Gravity and Other Fields Under the Volcano

Report of Contributions

https://agenda.infn.it/e/18116

Contribution ID: **1** Type: **not specified**

Fakeons and quantum gravity

Monday, 10 June 2019 12:00 (45 minutes)

Presenter: ANSELMI, Damiano (PI)

Contribution ID: **2** Type: **not specified**

Resummation, renormalons and asymptotic safety

Monday, 10 June 2019 09:15 (45 minutes)

Presenter: ANTIPIN, Oleg

Contribution ID: **3** Type: **not specified**

Covariance And Spectral Geometry of Spinor Fields

Wednesday, 12 June 2019 12:10 (45 minutes)

All the fundamental matter particles are fermions and correspond
to spinor fields.
They arise as projective representation of the rotations
and (pseudo) orthogonal groups, and their installation on curved
space-times requires introducing of particular geometric structures.
I will discuss some of their surprising and nontrivial aspects
including the seldom discussed subtle issue of general covariance.
Another aspect of spinor fields I will survey
is the spectral geometry as described by the Dirac operator
which constitutes a crucial ingredient of a {\em spectral triple};
the appropriate concept for a passage to “quantum” spaces.

Presenter: DABROWSKI, Ludwik

Contribution ID: **4** Type: **not specified**

Surprises in the O(N) models or why might the standard large N analysis fail

Wednesday, 12 June 2019 14:25 (45 minutes)

The O(N) models are probably the most studied field theories. Everything is supposed to be known about their symmetric and symmetry broken phases as well as their critical behavior. Many analytical methods were born here and it is the textbook example for both the $\epsilon = 4 - d$ and the large-N expansions. We nevertheless show that several
renormalization group fixed points of this model were not found by the usual methods. These new fixed points are relevant for the multicritical physics of the O(N) models.
We also show that the $N \to \infty$ limit was not
able to identify them because of an implicit analyticity prerequisite of this method that turns out to be wrong. The functional and nonperturbative renormalization group plays a key role to find them.

Presenter: DELAMOTTE, Bertrand

Contribution ID: **5** Type: **not specified**

Holography for general boundaries

Wednesday, 12 June 2019 15:10 (45 minutes)

I give a review of recent work on establishing holographic duals for quasi-local boundaries in 3D perturbative and non-perturbative gravity, as well as its extension to 4D gravity.
In particular I will show how holographic duals can be constructed as effective actions for geometric boundary observables. I will then connect this work with more standard holographic considerations at asymptotic AdS and flat boundaries.

Presenter: DITTRICH, Bianca

Contribution ID: **6** Type: **not specified**

Towards a phenomenology of scale invariance

Tuesday, 11 June 2019 14:45 (45 minutes)

Asymptotic safety, i.e., scale invariance in the ultraviolet, is a compelling proposal for the nature of fundamental interactions. Understanding its phenomenological consequences is a critical challenge, as any physical theory requires testing through confrontation with observations and experiments. In this talk I will discuss potential consequences of asymptotic safety for (Beyond) Standard Model physics as well as black holes.

Presenter: EICHHORN, Astrid

Contribution ID: **7** Type: **not specified**

Frame (In)equivalence in Quantum Field Theory and Cosmology

Tuesday, 11 June 2019 17:30 (45 minutes)

I will discuss whether or not scalar-tensor theories in the Einstein and Jordan frames are equivalent once quantum corrections are taken into account. To understand this problem it is crucial to carefully define the path integral measure that arises in the quantization of the equivalent classical theories. Generically two measures will differ if the spacetime metrics in the two theories are related by a non-trivial conformal factor. Consequently this difference leads to a finite contribution to the effective action which distinguishes the two frames at the quantum level. This contribution is of particular relevance for classically scale invariant theories since quantising the theory in the Einstein frame is equivalent to a scale invariant quantisation procedure in the Jordan frame.

