

Abstract: The use of high-energy transient or variable gamma-ray sources has been proposed in the late 90s to probe the quantum properties of space time at the Planck scale. Quantum gravity effects can indeed modify the velocity of photons propagating in vacuum, leading to energy-dependent time delays for photons emitted simultaneously by gamma-ray bursts, flaring blazars or pulsars. The main issue with these so-called "time of flight" studies is that photons of different energies could be emitted at different times. These delays, which are introduced by sources themselves, are called "source-intrinsic effects". In this contribution, I will first briefly review the different methods which are commonly used to take intrinsic effects into account in LIV searches. I will then focus on one of them, namely source emission modeling. The use of source modeling in connexion with LIV searches is still a new endeavor. Focusing on the case of flaring blazars, I will discuss the main results obtained so far in this effort. Then, I will review the future steps needed so that source intrinsic effect modeling and LIV searches can be combined.

Mauricio Bustamante #9

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Would you like to contribute a presentation?

Title: New physics from high-energy cosmic messengers

Abstract: High-energy particles of cosmic origin---gamma rays, cosmic rays, and neutrinos---offer remarkable insight into fundamental physics. Because they have the highest known energies---up to over 10^{20} eV---and travel the longest distances---up to a few Gigaparsecs---they have the potential to probe high-energy physics beyond the Standard Model, possibly tiny in size and operating at energy scales unreachable by other means, including effects coming from the breaking of fundamental symmetries. Today, we are already tapping into this potential, thanks to growing event samples, improvements in detection and reconstruction techniques, and advances in exploring large model parameter spaces. In the coming decade, our reach may extend further, thanks to an ambitious experimental program in astroparticle physics, presently under planning and execution. Yet much remains to be done. By means of illustration, I will survey the rich landscape of new-physics studies that use high-energy gamma rays, cosmic rays, and neutrinos, from the perspectives of theory and experiment. Along the way, I will point out manifest instances of the natural synergy between low-energy and high-energy experiments, and the all-important need to account for astrophysical unknowns.

José Manuel Carmona #1

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Would you like to contribute a presentation?

Title: CA18108 network: new challenges and opportunities for research in quantum gravity phenomenology

Abstract: The COST Action CA18108 was established with the aim of fostering the collaboration and synergies among diverse communities interested in the development and astrophysical testing of quantum gravity models. By combining expertises in theoretical models for quantum gravity effects and in the detection of the various cosmic messengers (gamma rays, neutrinos, cosmic rays, and gravitational waves), this network has started to explore exciting challenges in the field of quantum gravity phenomenology. Noteworthy opportunities have arisen since the beginning of the Action, such as the first detection of Gamma Ray Bursts by Imaging Atmospheric Cherenkov Telescopes (IACTs), the discovery of PeVatrons within our galaxy, or the detection of a high-energy neutrino event compatible with the Glashow resonance. These achievements have showcased the potential of the ongoing collaboration between these communities. Together with the upgrades of various instruments, the future holds promising prospects for the exploration of new paths for discovering quantum gravity effects in the physics of the cosmic messengers.

Alessandra D'Alise #54

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Would you like to contribute a presentation?

Title: Entanglement entropy of time domains

Abstract: "We elaborate on the correspondence between general radial conformal Killing vectors in Minkowski spacetime and generators of time evolution in conformal quantum mechanics. In the context of conformal quantum mechanics we provide an analysis of the sets of states associated to generators of time evolution whose orbits do not cover the whole time domain and those which do. Upon appropriate UV regularization, states labelled by global “inertial time” can be seen as thermofield double states built on bipartite eigenstates of non-global time evolution generators, whose temperature reproduces the one perceived by static diamond and Milne observers. We calculate the entanglement entropy associated to these thermofield double states and obtain a UV divergent logarithmic behaviour analogous to known results in two-dimensional conformal field theory.”

Marco de Cesare

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Would you like to contribute a presentation?

Title: Dynamical properties of black holes in effective quantum gravity

Abstract: I will present recent results on the evolution of black holes in effective descriptions of quantum gravity

Vittorio D'Esposito #53

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Would you like to contribute a presentation?

Title: Fundamental decoherence and neutrino oscillations

Abstract: We describe the effects of quantum gravity-induced decoherence on neutrino oscillations. We derive the oscillation probability when the Schrodinger equation is replaced by a general Lindblad equation and implement it to compute the oscillation probability for several quantum gravity-induced decoherence mechanisms. We discuss the potential for observation of the resulting anomalous oscillation effects for astrophysical, atmospherical and solar neutrinos.

