Advances in High Energy Physics and Cosmology

Report of Contributions

https://indico.cern.ch/e/664964

Contribution ID: **1** Type: **Talk**

Using infinite derivative gravity to resolve singularities

Thursday 22 March 2018 17:40 (20 minutes)

Infinite derivative gravity adds terms which make gravity weaker at short distances, allowing us the possiblity of avoiding the singularities which plague General Relativity. I will discuss both linearised perturbations to the flat metric and bouncing FRW cosmologies.

Primary author: EDHOLM, James

Presenter: EDHOLM, James

Contribution ID: **2** Type: **Talk**

The linear bias of radio loud active galactic nuclei via cosmic microwave background lensing

Large areas of galaxy clusters, voids and filaments make up the cosmic web. An important realisation was that the distribution of galaxies does not exactly trace the total matter density field (dark matter plus baryonic matter) of the cosmic web. The linear bias (overdensity of baryonic matter to all matter) of galaxy populations informs us about their environmental properties, which can be a key driver of galaxy evolution and overall cosmological context. Radio-loud AGNs exist within the most massive galaxies and are therefore expected to be highly biased tracers of the matter field. Traditionally, measurements of bias have relied on galaxy n-point auto or cross-correlations. A promising alternative technique is that of measuring the cross-power spectrum of galaxy density fields with weak lensing maps of the cosmic microwave background (CMB), offering a very clean measurement using the CMB as a z = 1100 backlight. Light from the CMB has been travelling for 13.6 billion years and its path has been bent by the gravitational effect of all intervening matter that lenses the light.

We measure the cross-power spectrum of 12,820 AGNs at z<0.7, from the Best and Heckman selection of the FIRST radio galaxy catalogue, with the projected mass density from the Planck CMB lensing potential map. The amplitude of the cross-correlation signal is used to directly measure the linear bias using a spherical cut-sky approach. Here we report a 5.6 detection of the CMB-AGN cross-power spectrum. Using a spherical collapse formalism it is possible to estimate the halo mass from the linear bias. The results imply that radio-loud AGN typically inhabit halos of masses comparable to that of a large group of galaxies, in agreement with estimates of radio-loud AGN environments from optical and X-ray work.

Primary authors: Dr DEVEREUX, Carolyn (University of Herfordshire); Dr GEACH, James (University of Hertfordshire); Prof. HARDCASTLE, Martin (University of Hertfordshire)

Presenter: Dr DEVEREUX, Carolyn (University of Herfordshire)

Contribution ID: **3** Type: **Talk**

Predicting the Right-Handed Neutrino Masses From the Littlest Seesaw and Leptogenesis

Thursday 22 March 2018 17:00 (20 minutes)

The Littlest Seesaw model based on two right-handed neutrinos with constrained Yukawa couplings provides a highly predictive description of neutrino masses and PMNS mixing parameters. If realised at high energies there will be renormalisation group corrections to the low energy predictions, which depend on the right-handed neutrino masses. We perform a χ^2 analysis to determine the right-handed neutrino masses from a four-parameter fit to the low energy neutrino parameters, also eventually taking into account leptogenesis.

Primary authors: Mr ROWLEY, Sam (University of Southampton); Prof. KING, Stephen F (University of Southampton); Ms MOLINA-SEDGWICK, Susana (University of Southampton, QMUL)

Presenter: Mr ROWLEY, Sam (University of Southampton)

Contribution ID: **4** Type: **Talk**

Fast simulations of dark matter structure formation with modified gravity and massive neutrinos.

Thursday 22 March 2018 14:40 (20 minutes)

I will briefly introduce the need for fast, approximate tools for cosmological simulations of dark matter structure formation, before talking about how we have implemented both modified gravity and massive neutrinos into the fast, approximate simulation tool COLA.

I will present results produced by this extended version of COLA and explain how a potential degeneracy between the enhancement of structure formation due to modified gravity and suppression of structure formation due to massive neutrinos can make it difficult to distinguish between ΛCDM and modified gravity in observables such as the matter power spectrum.

Primary author: Mr WRIGHT, Bill (Institute of Cosmology and Gravitation, University of Portsmouth)

Presenter: Mr WRIGHT, Bill (Institute of Cosmology and Gravitation, University of Portsmouth)

Contribution ID: **5** Type: **Talk**

A novel way to determine the scale of inflation

Efforts to constrain the inflationary energy scale using the tensor-to-scalar ratio are limited by the minimum upper bound from observations. This still leaves a window of nearly 8 orders of magnitude in energy before the LHC can potentially offer complementary constraints from below. In the Feebly Interacting Massive Particle (FIMP) model of Dark Matter (DM), we find that one may express the inflationary energy scale as a function of three otherwise unrelated quantities: the DM isocurvature perturbation amplitude, its mass and its self-coupling constant, independently of the tensor-to-scalar ratio. In this talk, we will derive this expression for the inflationary energy scale, considering carefully the various astrophysical, cosmological and model constraints as well as accounting for variations in inflationary dynamics and the reheating history. Within the context of FIMP DM, one may thus determine the energy scale reliably from the parameters of the model even in the absence of observable tensor perturbations.

