The 12th International Workshop Dark Side of the Universe

Report of Contributions

https://indico.cern.ch/e/459881

Contribution ID: **0** Type: **Contributed talk**

Coupled dark energy: a dynamical analysis with complex scalar field

Tuesday, 26 July 2016 15:15 (15 minutes)

Summary

The dynamical analysis for coupled dark energy with dark matter is presented, where a complex scalar field is taken into account and it is considered in the presence of a barothropic fluid. We consider three dark-energy candidates: quintessence, phantom, and tachyon. The critical points are found and their stabilities analyzed, leading to the three cosmological eras (radiation, matter, and dark energy), for a generic potential. The results presented here extend the previous analyses found in the literature.

Based on (arXiv number)

1507.00902

Primary author: LANDIM, Ricardo (University of Sao Paulo)

Presenter: LANDIM, Ricardo (University of Sao Paulo)

Session Classification: Dark Energy and Modified Gravity

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **1** Type: **Contributed talk**

Indirect dark-matter searches with gamma-rays experiments : status and future plans from KeV to TeV

Thursday, 28 July 2016 15:15 (15 minutes)

Summary

Detection of gamma rays and cosmic rays from the annihilation or decay of dark matter particles is a promising method for identifying dark matter, understanding its intrinsic properties, and mapping its distribution in the universe. I will review recent results from the Fermi Gamma-ray Space Telescope and other space-based experiments, and highlight the constraints these currently place on particle dark matter models. I will also discuss the prospects for indirect searches to robustly identify or exclude a dark matter signal using upcoming experiments at energies below Fermi (ASTROGAM) and above Fermi , Magic and H.E.S.S. (CTA, LHAASO).

Based on (arXiv number)

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Primary author: MORSELLI, Aldo (INFN)

Presenter: MORSELLI, Aldo (INFN)

Session Classification: Indirect Dark Matter Detection

Track Classification: Indirect Dark Matter Detection

Contribution ID: **3** Type: **Contributed talk**

A global fit of the gamma-ray galactic center excess within the scalar Higgs portal model

Thursday, 28 July 2016 16:30 (15 minutes)

Summary

We present an interpretation of the excess in the gamma-ray emission from the center of our galaxy observed by Fermi-LAT in terms of dark matter annihilation within the scalar singlet Higgs portal model. In particular, we include the astrophysical uncertainties from the dark matter distribution and allow for unspecified additional dark matter components. We demonstrate through a detailed numerical fit that the strength and shape of the gamma-ray spectrum can indeed be described by the model in various regions of dark matter masses and couplings. Constraints from invisible Higgs decays, direct dark matter searches, indirect searches in dwarf galaxies and for gamma-ray lines, and constraints from the dark matter relic density reduce the parameter space to dark matter masses near the Higgs resonance. We find two viable regions: one where the Higgs-dark matter coupling is of O(0.01), and an additional dark matter component beyond the scalar WIMP of our model is preferred, and one region where the Higgs-dark matter coupling may be significantly smaller, but where the scalar WIMP can constitute a significant fraction or all of dark matter. Both viable regions are hard to probe in future direct detection and collider experiments.

Based on (arXiv number)

1603.08228

Primary author: Dr HEISIG, Jan (RWTH Aachen University)

Presenter: Dr HEISIG, Jan (RWTH Aachen University)

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **5** Type: **Contributed talk**

Search for Dark photons at colliders

Thursday, 28 July 2016 11:30 (15 minutes)

Summary

We present a model-independent study of the exotic resonant monophoton signature coming from a Higgs boson decaying into a photon plus a dark photon at the LHC. Dark-photon scenarios have been extensively considered in the literature, especially in the framework of astroparticle and cosmology. More recently, they acquired a role in the context of dark U(1)_F flavor models, explaining the origin and hierarchy of the standard model Yukawa couplings. After a short presentation of U(1)_F flavor models, we explore experimentally allowed frameworks, where the Higgs-boson coupling to photon and dark photon can be enhanced. We also outline possible new searches for correlated signatures at future e+e- colliders.

Based on (arXiv number)

1405.5196; 1503.05836; 1603.01377

Primary author: Dr GABRIELLI, Emidio (Nat. Inst. of Chem.Phys. & Biophys. (EE))

Co-authors: MELE, Barbara (Universita e INFN, Roma I (IT)); HEIKINHEIMO, Matti (Helsinki Institute of Physics); BISWAS, Sanjoy (Korea Institute for Advance Study, Republic of Korea)

Presenter: Dr GABRIELLI, Emidio (Nat. Inst. of Chem.Phys. & Biophys. (EE))

Session Classification: Dark Matter at Particle Colliders

Track Classification: Dark Matter at Particle Colliders

Contribution ID: **6** Type: **Contributed talk**

AMS results after 5 years of data taking on the International Space Station

Monday, 25 July 2016 15:45 (15 minutes)

Summary

The Alpha Magnetic Spectrometer (AMS-02) is a particle physics experiment designed to study origin and nature of Galactic Cosmic Rays (CRs) up to TeV energies from space. With its high sensitivity, long exposure and excellent identification capabilities, AMS is conducting a mission of fundamental physics research in space. In particular, the presence of a magnetic field is a unique opportunity to study the anti-particle component of CRs: positrons, anti-protons, anti-deuterium, anti-helium. To date, more than 60 billion CR events have been collected by AMS, setting strong constraints on the generation and propagation of CRs through the galaxy. After reviewing the propagation of "standard" CRs, new results on lepton ond on anti-proton fluxes will be discussed, as well as their implication in terms of Dark Matter searches. Prospects on future data at TeV energies and forthcoming measurements on rare species, like anti-deuterium and anti-helium, crucial in investigating both the content of Dark Matter and the presence of anti-matter in the Universe, will also be presented.

Based on (arXiv number)

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Primary author: INCAGLI, Marco (Universita di Pisa & INFN (IT))

Presenter: INCAGLI, Marco (Universita di Pisa & INFN (IT))

Session Classification: Indirect Dark Matter Detection

Track Classification: Indirect Dark Matter Detection

Contribution ID: **8** Type: **Invited talk**

Unveiling dark energy with the large scale structure: the theoretical side of the challenge

Tuesday, 26 July 2016 11:30 (30 minutes)

I will focus on the challenge posed by dark energy and discuss theoretical issues involved in finding an optimal framework to unveil its nature from upcoming high precision measurements of the large scale structure, giving an overview of recent progress.

Summary

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Based on (arXiv number)

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Primary author: Dr SILVESTRI, Alessandra (Leiden University)

Presenter: Dr SILVESTRI, Alessandra (Leiden University)

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **9** Type: **Contributed talk**

Domain walls in axion models with ultra-violet completion

Thursday, 28 July 2016 17:45 (15 minutes)

Summary

The QCD axion with f_a at an intermediate scale, $10^9 - 10^{12}$ GeV, seems in conflict with the gravity spoil of global symmetries and may face the axionic domain wall problem. We point out that the string compactifications with an anomalous U(1) gauge symmetry, allowing desirable chiral matter spectra, circumvent these two problems simultaneously.

Based on (arXiv number)

1604.00716[hep-ph]

Primary author: Prof. KIM, Jihn E. (Kyung Hee University)

Presenter: Prof. KIM, Jihn E. (Kyung Hee University)

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **10** Type: **Contributed talk**

Observational Constraints on Decoupled Hidden Sectors

Thursday, 28 July 2016 17:00 (15 minutes)

Based on (arXiv number)

1604.02401 [astro-ph.CO]

Summary

I will discuss observational constraints that can be placed on a decoupled hidden sector of dark matter, using as an example a Higgs-portal model, where the portal coupling is weak enough so that the hidden sector never thermalizes with the Standard Model. Even though the dark matter - SM scattering in this case is suppressed by the tiny coupling, the properties of the hidden sector can be constrained by astrophysical and cosmological observations.

The absence of inflationary isocurvature fluctuations provides lower bounds on the magnitude of the dark sector self-interactions, which in turn may lead to thermalization within the hidden sector, resulting in relic abundance of DM determined through a freeze-out process operating in the hidden sector. The parameter space of the decoupled sector is further constrained by considering observations of cluster mergers and by the Lyman-alpha forest bounds on warm dark matter.