Armando di Matteo #50

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Would you like to contribute a presentation?

Title: Collaborations between collaborations in astroparticle physics: the example of the Pierre Auger Observatory and Telescope Array

Abstract: Certain studies in astroparticle physics require simultaneously using data taken by different detectors operated by different experimental collaborations. This can introduce non-trivial complications, including both technical ones (due to different systematic uncertainties in different datasets) and sociological ones (due to collaboration policies on the use of proprietary data). These difficulties can sometimes delay such analyses by several years and/or severely restrict their scope compared to what would be possible if all the data were collected by one experiment. I will describe my personal impressions of such situations, using the example of the working groups established to perform full-sky studies about ultra-high-energy cosmic rays by the Pierre Auger and Telescope Array collaborations, of which I am, respectively, a member and a former member (but will not be talking on behalf of either at this conference), as well as possible lessons from the future of experimental multi-messenger astroparticle physics that can be learned from them.

Goran Djordjević #22

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Would you like to contribute a presentation?

Title: Constant-roll inflation in Randall-Sundrum II cosmology

Abstract: Despite some inflationary models can not be embedded into a consistent theory of quantum gravity, inflationary models in the brane-world scenario have the potential to evade the swampland constraints, and hence it is very interesting to investigate inflation in this framework, as well as its implications. We have investigated a variation of the RSII the inflation model where the second slow-roll parameter η remains constant. In this case, the Hubble expansion rate equation has analytical solutions describing four possible inflation scenarios. The corresponding observational parameters are determined, and their values are compared with observational data. The case when the inflaton is taken as a tachyon field is considered also in standard cosmology, and comapred with the Randall-Sundrum II cosmology framework. The attractor behavior for the solution is demonstrated.

Alba Domi #45

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Would you like to contribute a presentation?

Title: Lorentz Invariance Violation with KM3NeT/ORCA115

Abstract: Lorentz invariance underlies both the Standard Model of particle physics and General Relativity, and it represents our understanding of the nature of spacetime. It is therefore of fundamental interest to test its validity in every accessible regime as this would allow us to probe the microscopic structure of space-time and to eventually constrain quantum gravity models. In the neutrino sector, a possible Lorentz invariance violation (LIV), could impact standard neutrino oscillations, resulting in modifications of the observed energy and zenith angle distributions of atmospheric neutrinos that can be detected by neutrino telescopes. KM3NeT/ORCA is a next-generation neutrino telescope, under construction in the Mediterranean sea, optimised for atmospheric neutrino oscillations studies. In this contribution, the sensitivity of ORCA to the presence of LIV is presented.

Giuseppe Fabiano #52

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Would you like to contribute a presentation?

Title: A quantum space-time model with kinematic IR/UV mixing and its cold atom phenomenology

Abstract: I present a doubly special relativistic model inspired from a non-commutative space-time framework. A kinematic IR/UV mixing mechanism emerges naturally from the deformed dispersion relation, when considering particles with masses much higher than their momenta. Thus, the model is suited for studying Planck-scale corrections to cold atom recoils in atom interferometry experiments. I present the theoretical prediction for such corrections and compare it with up to date experimental results, setting limits on the UV deformation scale.

Vasileios Fragkos

#107

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Would you like to contribute a presentation?

Title: Table top experiments
Abstract:

Domenico Frattulillo #51

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Would you like to contribute a presentation?

Title: Phenomenology of DSR-relativistic in-vacuo dispersion in FLRW spacetime

Abstract: Time of flight of particles produced by astrophysical sources can be used to test Planck-scale departures from (local) Lorentz invariance. In this work we focus on a doubly special relativistic framework and derive the most general formula, to the first order in powers of the particles' energy over the Planck scale, for the time of flight of particles propagating in an expanding universe (FRW spacetime). The resulting formula admits interesting deviations from the famous one proposed by Piran for the LIV scenario, paving the way for novel phenomenological studies.

Alfonso Garcia #77

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Would you like to contribute a presentation?

Title: Probing quantum gravity with elastic interactions of ultrahigh-energy neutrinos

Abstract: The next generation of radio telescopes will be sensitive to low-scale quantum gravity by measuring ultrahigh-energy neutrinos. In this work, we demonstrate for the first time that neutrino-nucleon soft interactions induced by TeV-scale gravity would significantly increase the number of events detected by the IceCube-Gen2 radio array in the EeV regime. However, we show that these experiments cannot measure the total cross section using only the angular and energy information of the neutrino flux, unless assumptions on the underlying inelasticity distribution of neutral interactions are made.