Presenter: FALLS, Kevin

Contribution ID: **8** Type: **not specified**

Gravity with more or less gauging

Wednesday, 12 June 2019 16:25 (45 minutes)

General Relativity is conventionally formulated as a theory with gauge invariance under the diffeomorphism group of general coordinate transformations, but there are locally equivalent formulations in terms of either a larger (additional local conformal invariance) or smaller (only "special" diffeomorphisms) group of symmetries. Other formulations with the same number of gauge generators, but a different gauge algebra, also exist. We will discuss how one can relate these different formulations to each other, and illustrate various applications in which one may prefer one or another formalism. The talk is mostly based on arXiv:1805.11626.

Presenter: GIELEN, Steffen

Contribution ID: **9** Type: **not specified**

SO(7,7) structure of the SM fermions

Wednesday, 12 June 2019 11:25 (45 minutes)

It has been suggested in the past (by several different authors) that the Standard Model gauge group can be combined with Lorentz group. If this is done, all fermions of a single generation of the SM receive the interpretation of components of a single spinor of a pseudo-orthogonal group Spin(p,q) of dimension p+q=14. There are only two possibilities that do not lead to the fermion doubling - Spin(11,3) and Spin(7,7). The former has in particular been studied by Roberto Percacci. This talk advocates the second option. We point out that there is some exceptional geometry related to the Weyl representation of Spin(7,7) (components of which are the SM fermions). In particular, we explain that a non-zero generic Weyl spinor of Spin(7,7) defines a metric in 7 dimensions. This suggests that there is some hidden geometric structure behind the pattern of the SM fermions.

Presenter: KRASNOV, Kirill

Contribution ID: **10** Type: **not specified**

Fixed points of gauge theories and gravity

Tuesday, 11 June 2019 11:45 (45 minutes)

Presenter: LITIM, Daniel

Contribution ID: **11** Type: **not specified**

Peculiarities of FRG-Quantum-Gravity

Wednesday, 12 June 2019 17:10 (45 minutes)

In this talk I will point out some properties of general relativity, which are particularly important for the FRG. First I am going to consider the special structure of the gauge symmetry in gravity leading to a discussion of gauge invariance within asymptotic safety. Second I will highlight some consequences of boundaries in path integrals arising, e.g., when restricting the path integral to metrics of Euclidean signature.

Presenter: LIPPOLDT, Stefan

Contribution ID: **12** Type: **not specified**

Wilson loops and curvature in (quantum) gravity

Tuesday, 11 June 2019 14:00 (45 minutes)

Presenter: LOLL, Renate

Contribution ID: **13** Type: **not specified**

Indirect Dark Matter searches and fundamental physics with present- and next-generation Cherenkov telescopes

Wednesday, 12 June 2019 09:00 (45 minutes)

Very-high energy (VHE, E>~50 GeV) gamma rays of cosmic origin can reveal unique information on paramount open issues of fundamental physics while also providing a complementary probe to laboratory experiments and particle accelerators. In fact, the search for VHE gamma-ray signatures from the annihilation or decay of dark matter (DM) particles is a promising method for identifying DM, understanding its intrinsic properties, and mapping its distribution in the universe. Furthermore, VHE gamma rays can be used to search for evidence of Lorentz invariance violation (LIV) associated with possible quantum gravity effects on space-time at the Planck scale. Nowadays, the most prominent instruments suited for searches at the VHE gamma-ray regime are Imaging Atmospheric Cherenkov Telescopes (IACTs). The present-generation of IACTs, which includes MAGIC, HESS and VERITAS, has been pursuing fundamental physics programs for almost two decades, in synergy with space-borne gamma-ray telescopes. These instruments will soon be superseded by the Cherenkov Telescope Array (CTA), the next-generation ground-based observatory for gamma-ray astronomy with an energy window ranging from 20 GeV to more than 300 TeV. With ~120 telescopes of 3 different sizes (small-sized, ~4 m; medium-sized, ~12 m; large-sized, ~23 m) located in two sites in the northern and southern hemispheres, CTA will provide full-sky coverage and achieve an improvement in sensitivity by a factor of five to twenty, as well as improved energy and angular resolutions, with respect to the current major gamma-ray facilities. Such unprecedented performance will make CTA an outstanding gamma-ray instrument with a considerable potential for discovery in the area of fundamental physics.
In this talk, I will present an overview of some fundamental physics topics in VHE gamma-ray astronomy that can be addressed by present- and next-generation IACTs. The focus will be given to the current status of indirect DM searches in the VHE gamma-ray regime, and in particular within the Weakly Interacting Massive Particles (WIMPs) scenario. The capabilities to contribute to this field by the ASTRI mini-array, a CTA pre-production facility of nine small-sized telescopes, proposed to be deployed and operated as a pathfinder sub-array at the CTA Observatory southern site, will be also discussed.