Primary author: HEIKINHEIMO, Matti (Helsinki Institute of Physics)

Presenter: HEIKINHEIMO, Matti (Helsinki Institute of Physics)

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **13** Type: **Contributed talk**

Dark Forces in the Sky: signals from Z' and the dark Higgs

Monday, 25 July 2016 16:30 (15 minutes)

Based on (arXiv number)

Summary

We consider the indirect detection signals for a self-consistent hidden U (1) sector, containing a fermionic dark matter candidate, dark gauge boson and a Dark Higgs. The presence of an additional scalar, the Dark Higgs, provides a mass generation mechanism for the dark sector particles and is required to avoid unitarity violation at high energies. We find that the inclusion of the additional scalar to the sector opens up a new two-body channel and allows fermionic dark matter annihilation to be used to probe the properties of a scalar final state. We examine the phenomenology of the sector with a focus on this new process, and
determine the limits on the model parameter space from Fermi data on Dwarf Spheriodal Galaxies and other relevant experiments.

Primary author: Dr CAI, Yi (The University of Melbourne)

Co-authors: Dr BELL, Nicole F. (The University of Melbourne); Ms LEANE, Rebecca K. (The University of Melbourne)

Presenter: Dr CAI, Yi (The University of Melbourne)

Session Classification: Direct Dark Matter Detection

Track Classification: Indirect Dark Matter Detection

Contribution ID: **14** Type: **Contributed talk**

Astrophysical Signatures of Dark Matter

Wednesday, 27 July 2016 11:00 (15 minutes)

Summary

I will talk about the possibility of asymmetric dark matter forming stable stellar-like objects that could be present today and could have observational consequences.I will also present new spectral features that can potentially identify dark matter properties in a precise way in direct search experiments due to scattering of dark matter particles that are gravitationally bound to the Earth.

Based on (arXiv number)

1507.00959,1511.04474,1602.00006

Primary author: KOUVARIS, Chris (CP3-Origins, University of Southern Denmark)

Presenter: KOUVARIS, Chris (CP3-Origins, University of Southern Denmark)

Session Classification: Cosmological Probes of Dark Matter

Track Classification: Cosmological Probes of Dark Matter

Contribution ID: **16** Type: **Contributed talk**

A new formalism for scalar-tensor theories of gravity and its applicability

Tuesday, 26 July 2016 12:00 (15 minutes)

Summary

In this talk, I will present a new formalism for describing general scalar-tensor theories of gravity based on the language of differential forms. I will show how, thanks to this novel approach, the construction of viable theories in arbitrary number of dimensions becomes both simpler and more systematic. In four dimensions, our results can be associated with Horndeski's theory. Afterwards, I will discuss the potential applications of this new description, focusing on the role of field redefinitions in scalar-tensor theories.

Based on (arXiv number)

1603.01269

Primary author: EZQUIAGA, Jose María (Instituto de Física Teórica UAM-CSIC)

Co-authors: GARCIA-BELLIDO, Juan; ZUMALACÁRREGUI, Miguel (Nordita)

Presenter: EZQUIAGA, Jose María (Instituto de Física Teórica UAM-CSIC)

Session Classification: Dark Energy and Modified Gravity

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **17** Type: **Contributed talk**

A realistic model for Dark Matter interactions in the neutrino portal paradigm

Thursday, 28 July 2016 17:15 (15 minutes)

Summary

We discuss a simple extension of the Standard Model (SM) that provides an explicit realization of the dark-matter (DM) neutrino-portal paradigm. The dark sector is composed of a scalar Φ and a Dirac fermion Ψ, with the latter assumed to be lighter than the former. These particles interact with the SM through the exchange of a set of heavy Dirac fermion mediators that are neutral under all local SM symmetries, and also under the dark-sector symmetry that stabilizes the Ψ against decay. We show that this model can accommodate all experimental and observational constraints provided the DM mass is below ˜35 GeV or is in a resonant region of the Higgs or Z boson. We also show that if the dark scalar and dark fermion are almost degenerate in mass, heavier DM fermions are not excluded. We note that in this scenario DM annihilation in the cores of astrophysical objects and the galactic halo produces a monochromatic neutrino beam of energy m_Ψ, which provides a clear signature for this paradigm. Other experimental signatures are also discussed.

Based on (arXiv number)

1601.05051

Primary author: ILLANA, Jose Ignacio (University of Granada)

Co-authors: WUDKA, Jose (University of California Riverside); GONZALEZ MACIAS, Vannia (University of California Riverside)

Presenter: ILLANA, Jose Ignacio (University of Granada)

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **19** Type: **Contributed talk**

Turnaround radius in an accelerated universe in Einstein and in modified gravity

Friday, 29 July 2016 15:20 (15 minutes)

Based on (arXiv number)

arXiv:1508.01725; (arXiv:1508.00475

Summary

In an accelerating universe there is a maximum radius above
which a shell of test particles cannot collapse and is dispersed by the cosmic expansion. This radius could be used in conjunction with observations of large structures to constrain the equation of state of the universe. We express the turnaround radius in general relativity in terms of the Hawking quasilocal mass
and we extend the concept to modified theories of gravity for which the gravitational slip is non-vanishing.

Primary author: FARAONI, Valerio (Bishop's University)

Presenter: FARAONI, Valerio (Bishop's University)

Session Classification: Alternatives to LambdaCDM Cosmology

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **20** Type: **Contributed talk**

GAMBIT: the Global and Modular BSM Inference Tool

Thursday, 28 July 2016 12:15 (15 minutes)

Summary

I introduce GAMBIT, the Global and Modular BSM Inference Tool, representing the next generation of numerical tools in global fitting, parameter estimation and model comparison. I also illustrate the use of GAMBIT in dark matter related calculations.

Based on (arXiv number)

Primary author: BALAZS, Csaba (Monash University)

Presenter: BALAZS, Csaba (Monash University)

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **21** Type: **Contributed talk**

Constraining dark matter with small-scale structure formation

Wednesday, 27 July 2016 11:15 (15 minutes)

Summary

Observations from both the local and the high-redshift universe can be used to test the nature of dark matter. I will discuss several astrophysical probes (dwarf galaxy counts, Lyman-alpha forest, ..) and their constraining power on different dark matter scenarios (such as warm, mixed, and interacting dark matter).

Based on (arXiv number)

1601.07553, 1412.2133

Primary author: SCHNEIDER, Aurel (University of Zurich)

Presenter: SCHNEIDER, Aurel (University of Zurich)

Session Classification: Cosmological Probes of Dark Matter

Track Classification: Cosmological Probes of Dark Matter

Contribution ID: **22** Type: **Contributed talk**

Finding the Missing Dwarfs: a challenge to CDM?

Tuesday, 26 July 2016 17:00 (15 minutes)

Summary

No explanation exists so far for the the observed dearth of dwarf galaxies in the Local Volume compared to the large number of dark matter halos predicted by CDM. By means of simple models together with high-resolution cosmological simulations we investigate the impact of reionization and stellar feedback, as well as observational systematics, on the observed of the velocity function of galaxies and its use as a cosmological probe. Despite the importance of reionization, extreme feedback from stars seems to be the only alternative to reproduce the abundance of dwarfs. However, invoking stellar feedback as a solution results in tensions with several other observational constraints including the abundance of star-forming dwarfs, the number of satellites around the MW and M31, and the baryonic Tully-Fisher relation.

Based on (arXiv number)

Primary author: TRUJILLO-GOMEZ, Sebastian (University of Zurich)

Co-author: SCHNEIDER, Aurel (University of Zurich)

Presenter: TRUJILLO-GOMEZ, Sebastian (University of Zurich)

Session Classification: Alternatives to LambdaCDM Cosmology

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **23** Type: **Contributed talk**

DAMA confronts null searches in the effective theory of dark matter-nucleon interactions

Monday, 25 July 2016 16:45 (15 minutes)

Summary

We examine the dark matter interpretation of the modulation signal reported by the DAMA experiment from the perspective of effective field theories displaying Galilean invariance. We consider the most general effective coupling leading to the elastic scattering of a dark matter particle with spin 0 or 1/2 off a nucleon, and we analyze the compatibility of the DAMA signal with the null results from other direct detection experiments, as well as with the non-observation of a high energy neutrino flux in the direction of the Sun from dark matter annihilation. To this end, we develop a novel semi-analytical approach for comparing experimental results in the high-dimensional parameter space of the non-relativistic effective theory. Assuming the standard halo model, we find a strong tension between the dark matter interpretation of the DAMA modulation signal and the null result experiments. We also list possible ways-out of this conclusion.