Gerardo García-Moreno #94

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Would you like to contribute a presentation?

Title: Bootstrapping gravity and its extension to metric-affine theories

Abstract: In this work we study diffeomorphism-invariant metric-affine theories of gravity from the point of view of self-interacting field theories on top of Minkowski spacetime (or other background). We revise how standard metric theories couple to their own energy-momentum tensor, and discuss the generalization of these ideas when torsion and nonmetricity are also present. We review the computation of the corresponding currents through the Hilbert and canonical (Noether) prescriptions, emphasizing the potential ambiguities arising from both. We also provide the extension of this consistent self-coupling procedure to the vielbein formalism, so that fermions can be included in the matter sector. In addition, we clarify some subtle issues regarding previous discussions on the self-coupling problem for metric theories, both General Relativity and its higher derivative generalizations. We also suggest a connection between Lovelock theorem and the ambiguities in the bootstrapping procedure arising from those in the definition of conserved currents.

Eduardo Guendelman #75

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Would you like to contribute a presentation?

Title: Signed General Coordinate Invariance Modified Measure Theory , Quantum creation of a baby Universe, Strings and Anti Strings

Abstract: Standard general coordinate invariance is extended to general coordinate transformations that have a negative jacobian. This is possible by introducing a non Riemannian Measure of integration, which transforms according to the jacobian of the coordinate transformation, not the absolute value of the jacobian of the coordinate transformation as it is the case with $\sqrt{-g}$. This analysis can be applied to give a framework for the Farhi, Guven and Guth treatment of the Quantum creation of a baby Universe, where the tunneling solution requires regions of space-time where the measure of integration must change sign, which is consistently formulated in the modifed measure theory extension of General Relativity. We then consider the signed reparametrization invariant formulation of dynamical strings and branes and find that the dynamical tension is given by a quadratic equation giving positive tensions and negative tensions , corresponding exactly to strings and branes and anti strings and anti branes respectively. The situation resembles the situation in Relativistic Quantum Mechanics with positive and negative energies

Sjors Heefer #16

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Would you like to contribute a presentation?

Title: Finsler gravitational waves of (α,β)-type and their observational signature

Abstract: We introduce a new class of (α, β)-type exact solutions in Finsler gravity, closely related to the well-known pp-waves in general relativity. Our class contains most of the exact solutions currently known in the literature as special cases. The linearized versions of these solutions may be interpretted as Finslerian gravitational waves, and we investigate the physical effect of such waves. More precisely, we compute the Finslerian correction to the radar distance along an interferometer arm at the moment a Finslerian gravitational wave passes a detector. We come to the remarkable conclusion that the effect of a Finslerian gravitational wave on an interferometer is indistinguishable from that of standard gravitational wave in general relativity.

Nikola Herceg #49

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Country: Croatia

Would you like to contribute a presentation?

Title: Gravitational quasinormal modes of noncommutative Schwarzschild black hole

Abstract: A generalization of Regge-Wheeler procedure for the noncommutative Schwarzschild black hole is presented. Starting with lienarized metric and star-product coming from the twisted Hopf algebra of symmetries we obtain a modified Regge-Wheeler potential governing the dynamics of the axial modes up to the first order in the noncommutativity parameter.

Alexandros Karam #57

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Would you like to contribute a presentation?

Title: Implications of Palatini gravity for inflation and beyond

Abstract: We present an introduction to cosmic inflation in the framework of Palatini gravity, which provides an intriguing alternative to the conventional metric formulation of gravity. In the latter, only the metric specifies the spacetime geometry, whereas in the former, the metric and the spacetime connection are independent variables-an option that can result in a gravity theory distinct from the metric one. In scenarios where the field(s) responsible for cosmic inflation are non-minimally coupled to gravity or the gravitational sector is extended, assumptions about the underlying gravitational degrees of freedom can have substantial implications for the observational effects of inflation. We examine this explicitly by discussing various compelling scenarios, such as Higgs inflation with non-minimal coupling to gravity, Higgs inflation with non-minimal derivative coupling, R2 inflation, and beyond. We also comment on reheating in these models. Finally, as an application of the general results of Palatini R2 inflation, we review a model of successful quintessential inflation, where a single scalar field acts initially as the inflaton and then becomes dynamical dark energy, in agreement will all experimental constraints.