Primary authors: Prof. ENQVIST, Kari; HARDWICK, Robert; TENKANEN, Tommi; VENNIN, Vincent (University of Portsmouth (UK), Institute of Cosmology and Gravitation); WANDS, David (University of Portsmouth)

Presenter: HARDWICK, Robert

Contribution ID: **6** Type: **Talk**

Quantum diffusion during inflation and primordial black holes

Thursday 22 March 2018 17:20 (20 minutes)

I will explain how primordial black holes can form from perturbations seeded during inflation and how their abundance can be calculated in the framework of stochastic inflation. This formalism incorporates quantum backreaction of the small-wavelength fluctuations on the large distances dynamics of the Universe. If quantum corrections are small, the probability distribution of density fluctuations is well approximated by a Gaussian. If they are large, the PDF has a different profile with a longer tail and leads to constraints different from the ones usually derived.

Primary author: Mr PATTISON, Chris (ICG)

Presenter: Mr PATTISON, Chris (ICG)

Contribution ID: **8** Type: **Talk**

Semi-empirical techniques to unveil the properties of both galaxies and their host dark matter halos

Friday 23 March 2018 11:15 (50 minutes)

Presenter: Dr SHANKAR, Francesco

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

Holographic Cosmology

Thursday 22 March 2018 09:30 (50 minutes)

Presenter: SKENDERIS, Kostas (University of Amsterdam)

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

Invited speaker 2

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

Leptogenesis and BSM physics

Thursday 22 March 2018 15:40 (50 minutes)

Presenter: DI BARI, Pasquale (University of Southampton)

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

Testing gravity with black holes and gravitational waves

Friday 23 March 2018 09:00 (50 minutes)

Presenter: Dr WITEK, Helvi

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

Gravitational Waves and Compact Binaries

Friday 23 March 2018 14:00 (50 minutes)

Presenter: BERRY, Christopher

Contribution ID: **14** Type: **Talk**

Searches for NMSSM Signatures with Low Missing Transverse Energy at the LHC

Thursday 22 March 2018 11:30 (20 minutes)

We examine scenarios in the Next to Minimal Supersymmetric Standard Model where pair-produced squarks and gluinos decay via two cascades, each ending in a stable neutralino LSP and a standard model Higgs with the mass gaps in the decay such that the Missing Transverse Energy is very small. Performing two-dimensional parameter scans and focusing on the hadronic h⟶$b\bar{b}$ decay giving a $b\bar{b}b\bar{b}$ + E_T^{miss} final state we then explore the sensitivity of a current CMS α_T-based general-purpose jets+E_T^{miss} analysis to such scenarios with a view to developing novel search approaches in the near future.

Primary author: TITTERTON, Alexander (University of Bristol (GB))

Presenter: TITTERTON, Alexander (University of Bristol (GB))

Contribution ID: **15** Type: **Talk**

Dark Matter indirect detection at Neutrino Telescopes: a multi-messenger approach

Thursday 22 March 2018 16:30 (30 minutes)

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Primary author: Dr CHIANESE, Marco (University of Southampton)

Co-author: DI BARI, Pasquale (University of Southampton)

Presenter: Dr CHIANESE, Marco (University of Southampton)

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

Invited Speaker

Contribution ID: **17** Type: **Talk**

Dimension-8 operators in Higgs physics

Thursday 22 March 2018 12:10 (20 minutes)

I will describe the process by which one can derive the full set of dimension-8 bosonic operators involving Higgses and gauge bosons. I will then discuss the implications of these operators on current measurements and bounds on dimension-6 Wilson coefficients.

Primary author: SETFORD, Jack (University of Sussex)

Presenter: SETFORD, Jack (University of Sussex)

Contribution ID: **18** Type: **Talk**

Lattice Holographic Cosmology

Thursday 22 March 2018 10:20 (20 minutes)

Placeholder

Primary authors: MOSTERT, Matthew (University of Southampton); Dr JUETTNER, Andreas

Presenter: MOSTERT, Matthew (University of Southampton)

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

Dark Matter

Thursday 22 March 2018 13:30 (50 minutes)

Presenter: Dr WEST, Stephen (Royal Holloway, University of London)

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

Graviataional Waves from Phase Transitions in the Early Universe

Friday 23 March 2018 15:10 (50 minutes)

Presenter: HINDMARSH, Mark (University of Sussex)

Contribution ID: **21** Type: **Talk**

Lattice QCD

Thursday 22 March 2018 11:10 (20 minutes)

Place holder

Primary author: RICHINGS, James (University of Southampton)

Presenter: RICHINGS, James (University of Southampton)

Contribution ID: **22** Type: **Talk**

Conformal window of asymptotic safety

Thursday 22 March 2018 18:00 (20 minutes)

The conformal window of a general class of gauge theories featuring a weakly coupled UV fixed point is investigated at next-to-next-to-leading order and found to lie completely within the domain of perturbation theory. Constraints are derived in various approximations, finding that vacuum instability yields the tightest constraint at NNLO.