Based on (arXiv number)

1602.04074

Primary author: Mr WILD, Sebastian (TU Munich)

Presenter: Mr WILD, Sebastian (TU Munich)

Session Classification: Direct Dark Matter Detection

Track Classification: Direct Dark Matter Detection

Contribution ID: **25** Type: **Invited talk**

Evidence for Dark Matter

Monday, 25 July 2016 10:05 (30 minutes)

Summary

Based on (arXiv number)

Presenter: GONDOLO, Paolo (University of Utah)

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

Registration

Monday, 25 July 2016 09:00 (45 minutes)

Contribution ID: **28** Type: **Contributed talk**

Observational constraints on viable f(R) gravity models

Tuesday, 26 July 2016 15:00 (15 minutes)

Summary

We investigate the matter power spectra in the power law and exponential types of viable f(R) theories along with massive neutrinos. The enhancement of the matter power spectrum is found to be a generic feature in these models. In particular, we show that in the former type, such as the Starobinsky model, the spectrum is magnified much larger than the latter one, such as the exponential model. A greater scale of the total neutrino mass is allowed in the viable f(R) models than that in the LCDM one. We obtain the constraints on the neutrino masses by using the CosmoMC package with the modified MGCAMB.

Based on (arXiv number)

arXiv:1411.3813

Primary author: Dr LEE, Chung-Chi (National Center for Theoretical Sciences, Taiwan)

Co-authors: Prof. GENG, Chao-Qiang (National Tsing Hua University, Taiwan); Mr SHEN, Jia-Liang (National Tsing Hua University, Taiwan)

Presenter: Dr LEE, Chung-Chi (National Center for Theoretical Sciences, Taiwan)

Session Classification: Dark Energy and Modified Gravity

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **29** Type: **Contributed talk**

Dark matter decays from non-minimal coupling to gravity

Monday, 25 July 2016 15:15 (15 minutes)

Summary

We consider the Standard Model extended with a dark matter particle in curved spacetime and we investigate the impact on the dark matter stability of terms in the Lagrangian linear in the dark matter field and proportional to the Ricci scalar. We show that this "gravity portal" induces decay even if the dark matter particle only has gravitational interactions, and that the decay branching ratios into Standard Model particles only depend on the dark matter mass. We calculate the dark matter decay widths in some simple scenarios and we set conservative limits on the non-minimal coupling parameter from experiments.

Based on (arXiv number)

1603.03696

Primary author: INGENHÜTT, Sebastian

Co-authors: IBARRA, Alejandro; CATA, Oscar

Presenter: INGENHÜTT, Sebastian

Session Classification: Indirect Dark Matter Detection

Track Classification: Indirect Dark Matter Detection

Contribution ID: **30** Type: **Invited talk**

Antimatter and photons from cosmic rays

Monday, 25 July 2016 14:30 (30 minutes)

After a brief review of the standard diffusion approach to the propagation of cosmic rays (CR), I discuss as alternative method the calculation of individual CR trajectories. The results obtained with this approach suggest that CR propagate strongly anisotropic, and that the antimatter fluxes observed are dominated by a single local source. Finally, I discuss
different approaches to predict antiproton production and their theoretical uncertainties.

Based on (arXiv number)

Summary

Primary author: KACHELRIESS, Michael (NTNU)

Presenter: KACHELRIESS, Michael (NTNU)

Track Classification: Indirect Dark Matter Detection

Contribution ID: **31** Type: **Contributed talk**

Dark matter annihilations and 21cm signal

Friday, 29 July 2016 12:15 (15 minutes)

Based on (arXiv number)

http://arxiv.org/abs/1603.06795

Summary

PDF
Dark matter annihilations and 21cm signal
Submitted by Laura lopez Honorez on 29 Mar 2016 at 11:43
Id: 92
Last modification: 29 Mar 2016 11:43
Abstract
Dark matter (DM) annihilations into charged particles change the thermal history of the Universe and, as a consequence, affect the 21 cm signal. In my talk I will discuss how predicting the effect of DM strongly relies on the modeling of annihilations inside halos. Given current uncertainties on the description of the astrophysical processes driving the epochs of reionization, X-ray heating and Lyman-α pumping, we found in a recent work that disentangling DM signatures from purely astrophysical effects, related to early-time star formation processes or late-time galaxy X-ray emissions, will be a challenging task. We have concluded that only annihilations of DM particles with masses of ~100 MeV, could leave an unambiguous imprint on the 21 cm signal and, in particular, on the 21 cm power spectrum. Additional measurements of the 21 cm signal at different cosmic epochs should help to break the strong parameter degeneracies between DM annihilations and astrophysical effects in order to undoubtedly single out a DM imprint for masses different from ~100 MeV.

Primary author: LOPEZ HONOREZ, Laura (Vrije Universiteit Brussel)

Co-authors: VINCENT, Aaron (Durham University); Dr MOLINÉ, Angeles (CFTP, Instituto Superior Tecnico, Universidade Tecnica de Lisboa); MENA, Olga (IFIC); PALOMARES-RUIZ, Sergio (IFIC-Valencia)

Presenter: LOPEZ HONOREZ, Laura (Vrije Universiteit Brussel)

Session Classification: Cosmological Probes of Dark Matter

Track Classification: Cosmological Probes of Dark Matter

Contribution ID: **32** Type: **Contributed talk**

Sterile neutrino dark matter production from scalar decay

Tuesday, 26 July 2016 16:30 (15 minutes)

Based on (arXiv number)

1409.4330, 1507.05694, and ongoing work

Summary

Sterile Neutrinos with a mass in the keV range form a good candidate for dark matter. They are naturally produced from neutrino oscillations via their mixing with the active neutrinos. However the production via non-resonant neutrino oscillations has recently been ruled out. Sterile neutrino dark matter production from scalar decay is an attractive possibility to circumvent the astrophysical constraints. I will discuss different realisations of this interesting production mechanism.

Primary author: SCHMIDT, Michael (The University of Sydney)

Co-authors: ADULPRAVITCHAI, Adisorn (Chulalongkorn University); COY, Rupert (University of Sydney)

Presenter: SCHMIDT, Michael (The University of Sydney)

Session Classification: Alternatives to LambdaCDM Cosmology

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **35** Type: **Contributed talk**

Boosted Dark Matter at Neutrino Experiments

Thursday, 28 July 2016 15:45 (15 minutes)

Summary

In this talk, I present a new class of dark matter models in which decays/annihilations in the present universe produce a highly boosted dark matter component. This " boosted dark matter" can interact with the standard model via electron scattering and produce signals at neutrino experiments, which resemble those from atmospheric neutrinos. I will carefully study a simple realization of such a model, and show the reach of Cherenkov experiments in the viable parameter space. I will then discuss how liquid argon detectors can be used to improve these bounds, and perform a more general analysis of boosted dark matter scenarios.

Based on (arXiv number)

1405.7370 as well as upcoming work

Primary author: NECIB, Lina (MIT)

Co-authors: CONRAD, Janet (Massachusetts Institute of Technology); MOON, Jarrett (Massachusetts Institute of Technology); THALER, Jesse (Massachusetts Institute of Technology); AGASHE, Kaustubh (University of Maryland); CUI, Yanou (Perimeter Institute for Theoretical Physics)

Presenter: NECIB, Lina (MIT)

Session Classification: Indirect Dark Matter Detection

Track Classification: Indirect Dark Matter Detection

Contribution ID: **36** Type: **Contributed talk**

DRAGON 2: implications for dark matter searches

Monday, 25 July 2016 15:30 (15 minutes)

Based on (arXiv number)

Summary

We present DRAGON 2, a numerical package designed to solve a general version of the cosmic-ray (CR) transport equation including all the relevant physical processes: diffusion, reacceleration, energy losses, advection, spallation.

The new version contains significant update and has been documented in full detail.

The code computes CR propagation for all species, both hadronic —including heavy nuclei – and leptonic, originating from astrophysical processes and also from dark matter annihilation or decay. The propagation can be followed in 2D and 3D mode, and the full detail of the Galactic structure (spiral-arm pattern, central molecular zone) can be considered.

This numerical package, together with auxiliary tools computing gamma-ray, neutrino and synchrotron emission, is able to provide a deep insight on the astrophysical backgrounds representing the major challenge in all indirect dark matter detection attempts.

In particular, since the code is able to to explore with high resolution the structures in the Galactic bulge, and to model CR anisotropic escape via diffusion and advection, it represents a crucial tool in the perspective of a better understanding of the anomalous gamma-ray emission detected in the inner Galaxy. Moreover, the possibility to keep all channels under control in a consistent way allows to characterize all the related constraints (e.g. coming from antiproton data or other CR observables). The modular and general structure of the code is especially designed to consider different problems on different scales, and the package can be easily adapted and scaled to study smaller or larger systems (from the solar neighborhood to clusters of galaxies).

We show in this talk the main features of the code, the expected future developments of the project, with particular focus on the most relevant current and future applications for any DM-oriented study.