Vasiliki Karanasou #85

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Would you like to contribute a presentation?

Title: Quasinormal modes in NGR

Abstract: Small perturbations of spherical symmetric Schwarzschild backgrounds in General Relativity have been already discussed since 1957 by Regge and Wheeler [1] and the quasinormal frequencies of relativistic stars and black holes that emit gravitational waves have been investigated by Nollert [2], Kokkotas and Schmidt [3] as well since 1999. Considering the quite recent detection of gravitational waves in 2015 [4], it is interesting to go back to the topic of quasinormal modes. General Relativity -though a quite successful theory of gravity- is not able to address several issues like the nature of dark matter and dark energy and the accelerated expansion of the universe. Modified theories of gravity appear to be better candidates. We consider in particular the metric teleparallel theory where the gravitational field is not mediated by the curvature as in GR but instead by the torsion [5]. We discuss how we approach the topic of quasinormal modes in this theory following the recent master thesis work by Asuküla [6]. [1] T. Regge and J. A. Wheeler, "Stability of a Schwarzschild Singularity", Phys. Rev. 108, 1063–1069 (1957) [2] K. D. Kokkotas and B. G. Schmidt, "Quasi-Normal Modes of Stars and Black Holes", Living Reviews in Relativity 2 (1999) [3] H.-P. Nollert, "Quasinormal modes: the characteristic ’sound’ of black holes and neutron stars", Classical and Quantum Gravity 16, R159–R216 (1999) [4] B. P. Abbott et al. (LIGO Scientific Collaboration and Virgo Collaboration), "Observation of Gravitational Waves from a Binary Black Hole Merger", Phys. Rev. Lett. 116, 061102 (2016) [5] K. Hayashi and T. Shirafuji, "New general relativity", Phys. Rev. D 19, 3524–3553 (1979) [6] H. Asuküla, "Quasinormal modes of Schwarzschild black holes in 1-parameter New General Relativity" (2021) (Master Thesis, Institute of Physics, University of Tartu)

Marin Karuza #13

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Would you like to contribute a presentation?

Title: Cosmic WISPers

Abstract: The European COST Action CA21106 "Cosmic WISPers in the Dark Universe: Theory, astrophysics and experiments" is an initiative funded by the COST Association, whose goal is to study axions and other very weakly interacting slim particles (WISPs) emerging in several extensions of the Standard Model of Particle Physics.Searches for WISPs are strongly motivated by our attempts to understand the nature of the dark matter and puzzling astrophysical and particle physics observations. The aim of the COST Action COSMIC WISPers is to coordinate and support WISPs searches in a synergic way at the boundary between particle physics, astrophysics and cosmology.

Teppei Katori #41

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Would you like to contribute a presentation?

Title: Search for Quantum-Gravity-Motivated Effects in IceCube

Abstract: IceCube Neutrino Observatory is a neutrino telescope embedded in the Antarctic ice at the geographic South Pole. Over 5000 photo-sensors are distributed in the deep ice, covering roughly a cubic kilometre volume to detect high-energy atmospheric and astrophysical neutrino events. These neutrinos are the highest-energy neutrinos with the longest propagation distance detected. In combination with the flavour-mixing nature, this neutrino system provides an ideal place to test fundamental physics motivated by quantum gravity. In this talk, I introduce the IceCube detector and high-energy neutrino events, then I discuss recent efforts to look for the effects motivated by quantum gravity models.

Nikola Konjik #28

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Would you like to contribute a presentation?

Title: Spinors on lambda-Minkowski noncommutative spacetime

Abstract: Some noncommutative (NC) theories posses a certain type of dualities that are implicitly built within their structure. In this paper we establish still another example of this kind. More precisely, we show that the noncommutative U(1) gauge theory coupled to a NC scalar field and to a classical geometry of the Reissner Nordstrom (RN) type is completely equivalent at the level of equations of motion to the commutative U(1) gauge theory coupled to a commutative scalar field and to a classical geometry background, different from the starting RN background. The new (effective) metric is obtained from the RN metric by switching on an additional nonvanishing r-phi component. Using this duality between two theories and physical systems they describe, we formulate an effective approach to studying a dynamics of spin 1/2 fields on the curved background of RN type with an abiding noncommutative structure. We calculate QNM spectrum of fermions in this type of space.

Jerzy Kowalski-Glikman #19

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Would you like to contribute a presentation?