Presenter: LOMBARDI, Saverio (INAF-OAR and ASI Science Data Center, Rome, Italy)

Contribution ID: **14** Type: **not specified**

Perturbatively renormalizable quantum gravity

Tuesday, 11 June 2019 09:45 (45 minutes)

The Wilsonian renormalization group (RG) requires Euclidean signature. The conformal factor of the metric then has a wrong-sign kinetic term, which has a profound effect on its RG properties. In particular around the Gaussian fixed point, it supports a Hilbert space of renormalizable interactions involving arbitrarily high powers of the gravitational fluctuations. These interactions are characterised by being exponentially suppressed for large field amplitude, perturbative in Newton's constant but non-perturbative in Planck's constant. By taking a limit to the boundary of the Hilbert space, diffeomorphism
invariance is recovered in the continuum quantum field theory. Thus the so-called conformal factor instability is the key that allows the construction of a genuine continuum
limit for quantum gravity.

Presenter: MORRIS, Tim

Contribution ID: **16** Type: **not specified**

Massive Gravity

Monday, 10 June 2019 16:15 (45 minutes)

I describe the efforts to implement a theory of massive graviton and how the request for a weakly coupled phase leads to the need to break not only general covariance, but also Lorentz symmetry. Hamiltonian analysis of the nonperturbative degrees of freedom, as well as cosmology and exact solutions generalizing the Schwarzschild one are described.

Presenter: NESTI, Fabrizio (TS)

Contribution ID: **17** Type: **not specified**

Ultraviolet completion and predictivity from a minimal parameterization of Beyond-Standard-Model physics

Monday, 10 June 2019 17:35 (35 minutes)

I will discuss the fate of the U(1) gauge coupling under the inclusion of vector-like fermions in the standard model. Then, motivated by results on quantum gravity contributions to the running of gauge and Yukawa couplings, I talk about the effect of simple but general corrections on the running of those couplings from the EW to large enough energy scales. One of our goals is to have an explanation for the pattern observed in the masses of the quark sector in the standard model, as well as the mixing angles.

Presenter: NIETO, Carlos

Contribution ID: **18** Type: **not specified**

Asymptotic safety and the dimension of the critical surface

Tuesday, 11 June 2019 16:00 (45 minutes)

Presenter: OHTA, Nobuyoshi

Contribution ID: **19** Type: **not specified**

Geometry of the theory space and the functional renormalization group

Tuesday, 11 June 2019 16:45 (45 minutes)

We consider the theory space as a manifold whose coordinates are given by the couplings appearing in the effective action. We discuss how to introduce connections on this theory space in the framework of the functional renormalization group (FRG). Finally, we discuss possible developments and limitations of this formalism and how to overcome such difficulties in the FRG setting.