Primary author: GAGGERO, Daniele

Presenter: VITTINO, Andrea (TU Munich)

Session Classification: Indirect Dark Matter Detection

Track Classification: Indirect Dark Matter Detection

Contribution ID: **37** Type: **Contributed talk**

Dark matter annual modulation with CUORE experiment

Monday, 25 July 2016 18:15 (15 minutes)

Based on (arXiv number)

Summary

Experiments with a non-null background in the region of interest for particle dark matter direct detection can search for it exploiting the expected signal annual modulation signature.
A search for annual modulation will be possible with the CUORE (Cryogenic Underground Observatory for Rare Events) experiment.
CUORE is a ton-scale neutrinoless double beta decay experiment based on TeO2 cryogenic bolometers that is currently in the last construction stage at the Gran Sasso National Laboratory (LNGS) in Italy.
Thanks to its large mass (988 TeO2 bolometers arranged in 19 towers for a total active mass of 741 kg), to its low energy threshold and to its projected stability on working conditions, CUORE can extend its physics potential also to study dark matter.
Waiting for CUORE commissioning, all the necessary tools for a low energy and subsiquent annual modulation
analysis have been developed and tuned using data acquired with CUORE-0, a single-tower CUORE prototype recently concluded. They include a new low-threshold trigger, low energy calibration, event selection, efficiencies evaluation and stability checks.
Preliminary results of the annual modulation study on the CUORE-0 data and prospects for CUORE will be discussed here.

Primary author: Ms MARINI, Laura (University of Genoa - INFN)

Presenter: Ms MARINI, Laura (University of Genoa - INFN)

Session Classification: Direct Dark Matter Detection

Track Classification: Direct Dark Matter Detection

Contribution ID: **38** Type: **Contributed talk**

Cosmological Aspects of Spontaneous Baryogenesis

Friday, 29 July 2016 15:05 (15 minutes)

Summary

Spontaneous baryogenesis is a unique idea for generating the baryon asymmetry of our universe, which does not require a departure from thermal equilibrium, but instead invokes spontaneous breaking of the CPT symmetry. In this talk I will discuss the cosmological aspects of spontaneous baryogenesis, and present general constraints that are independent of the particle physics model. I will show that cosmological considerations alone provide powerful constraints for spontaneous baryogenesis, through analyses of the backreaction of the produced baryons on the scalar field, the cosmological expansion history after baryogenesis, and the baryon isocurvature perturbations. I will also discuss possible extensions to the minimal setup, and propose two ideas for evading constraints on isocurvature perturbations: one is to suppress the baryon isocurvature with nonquadratic scalar potentials, another is to compensate the baryon isocurvature with cold dark matter isocurvature. The latter proposal provides an example where dark matter isocurvature perturbations can be used to save baryogenesis scenarios that would otherwise be ruled out by observations.

Based on (arXiv number)

1605.00670

Primary author: KOBAYASHI, Takeshi (SISSA)

Presenter: KOBAYASHI, Takeshi (SISSA)

Session Classification: Alternatives to LambdaCDM Cosmology

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **39** Type: **Contributed talk**

COSINE-100 experiment at Yangyang underground laboratory

Monday, 25 July 2016 17:45 (15 minutes)

Based on (arXiv number)

Summary

The DAMA collaboration at Gran Sasso claims that they have discovered dark matter with a significance of 9.3 sigma. However, no other experiment has found conclusive evidence for a WIMP signal in the 17 years since DAMA first announced their discovery. COSINE-100 is a Collaboration Of Sodium lodiNe Experiments to prove/disprove the DAMA/LIBRA annual modulation, founded by DM-Ice and KIMS experiments. COSINE-100 will use 107 kg of NaI(Tl) scintillating crystals at Yangyang underground laboratory in South Korea.

In this presentation, we will discuss the current status of COSINE-100 experiment at Yangyang underground laboratory.

Primary author: Dr JEON, Eunju (Center for Underground Physics, IBS)

Presenter: Dr JEON, Eunju (Center for Underground Physics, IBS)

Session Classification: Direct Dark Matter Detection

Track Classification: Direct Dark Matter Detection

Contribution ID: **40** Type: **Contributed talk**

Relic density at NLO: the thermal corrections

Friday, 29 July 2016 11:30 (15 minutes)

Summary

In recent years there has been an increasing interest in computations of the dark matter thermal relic density beyond the leading order in perturbation theory. In this talk we point out that the standard calculation, based on solving the Boltzmann equations, at NLO suffers from a temperature-dependent IR divergence. In an example model we show how both soft and collinear temperature-dependent divergences cancel when the collision term is instead computed in the thermal field theory formalism. We also discuss the remaining finite temperature-dependent correction and its interpretation within the EFT framework.

Based on (arXiv number)

1409.3049

Primary author: HRYCZUK, Andrzej (University of Oslo)

Co-authors: DIGHERA, Francesco; BENEKE, Martin (Rheinisch-Westfaelische Tech. Hoch. (DE))

Presenter: HRYCZUK, Andrzej (University of Oslo)

Session Classification: Cosmological Probes of Dark Matter

Track Classification: Cosmological Probes of Dark Matter

Contribution ID: **41** Type: **Contributed talk**

Cosmic antideuterons from dark matter and primordial black holes

Monday, 25 July 2016 15:00 (15 minutes)

Based on (arXiv number)

Summary

The search for antideuterons in cosmic rays has been proposed as a very promising channel to look for exotic processes taking place in our Galaxy. In particular, both the pair annihilation (or the decay) of WIMPs and the evaporation of primordial black holes could generate a flux of low-energy antideuterons much larger than the expected astrophysical background.
The aim of this talk is to present a detailed investigation of the main features that characterize the antideuteron fluxes produced by such mechanisms. An overview of the principal issues related both to the antideuterons production and to their subsequent propagation through the interstellar medium will be given and the capability of current and future experiments to detect an antideuteron signal coming from WIMPs or from primordial black holes will be discussed.
In addition, an investigation of the properties of the astrophysical background will be presented, with a particular focus on the antideuteron flux that could be generated by primary astrophysical sources, such as Supernova Remnants.

Primary author: VITTINO, Andrea (TU Munich)

Co-authors: IBARRA, Alejandro; HERMS, Johannes (TU Munich); WILD, Sebastian (TU Munich)

Presenter: VITTINO, Andrea (TU Munich)

Session Classification: Indirect Dark Matter Detection

Track Classification: Indirect Dark Matter Detection

Contribution ID: **42** Type: **Contributed talk**

Cosmological constraints on thermal axions and neutrinos from Planck 2015 temperature and polarization data

Friday, 29 July 2016 12:00 (15 minutes)

Based on (arXiv number)

Summary

Recent Cosmic Microwave Background (CMB) temperature and polarization anisotropy measurements from the Planck mission have significantly improved previous constraints on the neutrino masses, as well as the bounds on extended models with massive sterile neutrino states or extra particles, as for example thermal axions.
I will show the recent constraints from cosmology for the thermal axion mass and the total neutrino mass, considering several combination of datasets and scenarios. In particular, I will show how the inclusion of additional low redshift priors is mandatory in order to sharpen the CMB neutrino bounds, and that we are close to test the neutrino mass hierarchy with existing cosmological probes.

Primary author: DI VALENTINO, Eleonora (Institut d'Astrophysique de Paris)

Presenter: DI VALENTINO, Eleonora (Institut d'Astrophysique de Paris)

Session Classification: Cosmological Probes of Dark Matter

Track Classification: Cosmological Probes of Dark Matter

Contribution ID: **43** Type: **Contributed talk**

SUSY scenarios in GUT Models with Non-Universal Scalar Masses

Thursday, 28 July 2016 16:45 (15 minutes)

Summary

We study SO(10), SU(5) and fipped SU(5) GUT models with non-universal soft supersymmetry-breaking scalar masses, exploring how they are constrained by LHC supersymmetry searches and cold dark matter experiments, and how they can be probed and distinguished in future experiments. We find characteristic differences between the various GUT scenarios, particularly in the coannihilation region, which is very sensitive to changes of parameters.

Based on (arXiv number)

1511.06205

Primary author: GOMEZ, Mario E. (Universidad de Huelva)

Co-authors: ELLIS, Jonathan R. (University of London (GB)); LOLA, Magda (University of Patras (GR)); Dr CANNONI, Mirco (Universidad de Huelva); RUIZ DE AUSTRI, Roberto (IFIC)

Presenter: GOMEZ, Mario E. (Universidad de Huelva)

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **45** Type: **Contributed talk**

Waves in Modified Gravity

Tuesday, 26 July 2016 14:00 (15 minutes)

Based on (arXiv number)

Summary

Scalar tensor (ST) theories have been studied systematically for decades, in particular to describe the dark sector of cosmos. When solving the equations of motion for the scalar field in these theories, it has been common to use the quasi-static approximation; assuming that the field sits at the bottom of the effective potential at all times.