Title: Quantum Gravity Phenomenology and particle physics

Abstract: In my talk I will discuss effects of deformations of relativistic symmetries that could be observable energies accessibly in current or next generation accelerators..

Francesco Longo

#106

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Would you like to contribute a presentation?

Title: Present and future gamma-ray experiments

Abstract: Present and future gamma-ray experiments that might be of interest for studies of quantum gravity will be presented.

Pablo Martinez Mirave #25

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Would you like to contribute a presentation?

Title: Testing CPT with the solar neutrino sector

Abstract: The study of neutrino oscillation in combined analyses strongly relies on the assumption of CPT symmetry, i.e. masses and mixing are equal for both neutrinos and antineutrios. However, given the improvement in sensitivity, independent analysis of neutrino and antineutrino data can be performed to test CPT. In this talk, I will discuss how next-generation experiments in the solar neutrino sector will improve the current status of these CPT tests using elementary particles.

Gloria Odak #43

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Would you like to contribute a presentation?

Title: Uncovering the Hidden Corners of Quantum Gravity

Abstract: In this talk, we will explore the role of asymptotic symmetries and corner charges of gravity in the context of general relativity. Through the Noether theorems, we will discuss how the gauge redundancy of general relativity leads to a rich algebra of boundary charges that generate physical symmetries. These charges are located at codimension-2 surfaces called corners, and the presence of non-trivial corner symmetries imposes strict constraints on the theory's mathematical structure. We will explore how the study of these corner charges can guide us towards a better understanding of the quantization of general relativity.

Laxmipriya Pati #34

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Would you like to contribute a presentation?

Title: Scalar-nonmetricity cosmology in the general relativity limit

Abstract: In symmetric teleparallel geometry the curvature and torsion tensors are assumed to vanish identically, while the dynamics of gravity is encoded by the nonmetricity. Here the spatially homogeneous and isotropic connections that can accompany flat Friedmann-Lemaître-Robertson-Walker metric come in three sets. As the trivial set has received much attention, in this work we focus upon the two alternative sets which lack a Minkowski limit. We consider symmetric teleparallel scalar-non metricity gravity with generic coupling functions, and study under which conditions these cosmological spacetime configurations with radiation and dust matter content relax to the limit of general relativity (possibly with a cosmological constant). We derive the approximate solutions and compare the behavior with the usual scalar-tensor cosmology based on curvature.

Tsvi Piran #67

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Would you like to contribute a presentation?

Title: Gamma-ray bursts as a tool to explore Lorentz invariance violation

Abstract: Gamma-ray bursts (GRBs), short and bright flashes of high-energy gamma-rays, were among the first tools suggested to explore the possibility of Lorentz invariance violation (LIV) at very high energies. Indeed, Fermi’s observations of GRB 190510 provides the best limits on LIV. I will explore our current understanding of GRBs observations and modeling and examine, in their light, GRBs’ limits on LIV and the prospective to improve (or revise) them. This will include the implication of the 18 TeV photon observed by LHASSO from GRB 221009A, the most powerful GRB observed so far. I will discuss both systematic (in which all photons from a given distance and energy suffer the same time delay) and fuzzy (in which LIV effects are random) LIV.

Cyann Plard #89

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Would you like to contribute a presentation?

Title: Lorentz invariance violation search with the Cherenkov Telescope Array Observatory Large-Sized Telescope

Abstract: Flares of active galactic nuclei (AGNs) can be used to detect or constrain Lorentz invariance violation (LIV) by measuring time lags in detection of high energetic photons. An important source of uncertainty is our lack of knowledge of source intrinsic processes. However, combining flares and sources allows us to increase the precision of these measurements, as well as to limit the noise of intrinsic source effects. Cherenkov Telescope Array (CTA) will be the next generation of GeV - TeV gamma-ray observatory. We will present the first results obtained searching for LIV from the data recorded by its first prototype, the Large Sized Telescope (LST-1). The LST-1 data will be shared in the framework of the gamma-ray LIV working group to be combined with the data sets of the other major Cherenkov telescopes (H.E.S.S. , MAGIC and VERITAS). The combination of data and the status of the working group will be discussed as well.

Filip Pozar

#116

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Would you like to contribute a presentation?