Primary author: MEDINA VAZQUEZ, Gustavo (University of Sussex)

Presenter: MEDINA VAZQUEZ, Gustavo (University of Sussex)

Contribution ID: **23** Type: **Talk**

Conformally Coupled General Relativity

Friday 23 March 2018 09:50 (20 minutes)

Gravity model developed in the series of papers Grav.Cosmol. 15 (2009) 199-212; Phys.Lett. B691 (2010) 230-233; Gen.Rel.Grav. 44 (2012) 2745-2783 is revisited. Model is based on Ogievetsky theorem that specifies structure of general coordinate transformation group. The theorem is implemented in the context of Noether theorem with the use of nonlinear representation technique. Quantization is performed with the use of reparametrization-invariant time and ADM foliation techniques. Basic quantum features of the models are discussed.

Primary authors: Prof. ARBUZOV, Andrej (Bogoliubov Laboratory for Theoretical Physics, JINR); Mr LATOSH, Boris (University of Sussex)

Presenter: Mr LATOSH, Boris (University of Sussex)

Contribution ID: **24** Type: **Talk**

Renormalisation group fixed points and physics at highest energies

Thursday 22 March 2018 11:50 (20 minutes)

Some recent developments in the understanding of particle theories controlled by ultraviolet fixed points.

Primary author: Mr BOND, Andrew (University of Sussex)

Presenter: Mr BOND, Andrew (University of Sussex)

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

SO(10)xS4 Grand Unified Theory of Flavour and Leptogenesis

(Elena Perdomo)

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

Probing the nature of Dark Matter at the ILC

Thursday 22 March 2018 14:20 (20 minutes)

We analyse the potential of the proposed international linear collider to detect Dark Matter (DM) and determine its properties. In many models stability of Dark Matter particles D is ensured by conservation of a new quantum number referred to as D-parity. Our models also contain charged D-odd particles $D^{\pm}$ with the same spin as D. In this work, we study two minimal consistent models corresponding to scalar and fermionic DM. The first of which is the inert higgs doublet model (I2HDM), which is a Z_2 symmetric Two Higgs Doublet Model, with the lightest neutral scalar being identified as D. The latter contains an SU(2) doublet of vector-like Dirac fermions, and an additional neutral singlet fermion. In this model, D is a mixture of neutral fermion singlet and doublet. For minimal fermionic DM, we perform an analysis of constraints of the parameter space, coming from DM relic density, DM direct detection, and collider. We propose a method to determine the mass of DM and distinguish its spin, in the process \$$e^+e^- \to D^+D^- \to DDW^+W^- \; toDD(q\bar{q})(\ell\nu)$ with a signature dijet + μ (or e) + missing mass.

Presenter: LOCKE, Daniel (University of Southampton)

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

Rapid response gravitational wave follow-up with the PIRATE robotic telescope

Friday 23 March 2018 10:10 (20 minutes)

In the last two years since LIGO discovered the first gravitational waves, the field of gravitational wave astronomy has advanced rapidly. In the last observing run (O2) LIGO detected two more binary black hole mergers and with the help of Virgo, was also able to detect gravitational waves from a binary neutron star merger. This event was a landmark discovery because in addition to gravitational waves there was an electromagnetic (EM) counterpart discovered less than 12 hours later, which turned out to be the first in ˜250 EM observations that followed, making this the most widely observed astronomical event in history. The large majority of these observations were performed by ground based optical telescopes, and it was these telescopes that have performed similar tasks in every other LIGO alert in O2; by searching the night sky for an optical counterpart to the gravitational wave signals. The PIRATE robotic telescope, owned by The Open University but located in Tenerife, took part in some of these follow-up searches and was able to utilize its robotic nature to perform rapid follow-up observations as soon as an alert was received.

Presenter: ROBERTS, Dean

Contribution ID: **29** Type: **not specified**

Neutrinoless Double Beta Decay and the Baryon Asymmetry of the Universe

Friday 23 March 2018 13:00 (1 hour)

I will discuss the impact of the observation of neutrinoless double beta decay on the washout of lepton number in the early universe. Neutrinoless double beta decay can be triggered by a large number of mechanisms that can be encoded in terms of SM effective operators which violate lepton number. Such operators, or the underlying UV processes would also be responsible for the washout of an asymmetry in the lepton number in the early universe. Combined with SM sphaleron transitions, this would render many baryogenesis mechanisms at higher scales ineffective. I will highlight potential caveats to this argument, and the role of high energy colliders.

Presenter: Dr DEPPISCH, Frank (University College London)

Contribution ID: **30** Type: **not specified**

Interacting vacuum dark energy

Thursday 22 March 2018 18:20 (20 minutes)

The standard model of cosmology, LCDM, suffers from both theoretical and observational problems that motivate alternative theories of dark energy. One such class of theories are interacting dark energy models. In my talk, I will give an overview of the problems with LCDM and discuss the interacting vacuum scenario, in which the time-varying vacuum energy is allowed to interact with dark matter. I will explain how this interaction can be reconstructed from and constrained by observational data and present some preliminary results.

Presenter: Ms HOGG, Natalie