It has been shown that in some ST theories (e.g. the symmetron), there are generated waves in the scalar field at some point in the history of the universe. We show that such waves can disrupt the evolution of the scalar field significantly. Consequentially, the fifth forces felt by matter particles can in some cases be several orders of magnitude larger than in the quasi-static case.

Primary author: HAGALA, Robert

Co-authors: LLINARES, Claudio (Durham University); MOTA, David F. (University of Oslo)

Presenter: HAGALA, Robert

Session Classification: Dark Energy and Modified Gravity

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **49** Type: **Contributed talk**

Direct dark matter detection with the DarkSide experiment

Monday, 25 July 2016 18:00 (15 minutes)

Summary

The DarkSide program aims to directly search for dark matter underground at Gran Sasso National Laboratory in Italy. The core of the experiment consists of a dual-phase argon Time Projection Chamber (TPC) with which we are searching for WIMP induced nuclear recoils. The TPC is surrounded by a 30 tons liquid scintillator neutron veto and a 1000 tons water Cherenkov detector in order to reject background that can mimic a WIMP interaction. The current phase of the experiment, DarkSide-50, consists in a TPC filled with 50 kg of argon obtained from underground sources, which is significantly reduced in 39Ar. DarkSide-50 has made the most sensitive measurement of the 39Ar depletion in underground argon and performed a WIMP search using data from 70 live-days, setting the strongest limit to date on the WIMP-nucleon elastic scattering cross section with an argon target. These results demonstrated the power of the argon technology and the feasibility of DarkSide-20k, a bigger version of the current detector. Overviews of the recent science results, current status of the DarkSide-50 experiment and future development of the program will be presented.

Based on (arXiv number)

Primary author: PAGANI, Luca (Università degli studi di Genova and INFN)

Presenter: PAGANI, Luca (Università degli studi di Genova and INFN)

Session Classification: Direct Dark Matter Detection

Track Classification: Direct Dark Matter Detection

Contribution ID: **50** Type: **Invited talk**

SO(10) Dark Matter Models

Friday, 29 July 2016 09:30 (30 minutes)

There are several reasons supersymmetric models are appealing as
a candidate for beyond the standard models physics. These include help with
gauge coupling unification, the gauge hierarchy problem, the stabilization of the
electroweak vacuum, radiative electroweak symmetry breaking, dark matter, and perhaps
an improvement to low energy phenomenology.
The lack of evidence for low energy supersymmetry at the LHC implies a
supersymmetry scale in excess a TeV. While this is consistent (and even helpful) with
a Higgs boson mass at $\approx$ 125 GeV, simple supersymmetric models with scalar
and gaugino mass universality are being pushed into strips of parameter space.
In contrast, non-supersymmetric grand unified theories such as SO(10) may
provide equivalent benefits to all of the above issues normally associated with
supersymmetry, including a dark matter candidate. Because of the presence of an intermediate scale,
these theories may unify gauge couplings, provide for neutrino masses and a suitably long lived proton.
The construction of SO(10) dark matter models
will be discussed.

Summary

Based on (arXiv number)

Primary author: Prof. OLIVE, Keith (University of Minnesota)

Presenter: Prof. OLIVE, Keith (University of Minnesota)

Track Classification: Dark Matter Models

Contribution ID: **51** Type: **Contributed talk**

Relic density of wino-like dark matter in the MSSM

Friday, 29 July 2016 11:45 (15 minutes)

Based on (arXiv number)

1601.04718

Summary

The relic density of TeV-scale wino-like neutralino dark matter in the MSSM is subject to potentially large corrections as a result of the Sommerfeld effect. A recently developed framework enables us to calculate the Sommerfeld-enhanced relic density in general MSSM scenarios, properly treating mixed states and multiple co-annihilating channels as well as including off-diagonal contributions. In this talk I will explain the main features of this framework and its recent application to the study of the regions of parameter space surrounding the well known pure-wino scenario: namely the effect of sfermion masses being non-decoupled and of allowing non-negligible Higgsino or bino components in the lightest neutralino. The results reveal a number of phenomenologically interesting but so far unexplored regions where the Sommerfeld effect is sizeable. Results for the indirect signals from charged cosmic rays and diffuse gamma rays also computed within our framework, and their impact on the corresponding experimental limits in the new wino-like regions will be also discussed.

Primary author: RUIZ-FEMENIA, Pedro (Technische Universität München)

Co-authors: BARUCHA, Aoife (CPT Marseille); DIGHERA, Francesco (TU München); ANDRZEJ, Hryczuk (University of Oslo); BENEKE, Martin (TU München); RECKSIEGEL, Stefan (TU München)

Presenter: RUIZ-FEMENIA, Pedro (Technische Universität München)

Session Classification: Cosmological Probes of Dark Matter

Track Classification: Cosmological Probes of Dark Matter

Contribution ID: **52** Type: **Contributed talk**

Small nonassociative corrections to the SUSY generators and cosmological constant

Tuesday, 26 July 2016 15:30 (15 minutes)

Based on (arXiv number)

Summary

We show that the cosmological constant Λ can be considered as a new fundamental constant controlling the smallness of nonassociative effects in physics. We show that in this case there exists a minimal 4D scalar curvature (a unique Lorentz invariant quantity having the dimensions cm^{-2}): $R_{min} \approx \Lambda$. It immediately leads to a very simple explanation for the acceleration of the present Universe: the Universe reaches the minimally possible curvature and has to stay in this state.

Small nonassociative corrections for the SUSY operators $Q_{a,\dot{a}}$ are considered. The smallness is controlled by the ratio of the Planck length and a characteristic length $\ell_0 = \Lambda^{-1/2}$. Corresponding corrections of the momentum operator arising from the anticommutator of the SUSY operators are considered. The momentum operator corrections are defined via the anticommutator of the unperturbed SUSY operators $Q_{a,\dot{a}}$
and nonassociative corrections $Q_{1,a,\dot{a}}$. Choosing different anticommutators, one can obtain either a modified or q – deformed commutator of position x^μ and momentum operators P_ν.

Primary author: DZHUNUSHALIEV, Vladimir (al-Farabi KazNU)

Presenter: DZHUNUSHALIEV, Vladimir (al-Farabi KazNU)

Session Classification: Dark Energy and Modified Gravity

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **53** Type: **Invited talk**

Direct Dark Matter search: status and perspectives

Monday, 25 July 2016 11:30 (30 minutes)

Theoretical review on the direct detection search for dark matter.

Summary

Theoretical review on the direct detection search for dark matter.

Based on (arXiv number)

Primary author: FORNENGO, Nicolao (University of Torino and INFN)

Presenter: FORNENGO, Nicolao (University of Torino and INFN)

Track Classification: Direct Dark Matter Detection

Contribution ID: **54** Type: **Contributed talk**

Indirect Dark Matter searches with the MAGIC Telescopes

Thursday, 28 July 2016 15:30 (15 minutes)

Summary

Dark matter (DM) is one of the most elusive component of the universe. Unveiling its nature represents a fundamental goal for the modern physics. Indirect DM searches are looking for signatures resulting from annihilation and decay of DM particles in highly DM dominated regions, such as the Galactic Centre, clusters of galaxies, and dwarf spheroidal satellite galaxies (dSphs) of the Milky Way. In the cold DM scenario of weakly interacting massive particles (WIMPs), we expect a flux of gamma rays of energies up to the DM mass, tracing back to the source, which could be accessible by Imaging Atmospheric Cherenkov Telescopes (IACTs). Since the beginning of operations, the MAGIC Cherenkov telescopes are carrying out deep observations of several promising highly DM dominated targets with the aim of detecting DM signals or alternatively setting stringent constrains to DM particle models in the TeV mass range. In this contribution we present the main indirect DM search results achieved by MAGIC on several targets, such as galaxy clusters and dwarf satellite galaxies, for which MAGIC reached the strongest constraints on DM annihilation searches above few hundreds of GeV. We also report on the new limits to DM annihilation cross section achieved with a combined analysis of the observation of the Segue 1 dSph with MAGIC and the 6-years observations of 15 dSphs with the Fermi Large Area Telescope (Fermi-LAT), covering the widest DM particle mass range (from 10 GeV up to 100 TeV) ever explored by a single analysis.