Title: Noncommutative corretions to black hole entropy

Abstract: Noncommutative geometry is an established potential candidate for including quantum phenomena in gravitation. We outline the formalism of Hopf algebras and its connection to the algebra of infinitesimal diffeomorphisms. Using a Drinfeld twist we deform spacetime symmetries, algebra of vector fields and differential forms leading to a formulation of noncommutative Einstein equations. We study a concrete example of charged BTZ and RN spacetime and deformations steaming from the so called angular twist. The entropy of the noncommutative black hole is obtained using the brick-wall method. We provide the method to calculate corrections to the Bekenstein-Hawking entropy in higher orders in WKB, but we present the final result in the lowest WKB order. The result is that even in the lowest order in WKB, the entropy, in general, contains higher powers in □, and it has logarithmic corrections. In contrast, such logarithmic corrections in the commutative setup appear only after the quantum effects are included through higher order WKB corrections or through higher loop effects. Our analysis thus provides further evidence towards the hypothesis that the noncommutative framework is capable of encoding quantum effects in curved spacetime.

Maykoll Reyes

#100

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Would you like to contribute a presentation?

Title: Testing Lorentz invariance violation using cosmogenic neutrinos

Abstract: In this talk we show a preliminary analysis of the effects of a superluminal neutrino Lorentz invariance violation on the cosmogenic neutrino flux (produced by ultra-high energy cosmic rays in interactions with low energy photon backgrounds).

Natascha Riahi

#102

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Would you like to contribute a presentation?

Title: Consequences of quantum fluctuations for cosmology according to unimodular quantum gravity

Abstract: Unimodular quantum cosmology admits wavepacket solutions with an appropriate probability interpretation. We investigate the dynamics of fluctuations of field and scale factor for quantized flat Friedmann-Robertson-Walker models with a scalar field. The quantum dynamics effects the expectation value of the matter density and leads to deviations from the classical value. The quantum nature of field and space-time also influences the propagation of light through the universe. We present results for the corresponding stochastic geodesic equation.

Giacomo Rosati #37

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Would you like to contribute a presentation?

Title: Testing planck-scale in-vacuo dispersion with Icecube astrophysical neutrinos

Abstract: GRB (gamma-ray-burst) neutrinos are excellent probes for testing quantum-gravity-induced in-vacuo dispersion, a scenario in which empty quantum spacetime behaves like a dispersive medium affecting the propagation of ultrarelativistic particles. The phenomenological models are based on a Planck-scale modified dispersion relation, that leads to a sizeable energy-dependent time-shift between the observation of astrophysical neutrinos and their electromagnetic counterparts, identified by means of directional criteria with certain GRBs. Due to the cosmological distance traveled, the interplay between Planck-scale effects and universe expansion yields a time-delay formula that has a certain dependence on the redshift of the source. I review some recent results of these analyses based on the study of the correlation between time-of-arrival and energy of the GRB neutrinos.

Jackson Said #88

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Would you like to contribute a presentation?

Title: CosmoVerse: Addressing observational tensions in cosmology with systematics and fundamental physics (CA21136)

Abstract: The standard concordance model has successfully explained all cosmological survey data for over two decades with unprecedented precision. However, our understanding of cosmology appears to be at a turning point in that predictions from the standard cosmological model from different surveys seem to give best-fit cosmological parameters that are in tension with each other. This may be due to systematics in our understanding of the underlying astrophysics for particular sectors. However, it may also be an indication of new physics in one or more cosmological sectors. In this talk, the specific areas where cosmic tensions have featured will be reviewed together with possible future areas of interest where new cosmic tensions may arise. The talk will also discuss some of the most promising areas of new physics that may address some of the cosmic tensions problem. There will also be a brief review of the CosmoVerse consortium and its upcoming activities and plans.

Izzet SAKALLI #70

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Would you like to contribute a presentation?

Title: Greybody Factors of Spin-1/2 Particles in Schwarzschild Acoustic Black Hole Spacetime

Abstract: We study the behavior of waves for fermions in the spacetime of Schwarzschild's acoustic black hole (SABH). Initially, we use a null tetrad in the Newman-Penrose formalism to consider the Dirac equation in SABH. We then proceed to examine the Dirac and Rarita-Schwinger equations. By reducing the field equations to radial and angular equations, we use the analytical solution of the angular equation set to separate the radial wave equations and obtain one-dimensional Schrödinger-like wave equations with effective potentials. The effective potentials are analyzed and depicted graphically. Additionally, we investigate the fermionic greybody factors (GFs) emitted by the SABH spacetime, with a thorough analysis of how the acoustic tuning parameter affects the GFs. The results are produced using both the semi-analytic WKB method and GF bounds, and are displayed graphically and discussed.