Presenter: PAGANI, Carlo

Contribution ID: **20** Type: **not specified**

Effective universality and unitarity in quantum gravity & the spectral function of the graviton

Tuesday, 11 June 2019 11:00 (45 minutes)

Presenter: PAWLOWSKI, Jan

Contribution ID: **21** Type: **not specified**

Metric-affine quantum gravity

Monday, 10 June 2019 15:00 (45 minutes)

Presenter: PERCACCI, Roberto

Contribution ID: **22** Type: **not specified**

Analytic Coupling Structure of Large N_f (Super) QED and QCD

Monday, 10 June 2019 17:00 (35 minutes)

Presenter: REICHERT, Manuel

Contribution ID: **23** Type: **not specified**

Background Independent Quantum Field Theory and Gravitating Vacuum Fluctuations

Tuesday, 11 June 2019 09:00 (45 minutes)

Presenter: REUTER, Martin

Contribution ID: **24** Type: **not specified**

Stability Issues with Broken Supersymmetry and Some Clues for Early Cosmology

Monday, 10 June 2019 11:15 (45 minutes)

Presenter: SAGNOTTI, Augusto (PI)

Contribution ID: **25** Type: **not specified**

Gravitational Waves: a novel powerful tool to test fundamental theories

Wednesday, 12 June 2019 09:45 (45 minutes)

The recent discoveries of gravitational waves (GWs)
from the LIGO and Virgo interferometers opened a new
era in GWs as well as multi-messenger astronomy, and offered new ways to test gravitational theories beyond Einstein's theory of General Relativity.
Very recently it has been also shown how nonperturbative quantum gravity (QG) can affect the GW luminosity distance associated with the long distance propagation of GWs, hence proposing a new test of QG theories through LIGO and LISA detection of merging events.

Presenter: SAKELLARIADOU, Mairi

Contribution ID: **26** Type: **not specified**

Aspects of higher spin theories

Monday, 10 June 2019 14:15 (45 minutes)

I will describe the salient features of higher spin theories as gauge theories based on infinite dimensional extension of (A)dS algebras, a la Vasiliev. The fully nonlinear equations of motion are formulated compactly on a product of spacetime with a noncommutative twistor space. I will highlight a powerful method for finding exact solutions of the theory which crucially employs the twistor space, and touch upon prospects for applications to cosmology.

Presenter: SEZGIN, Ergin

Contribution ID: **27** Type: **not specified**

Rethinking asymptotic freedom

Monday, 10 June 2019 10:00 (45 minutes)

The renormalization-group flow of Higgs-Yukawa models with a non-Abelian gauge sector has been studied for several decades by adopting two simplifying assumptions: that the theory is perturbatively renormalizable and that all mass terms are negligible at high energies. Within this theoretical framework, total asymptotic freedom appears to be a rare phenomenon which severely constrains the matter content and the symmetry groups. We show how dropping the two above-mentioned assumptions allows to construct new large families of totally asymptotically free quantum field theories. The latter have strong predictive power and may thus find applications in physics beyond the standard model.

Presenter: ZAMBELLI, Luca

Contribution ID: **28** Type: **not specified**

A Multi-Benefit Solution of Dark Energy problem based on the IR behavior of asymptotic safe gravity

Wednesday, 12 June 2019 10:30 (25 minutes)

Infrared corrections that arise in some theoretical attempts to
understand Quantum Gravity may be the solution to one tantalizing problem of modern physics. Recently a novel Asymptotically Safe cosmology suggested a simple and attractive mechanism towards resolving naturally the structure
of dark energy and its associated cosmic coincidence problem. The novel idea is that the recent accelerated expansion of the universe happens due to infrared quantum gravity modifications at intermediate astrophysical scales galaxies or galaxy clusters. The reason is that structures of matter are associated with a non zero positive cosmological constant of quantum origin. In this context no extra unproven energy scales or fine-tuning are
used. Furthermore, this model was confronted with the most recent observational data from low-redshift probes. Measurements of the Hubble parameter, standard candles (Pantheon SnIa, Quasi-stellar objects), Baryonic Acoustic Oscillations (BAOs) and high redshift probes (CMB shift parameters) were used to test the model. The overall likelihood analysis constrained the free parameters of the model. Moreover, it was tested against the concordance model (flat ΛCDM) utilizing a large family of information criteria. This Asymptotically Safe model proved to be statistically equivalent with ΛCDM, suggesting it as a very
interesting and realistic minimal solution to the problem of dark energy.

Presenter: ZARIKAS, Vasilios