Based on (arXiv number)

Primary author: Dr LOMBARDI, Saverio (INAF & ASDC)

Co-authors: RICO, Javier (IFAE); PALACIO, Joaquim (Institut de Física d'Altes Energies); ANTONELLI, Lucio Angelo (INAF); DORO, Michele (University of Padua and INFN Padua); VAZQUEZ ACOSTA, Monica (Imperial College London (UK)); GIAMMARIA, Paola (Univaq L'Aquila, INAF Roma)

Presenter: Dr LOMBARDI, Saverio (INAF & ASDC)

Session Classification: Indirect Dark Matter Detection

Track Classification: Indirect Dark Matter Detection

Contribution ID: **55** Type: **Contributed talk**

Diphoton and Diquark Resonances in U(1) Extension of the MSSM

Thursday, 28 July 2016 12:00 (15 minutes)

Summary

Based on (arXiv number)

Primary author: SHAFI, Qaisar (Bartol Research Institute)

Co-author: LAZARIDES, George (University of Thessaloniki)

Presenter: SHAFI, Qaisar (Bartol Research Institute)

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **56** Type: **Contributed talk**

Dark matter from the vector of SO (10)

Thursday, 28 July 2016 18:15 (15 minutes)

Summary

SO(10) grand unified theories can ensure the stability of new particles in terms of the gauge group structure itself, and in this respect are well suited to accommodate dark matter (DM) candidates in the form of new stable massive particles. We introduce new fermions in two vector 10 representations. When SO(10) is broken to the standard model by a minimal 45 + 126 + 10 scalar sector with $SU(3)_C \otimes SU(2)_L \otimes SU(2)_R \otimes U(1)_{B-L}$ as intermediate symmetry group, the resulting lightest new states are two Dirac fermions corresponding to combinations of the neutral members of the $SU(2)_L$ doublets in the 10's, which get splitted in mass by loop corrections involving W_R. The resulting lighter mass eigenstate is stable, and has only non-diagonal $Z_{L,R}$ neutral current couplings to the heavier neutral state. Direct detection searches are evaded if the mass splitting is sufficiently large to suppress kinematically inelastic light-to-heavy scatterings. By requiring that this condition is satisfied, we obtain the upper limit M_{W_R}
$lesssim25$ TeV.

Based on (arXiv number)

1511.02524

Primary author: KRAUSS, Martin (INFN - LNF and Chalmers University)

Co-authors: NARDI, Enrico; BOUCENNA, Sofiane (IFIC)

Presenter: KRAUSS, Martin (INFN - LNF and Chalmers University)

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **57** Type: **Contributed talk**

The Vainshtein mechanism in general disformal gravity

Tuesday, 26 July 2016 14:30 (15 minutes)

Summary

We study the Vainshtein mechanism in general disformal gravity which is a result of applying a general disformal transformation to Einstein gravity. We investigate the situations in which the late time accelerated expansion of the universe can be obtained in this theory. Based on these situations, we find that the Vainshtein mechanism can work when the scalar field in this theory is a phantom field or its kinetic term has a positive sign in the spherically symmetric static limit.

Based on (arXiv number)

Primary author: Dr KARWAN, Khamphee (The Institute for Fundamental Study)

Presenter: Dr KARWAN, Khamphee (The Institute for Fundamental Study)

Session Classification: Dark Energy and Modified Gravity

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **58** Type: **Contributed talk**

Latest results from the DRIFT dark matter detector

Monday, 25 July 2016 17:30 (15 minutes)

Summary

The DRIFT (Directional Recoil Identification From Tracks) experiment is the world leading directional dark matter detector in terms of sensitivity, searching for a galactic signature from WIMP-induced nuclear recoils. DRIFT has been running background free for over a year and the latest results from this data will be presented, along with recent studies on the directional capabilities of the detector and prospects for the future.

Based on (arXiv number)

Primary author: SCARFF, Andrew (University of Sheffield)

Presenter: SCARFF, Andrew (University of Sheffield)

Session Classification: Direct Dark Matter Detection

Track Classification: Direct Dark Matter Detection

Contribution ID: **59** Type: **Invited talk**

Dark energy: current and future observations

Tuesday, 26 July 2016 09:30 (30 minutes)

I will give an overview of the current state of dark energy research, from an observational point of view. Current and future probes of dark energy will be discussed; I will examine the latest constraints on dark energy physics from cosmological surveys, and describe future prospects for yet more powerful measurements in the coming decade.

Summary

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Based on (arXiv number)

Primary author: BACON, David (University of Portsmouth)

Presenter: BACON, David (University of Portsmouth)

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **60** Type: **Contributed talk**

Cosmological implications of the NMSSM domain wall decay

Tuesday, 26 July 2016 16:45 (15 minutes)

Summary

We study the decay of domain wall in the NMSSM. The decay causes a large late-time entropy production. Its cosmological implications on unwanted relics such as moduli, gravitino, LSP and axion are presented.

Based on (arXiv number)

1510.03595

Primary author: SETO, Osamu

Presenter: SETO, Osamu

Session Classification: Alternatives to LambdaCDM Cosmology

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **61** Type: **Contributed talk**

Late Kinetic Decoupling from Dark Matter - Dark Radiation Scattering

Wednesday, 27 July 2016 11:30 (15 minutes)

Based on (arXiv number)

1603.04884

Summary

There is a growing interest in how the particle nature of dark matter (DM) can affect cosmological and
astrophysical observables. Kinetic decoupling of DM from the heat bath in the early universe, e.g., leads
to a pronounced cutoff in the matter power spectrum. Traditional WIMP models for DM (like SUSY) typically
result in MeV-scale kinetic decoupling, corresponding to a cutoff at unobservably small scales. Here, we
provide instead a classification of DM models that result in keV-scale kinetic decoupling. Such models result
in a potentially observable cutoff in the power spectrum, at the scale of dwarf-galaxies and hence possibly
addressing the missing satellite problem. The main focus of the talk will be on the decoupling process of DM
in the early universe, implications for model building, and some examples from our work.

Primary author: IHLE, Håvard Tveit (University of Oslo)

Co-authors: KERSTEN, Joern (University of Bergen); WALIA, Parampreet (U); BRINGMANN, Torsten (University of Oslo)

Presenter: IHLE, Håvard Tveit (University of Oslo)

Session Classification: Cosmological Probes of Dark Matter

Track Classification: Cosmological Probes of Dark Matter

Contribution ID: **62** Type: **Contributed talk**

New Ideas for Detecting Light Dark Matter

Monday, 25 July 2016 17:00 (15 minutes)

Summary

Based on (arXiv number)

Primary author: ZUREK, Kathryn (LBNL)

Presenter: ZUREK, Kathryn (LBNL)

Session Classification: Direct Dark Matter Detection

Track Classification: Direct Dark Matter Detection

Contribution ID: **63** Type: **Invited talk**

Searching for Dark Matter at Colliders

Monday, 25 July 2016 12:00 (30 minutes)

Summary

Based on (arXiv number)

Primary author: ZUREK, Kathryn (LBNL)

Presenter: ZUREK, Kathryn (LBNL)

Track Classification: Dark Matter at Particle Colliders

Contribution ID: **64** Type: **Contributed talk**

Coherent fields in cosmology

Tuesday, 26 July 2016 17:30 (15 minutes)

Based on (arXiv number)

JHEP 1603 (2016) 013 arXiv:1509.08819

Summary

Coherently oscillating scalar fields play a fundamental role in models of inflation or in axion dark matter scenarios. In this talk we present recent results on the dynamics of coherent fields of higher spin in cosmological space-times. We show that, regardless of the spin, the energy-momentum tensor of homogeneous fields is always isotropic in average provided the fields remain bounded and evolve rapidly compared to the rate of expansion. An analytic expression for the average equation of state is obtained for Lagrangians with generic power-law kinetic and potential terms. As an example we discuss the behavior of a spin-two field in the standard Fierz-Pauli theory of massive gravity. We also consider the evolution of density perturbations of massive coherent fields and discuss their possible behaviour as dark matter candidates.

Primary author: L. MAROTO, Antonio (Universidad Complutense de Madrid)

Presenter: L. MAROTO, Antonio (Universidad Complutense de Madrid)

Session Classification: Alternatives to LambdaCDM Cosmology

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **65** Type: **Invited talk**

Towards an Effective THeory Of Structure formation (ETHOS)

Wednesday, 27 July 2016 10:00 (30 minutes)

Although there is substantial gravitational evidence for the existence of dark matter, its particle nature
remains one of the biggest mysteries in modern physics. The favourite theoretical model, Cold Dark Matter
(CDM), assumes that non-gravitational dark matter interactions are irrelevant for galaxy formation and evolution.

Surprisingly, current astronomical observations allow significant departures from the CDM hypothesis
that have a relevant impact on our understanding of how galaxies form and evolve. Moreover, the observed
properties of the smallest galaxies have been a consistent challenge for the CDM model.