Anuradha Samajdar #23

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Would you like to contribute a presentation?

Title: Gravitational waves as probes of gravity

Abstract: In this talk, I will give an overview of existing tests of gravity which have been performed on the gravitational wave detections made by LIGO and Virgo. I will further review the promises held by the third-generation era of gravitational waves and further constraints future detections will provide. Finally, I will assess the ways in which our analysis method may lead to claims of false detections from GR and how to improve our analysis method to avoid such issues.

Denitsa Staicova #38

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Would you like to contribute a presentation?

Title: Effect of the cosmological model on LIV constraints from GRB Time-Delays datasets

Abstract: Putting constraints on a possible Lorentz Invariance Violation (LIV) from astrophysical sources such as gamma-ray bursts (GRBs) is an essential tool for finding evidences of new theories of quantum gravity (QG) that predict energy-dependent speed of light. Such a search has its own difficulties, so usually, the effect of the cosmological model is understudied and the default model is a fixed-parameters ΛCDM. In this work, we use different astrophysical datasets to study the effect of a number of dark energy models on the LIV constrains. To this end, we combine two public time-delay GRB datasets with the supernovae Pantheon dataset, a number of angular baryonic acoustic oscillations (BAO), the cosmic microwave background (CMB) distance prior and a GRB or quasars dataset. We find for α the expected average value of □4×10−4, corresponding to EQG≥1017 GeV for both time-delay (TD) datasets, with the second one being more sensitive to the cosmological model. We find that the cosmology amounts to at least 20\% deviation in our constraints on the energy. Also interestingly, adding the TD points makes the DE models less-preferable statistically and shifts the value of the parameter $c/(H_0 r_d)$ down, making it smaller than the expected value. We see that possible LIV measurements depend critically on the transparency of the assumptions behind the published data with respect to cosmology and that taking it into account may be important contribution in the case of possible detection.

Christoph Andreas Ternes #10

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Would you like to contribute a presentation?

Title: Searching for non standard decoherence effects in neutrino oscillations

Abstract: In the first part of the talk I present a formalism to include non standard decoherence effects in neutrino oscillations using the Lindblad master equation for open quantum systems. Next I discuss the bounds on these models which can be obtained from the analysis of data of several classes of neutrino experiments.

Shubhanshu Tiwari #35

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Would you like to contribute a presentation?

Title: Observational consequences of non-linear memory of gravitational waves

Abstract: Non-linear memory is one of the most intriguing predictions of general relativity which is generated by the passage of gravitational waves (GWs) leaving the spacetime permanently deformed. For example a GW signal from binary black hole (BBH) will have two parts the oscillatory part which is known as the “chirp” and a much fainter non-oscillatory (DC like) part which is non-linear memory. A non-linear memory is produced by all the sources of GWs and has the peculiarity that even if the oscillatory part of the source lies at high frequency the non-linear memory will be available at low frequency. This property of non-linear memory makes it a valuable resource for GW astronomy. In this talk I will provide and introduction to how we can use gravitational waves memory as a resource for the current and future ground based detectors. To do this I will show examples of how one can creatively use the non-linear memory to probe seemingly inaccessible sources of GWs like ultra low mass compact binary mergers where the oscillatory part lies at outside the reach of any current detectors and only non-linear memory could be detected if these sources exist. Another example will be the matter effects from binary neutron stars and black hole neutron star binaries which are at high frequency but the non-linear memory is accessible. I will also discuss the post-merger neutron star memory and the prospects of its detection.

Tomasz Trześniewski #26

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Would you like to contribute a presentation?

Title: Carrollian and Galilean limits of deformed symmetries in 3D gravity

Abstract: Non-Lorentzian kinematical symmetries, especially the ones corresponding to the Galilei or Carroll relativistic limits (i.e., the speed of light taken to infinity or to zero), are nowadays the subject of vigorous investigations. This also concerns (quantum) deformations of such symmetries, described in the formalism of Lie bialgebras and Hopf algebras. The case of 2+1-dimensional spacetime is of particular interest due to the emergence of deformed symmetries already in the classical theory of gravity. Based on the complete classification of deformations of (2+1)d spacetime isometry algebras, one may derive their Carrollian and Galilean counterparts. In fact, all quantum deformations of (anti-)de Sitter-Carroll algebra are easily obtained via its well-known isomorphism with either Poincaré or Euclidean algebra, while quantum contractions from the (anti-)de Sitter to (anti-)de Sitter-Carroll case lead to (almost) the same results. The analogous contractions from the (anti-)de Sitter to (anti-)de Sitter-Galilei case provide a variety of (or possibly all) coboundary deformations of (anti-)de Sitter-Galilei algebra. Finally, Carrollian and Galilean contractions of deformations of Poincaré algebra lead to coboundary deformations of Carroll and Galilei algebras, which can also be recovered via contractions in the limit of vanishing cosmological constant.

Charalampos Tzerefos

#104

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Would you like to contribute a presentation?

Title: Investigating gravity with primordial black holes and their associated scalar-induced gravitational waves.

Abstract: One of the common prepositions in theoretical physics is that modified gravity theories capture quantum gravity corrections to general relativity at a phenomenological level. A recent new window to probe these corrections presented itself in the form of studying the scalar induced GWs which are produced by primordial black holes (PBHs) through second-order gravitational effects. In my talk, I shall present explicitly how one can perform this analysis in the context of scalar- torsion theories of modified gravity.

Sofía Vidal Guzmán #68

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Would you like to contribute a presentation?

Title: Stellar structure in scalar-tensor symmetric teleparallel gravity

Abstract: We present the Tolman-Oppenheimer-Volkoff (TOV) equation for stellar structure in equilibrium in the scalar-tensor version of symmetric teleparallel gravity. This theory is constructed with vanishing curvature and torsion, but nonzero non-metricity tensor. We demonstrate the derivation and result for the TOV equation as well as further interesting processes that can be analyzed from this starting point.

Nicoleta VOICU #15

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Would you like to contribute a presentation?

Title: Finsler spacetimes with (\alpha,\beta)-metrics and their isometries

Abstract: The class of (\alpha,\beta)-metrics is the most common and most used subclass of Finsler metrics, obtained by deforming a given pseudo-Riemannian metric \alpha by means of a 1-form \beta - and they arise naturally, e.g., when considering deformations of the Poincare group, such as in VSR/DSR models and their curved counterparts. For the general class of general (\alpha,\beta)-metrics, we establish the precise conditions relating the involved parameters, such that these admit a well defined causal structure. Moreover, we completely determine the relation between the Killing vector fields of a generic (\alpha,\beta)-metric and those of the underlying Riemannian metric \alpha; in particular, we list all (\alpha,\beta)-metrics which admit symmetries that are not symmetries of \alpha.

Fabian Wagner #66

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Would you like to contribute a presentation?

Title: A new perspective on minimal-length quantum mechanics

Abstract: The minimal-length paradigm is one of the oldest concepts in quantum-gravity phenomenology at low energies. While it has seen a great number of applications, vital consistency checks are lacking. We work on this gap by building the model from the bottom up, highlighting ensuing ambiguities. This is how from the question „What does it mean to have a minimal length?“, we arrive at constraints a possible minimal-length deformed Hamiltonian has to satisfy. On the way, we find that several models widely believed to contain a minimal length actually do not. We further show that the customary minimal-length deformed Hamiltonian does not allow for any generalized notion of Galilean relativity, thus implying the existence of a preferred frame, and propose how it may be improved to avoid this issue.

Aneta Wojnar #11

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Would you like to contribute a presentation?

Title: Effects of non-commutativity of space-time on the stellar properties

Abstract: I will discuss effects of non-commutativity of spacetime on the interior properties of compact and stellar objects.

Angela Zegarelli

#113

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Would you like to contribute a presentation?

Title: Neutrino astrophysics in the multi-messenger era: probing the Universe through high-energy neutrinos

Abstract: Current knowledge of the Universe is based on information carried by electromagnetic radiation, gravitational waves, neutrinos, and cosmic rays, taking advantage of a multi-messenger approach. This contribution will focus on high-energy astrophysical neutrinos that originate in processes involving very high-energy primary hadrons through collisions of cosmic rays with high-density matter and/or radiation fields, where both neutrinos and gamma rays are released. Neutrinos are peculiar particles, because they can cross the Universe preserving the directional information about their production site, allowing to unambiguously identify the most efficient sites of particle acceleration, shedding light on the extreme part of the Universe. This presentation will provide an overview of the state-of-art of neutrino astronomy, describing the current instruments performing high-energy neutrino astronomy and their detection principle, as well as summarizing recent experimental results. The most promising astrophysical neutrino emitters will be also discussed.