In this talk, I will argue that to explain galaxy formation and evolution in the broadest sense,
an effective dark matter theory must contain a wider range of dark matter particle physics. I will describe the
first steps we have taken towards developing ETHOS and present some of its applications.

Summary

Based on (arXiv number)

Primary author: ZAVALA FRANCO, Jesus (University of Iceland)

Presenter: ZAVALA FRANCO, Jesus (University of Iceland)

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **66** Type: **Contributed talk**

The 750 GeV in the light of Dark Matter

Thursday, 28 July 2016 11:45 (15 minutes)

Summary

"Who Ordered that" quipped I.I. Rabi in 1936 for the discovering of the muon. Recently, ATLAS and CMS reported a diphoton excess, which could correspond to a resonance at around 750 GeV, that was not expected by many models. We will discuss the different implications of such a particle in the dark matter framework, reviewing the different phenomenological constructions and the possibility to linked this new particle with the dark matter WIMP paradigm.

Based on (arXiv number)

arXiv:1512.04913 ; arXiv:1603.05601

Primary author: Dr MAMBRINI, Yann (LPT, Paris Saclay)

Presenter: Dr MAMBRINI, Yann (LPT, Paris Saclay)

Session Classification: Dark Matter at Particle Colliders

Track Classification: Dark Matter at Particle Colliders

Contribution ID: **68** Type: **Contributed talk**

Is cosmography a useful tool for testing cosmology?

Tuesday, 26 July 2016 12:15 (15 minutes)

Model-independent methods in cosmology have become an essential tool in order to deal with an increasing number of theoretical alternatives for explaining the late-time acceleration of the Universe. In principle, this provides a way of testing the Cosmological Concordance (or LambdaCDM) model under different assumptions and ruling out whole classes of competing theories. One such model-independent method is the so-called cosmographic approach, which relies only on the homogeneity
and isotropy of the Universe on large scales. We show that this method suffers from many shortcomings, providing biased results depending on the auxiliary variable used in the series expansion and is unable to rule out models or adequately reconstruct theories with higher-order derivatives in either the gravitational or matter sector. Consequently, in its present form, this method seems unable to provide reliable or useful results for cosmological applications.

Summary

I will review various approaches to cosmological modelling in f(R) theories of gravity, using both top-down and bottom-up constructions. The top-down models are based on Robertson-Walker geometries and employ techniques such as Dynamical Systems methods and the reconstruction of the gravitational action from the expansion history of the Universe. The bottom-up constructions are built by patching together sub-horizon-sized regions of perturbed Minkowski space. The results obtained suggest that these theories do not provide a theoretically attractive alternative to the standard Concordance model of cosmology.

Based on (arXiv number)

Primary author: DUNSBY, Peter (University of Cape Town)

Presenter: DUNSBY, Peter (University of Cape Town)

Session Classification: Dark Energy and Modified Gravity

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **69** Type: **Invited talk**

Status on Decaying Dark Matter (and other very weakly interacting candidates)

Thursday, 28 July 2016 14:00 (30 minutes)

We review model of decaying Dark Matter and other very weakly interacting DM candidates and present the status of theoretical developments for those models and DM searches both in indirect detection and at colliders.

Based on (arXiv number)

Summary

We review model of decaying Dark Matter and other very weakly interacting DM candidates and present the status of theoretical developments for those models and DM searches both in indirect detection and at colliders.

Primary author: COVI, Laura (Georg-August-Universitaet Goettingen (DE))

Presenter: COVI, Laura (Georg-August-Universitaet Goettingen (DE))

Track Classification: Dark Matter Models

Contribution ID: **70** Type: **Contributed talk**

Dark Matter in galaxies: a review

Wednesday, 27 July 2016 11:45 (20 minutes)

Recent observations have revealed the structural properties of the dark and luminous mass distribution in galaxies from dwarfs to giants. Their study led to the vision of a new and amazing scenario. The investigation of single and coadded objects has in fact shown that the rotation curves of spirals follow, from their centers out to their virial radii, an universal profile that implies a tuned combination of their stellar disk and dark halo mass distributions. The mass distribution of ellipticals and dwarf spheroidals is found similar. This, alongside with accurate mass modeling of individual galaxies, poses important challenges to the presently theoretically favored LCDM Cosmology and indicate a surprising direct interaction between the dark and the luminous components.

Based on (arXiv number)

arXiv:1111.1165 , arXiv:astro-ph/0703115, arXiv:1402.2280

Summary

Recent observations have revealed the structural properties of the dark and luminous mass distribution in galaxies from dwarfs to giants. Their study led to the vision of a new and amazing scenario. The investigation of single and coadded objects has in fact shown that the rotation curves of spirals follow, from their centers out to their virial radii, an universal profile that implies a tuned combination of their stellar disk and dark halo mass distributions. The mass distribution of ellipticals and dwarf spheroidals is found similar. This, alongside with accurate mass modeling of individual galaxies, poses important challenges to the presently theoretically favored LCDM Cosmology and indicate a surprising direct interaction between the dark and the luminous components.

Primary author: SALUCCI, Paolo (SISSA)

Presenter: SALUCCI, Paolo (SISSA)

Session Classification: Cosmological Probes of Dark Matter

Track Classification: Cosmological Probes of Dark Matter

Contribution ID: **72** Type: **Contributed talk**

Leptophilic dark matter and h -> mu tau

Thursday, 28 July 2016 17:30 (15 minutes)

Summary

I'd like to talk on the models of dark matter which interacts with the standard model via leptons. I'll address the dark matter phenomenology, collider signatures and the excess in h -> mu tau decay including constraints in these models.

Based on (arXiv number)

1510.00100; 1604.03738

Primary author: BAEK, Seungwon

Presenter: BAEK, Seungwon

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **74** Type: **Invited talk**

Detecting Black Holes with LIGO

Tuesday, 26 July 2016 11:00 (30 minutes)

The Laser Interferometer Gravitational-wave Observatory (LIGO) recently made the first direct detection of gravitational waves; minute distortions in space-time caused by cataclysmic events far away in the universe. I will talk about the source of the signal we detected, the physics behind the detectors, and prospects for the future of this emerging field.

Summary

The Laser Interferometer Gravitational-wave Observatory (LIGO) recently made the first direct detection of gravitational waves; minute distortions in space-time caused by cataclysmic events far away in the universe. I will talk about the source of the signal we detected, the physics behind the detectors, and prospects for the future of this emerging field.

Based on (arXiv number)

http://link.aps.org/doi/10.1103/PhysRevLett.116.061102

Primary author: EVANS, Matthew (MIT)

Presenter: EVANS, Matthew (MIT)

Contribution ID: **75** Type: **Contributed talk**

The LUX-ZEPLIN dark matter experiment

Monday, 25 July 2016 17:15 (15 minutes)

Summary

LUX-ZEPLIN (LZ) is a large dark matter detector to be installed 4850 ft underground at the Sanford Underground Research Facility in Lead, South Dakota, USA. The detector will be a two-phase xenon liquid/gas time projection chamber with a total mass of 10 tonnes. The liquid xenon target has a mass of 7 tonnes in the 'active' region where there is an electric drift field and a 5.6 tonne fiducial mass. The size of the detector makes it capable of reaching unprecedented sensitivity to WIMPs, but to achieve this goal careful characterisation of experimental backgrounds is required. In this talk I will discuss the LZ detector design, expected sensitivity and background-control strategy, in particular Monte-Carlo simulations and radioactivity screening techniques.

Based on (arXiv number)

Primary author: WOODWARD, David (University of Sheffield)

Presenter: WOODWARD, David (University of Sheffield)

Session Classification: Direct Dark Matter Detection

Track Classification: Direct Dark Matter Detection

Contribution ID: **78** Type: **Invited talk**

Cosmological tests of modified gravity

Friday, 29 July 2016 11:00 (30 minutes)

I review recent progress in the construction of modified gravity models as alternatives to dark energy as well as the development of cosmological tests of gravity. Einstein's theory of General Relativity (GR) has been tested accurately within the local universe i.e. the Solar System, but this leaves the possibility open that it is not a good description of gravity at the largest scales in the Universe. In 1998, astronomers made the surprising discovery that the expansion of the Universe is accelerating, not slowing down. Within the framework of GR, the acceleration would originate from an unknown dark energy. Alternatively, it could be that there is no dark energy and GR itself is in error on cosmological scales.

In this talk, I first give an overview of recent developments in modified gravity theories. I then focus on common properties these models share, such as screening mechanisms they use to evade the stringent Solar System tests. Once armed with a theoretical knowledge of modified gravity models, I move on to discuss how we can test modifications of gravity on cosmological scales. Since screening mechanisms leave distinct signatures in the non-linear structure formation, I review novel astrophysical tests of gravity using clusters, dwarf galaxies and stars.

Based on (arXiv number)

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I review recent progress in the construction of modified gravity models as alternatives to dark energy as well as the development of cosmological tests of gravity. Einstein's theory of General Relativity (GR) has been tested accurately within the local universe i.e. the Solar System, but this leaves the possibility open that it is not a good description of gravity at the largest scales in the Universe. In 1998, astronomers made the surprising discovery that the expansion of the Universe is accelerating, not slowing down. Within the framework of GR, the acceleration would originate from an unknown dark energy. Alternatively, it could be that there is no dark energy and GR itself is in error on cosmological scales.

In this talk, I first give an overview of recent developments in modified gravity theories. I then focus on common properties these models share, such as screening mechanisms they use to evade the stringent Solar System tests. Once armed with a theoretical knowledge of modified gravity models, I move on to discuss how we can test modifications of gravity on cosmological scales. Since screening mechanisms leave distinct signatures in the non-linear structure formation, I review novel astrophysical tests of gravity using clusters, dwarf galaxies and stars.

Primary author: KOYAMA, Kazuya (University of Portsmouth)

Presenter: KOYAMA, Kazuya (University of Portsmouth)

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **80** Type: **Contributed talk**

Exact Analytic Solution for Non-Linear Density Fluctuation in a LCDM Universe

Tuesday, 26 July 2016 14:45 (15 minutes)

Summary

We derive the exact third-order analytic solution of the matter density fluctuation in the proper-time hypersurface in a LCDM universe, accounting for the explicit time-dependence and clarifying the relation to the initial condition. Furthermore, we compare our analytic solution to the previous calculation in the comoving gauge, and to the standard Newtonian perturbation theory by providing Fourier kernels for the relativistic effects. Our results provide an essential ingredient for a complete description of galaxy bias in the relativistic context.

Based on (arXiv number)

1602.06300

Primary author: GONG, Jinn-Ouk (Asia Pacific Centerfor Theoretical Physics)

Co-author: YOO, Jaiyul (University of Zurich)

Presenter: GONG, Jinn-Ouk (Asia Pacific Centerfor Theoretical Physics)

Session Classification: Dark Energy and Modified Gravity

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **83** Type: **Contributed talk**

KiDS-450: Cosmological parameter constraints from tomographic weak gravitational lensing

Tuesday, 26 July 2016 14:15 (15 minutes)

Summary

The Kilo Degree Survey (KiDS) is an ongoing ESO survey aiming at studying the growth of structures and the expansion history of the Universe using weak gravitational lensing. In this talk I will present the first constraints on cosmological parameters from a tomographic cosmic shear analysis of 450 square degrees. I will discuss how uncertainties in the photometric redshift distribution are accounted for in the analysis as well as uncertainties in the shear estimation. Furthermore I will show how we model astrophysical effects such as intrinsic galaxy alignment and AGN feedbacks in order to estimate unbiased cosmological parameters. Finally I will discuss the level of agreement of our measurements with other cosmological probes and in particular with the Planck results.

Based on (arXiv number)

in preparation; will be submitted to arXiv by the conference date

Primary author: HILDEBRANDT, Hendrik

Presenter: HILDEBRANDT, Hendrik

Session Classification: Dark Energy and Modified Gravity

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **84** Type: **Invited talk**

Hunting for SUSY and decaying gravitino DM with the μνSSM

Friday, 29 July 2016 10:00 (30 minutes)

The μνSSM solves the μ-problem of SUSY models simply using right-handed neutrinos ν's, while simultaneously explains the origin of neutrino masses. In this context, novel signatures of SUSY at the LHC are present through the new states of the model. On the other hand, since R parity is broken, a decaying gravitino turns out to be an interesting candidate for dark matter which can be searched through gamma-ray observations such as those of the Fermi Large Area Telescope.

Summary

The μνSSM solves the μ-problem of SUSY models simply using right-handed neutrinos ν's, while simultaneously explains the origin of neutrino masses. In this context, novel signatures of SUSY at the LHC are present through the new states of the model. On the other hand, since R parity is broken, a decaying gravitino turns out to be an interesting candidate for dark matter which can be searched through gamma-ray observations such as those of the Fermi Large Area Telescope.

Based on (arXiv number)

Primary author: Prof. MUNOZ, Carlos (Universidad Autonoma de Madrid & IFT)

Presenter: Prof. MUNOZ, Carlos (Universidad Autonoma de Madrid & IFT)

Track Classification: Dark Matter Models

Contribution ID: **85** Type: **Invited talk**

Opening by DSU chair

Monday, 25 July 2016 09:50 (15 minutes)

Presenter: MUNOZ, carlos (Universidad Autonoma de Madrid)

Contribution ID: **89** Type: **Invited talk**

Evidence for Dark Matter from Astronomical Observations

Wednesday, 27 July 2016 09:30 (30 minutes)

I will review evidence for dark matter's existence from astronomical observations. I will focus primarily evidence from dwarf galaxies and galaxy clusters, but also discuss results from cosmological observations of the cosmic microwave background and large scale structure.

Summary

Based on (arXiv number)

Presenter: CLOWE, Douglas

Contribution ID: **96** Type: **Contributed talk**

Detecting self interacting and dissipative dark matter by gravitational waves

Wednesday, 27 July 2016 12:05 (15 minutes)

Summary

We show that gravitational waves are absorbed while propagating through a medium with non-zero shear viscosity. This provides a method of testing dark matter and dark energy models where there is a self interaction and non-zero shear viscosity by observations of gravitational waves.

Based on (arXiv number)

hep-ph 1603.02635

Primary author: Prof. MOHANTY, Subhendra (Physical Research Laboratory)

Presenter: Prof. MOHANTY, Subhendra (Physical Research Laboratory)

Session Classification: Cosmological Probes of Dark Matter

Track Classification: Cosmological Probes of Dark Matter

Contribution ID: **99** Type: **Invited talk**

PUBLIC LECTURE

Tuesday, 26 July 2016 18:15 (1h 30m)

The ordinary atoms that make up the known universe, from our bodies and the air we breathe to the planets and stars, constitute only 5% of all matter and energy in the cosmos. The remaining 95% is made up of a recipe of 25% dark matter and 70% dark energy, both nonluminous components whose nature remains a mystery. Freese will recount the hunt for dark matter, from the discoveries of visionary scientists like Knut Lundmark and Fritz Zwicky, the astronomers who coined the term "dark matter" in the 1930's, to the deluge of data today from underground laboratories, satellites in space, and the Large Hadron Collider. Theorists contend that dark matter consists of fundamental particles known as WIMPs, or weakly interacting massive particles. Billions of them pass through our bodies every second without us even realizing it, yet their gravitational pull is capable of whirling stars and gas at breakneck speeds around the centers of galaxies, and bending light from distant bright objects. In this talk Freese will provide an overview of this cosmic cocktail, including the evidence for the existence of dark matter in galaxies. Many cosmologists believe we are on the verge of solving this mystery and this talk will provide the foundation needed to fully fathom this epochal moment in humankind's quest to understand the universe.

Summary

Based on (arXiv number)

Presenter: FREESE, Katherine (University of Michigan)

Contribution ID: **100** Type: **Invited talk**

Small-Scale Structure and Interacting Dark Matter and Radiation

Friday, 29 July 2016 14:30 (15 minutes)

I will review attempts to address the small-scale problems of Lambda-CDM using a combination of dark matter self-interactions and dark matter interactions with a dark radiation-like species. We will see that most models are rather tightly constrained. New results outlining the role of non-perturbative corrections to these interactions will be presented.

Summary

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Based on (arXiv number)

1310.6337, 1404.6127, and forthcoming

Primary author: DASGUPTA, Basudeb (Tata Institute of Fundamental Research, Mumbai)

Presenter: DASGUPTA, Basudeb (Tata Institute of Fundamental Research, Mumbai)

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **102** Type: **Invited talk**

Indirect Dark Matter detection: Challenges and opportunities

Monday, 25 July 2016 11:00 (30 minutes)

I will briefly review the current status of WIMP indirect dark matter detection, identifying recent progresses and the hurdles to overcome in order to improve sensitivity. Particular attention will be paid to the charged cosmic ray channels, although some considerations will also concern other domains, such as gamma rays. I will then discuss how indirect probes also have some chances in constraining (or possibly detecting) DM models beyond the WIMP scenario, which are often hard to identify at (if not beyond the reach of) direct or collider searches.

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Based on (arXiv number)

Primary author: SERPICO, Pasquale (LAPTH, Annecy-le-vieux)

Presenter: SERPICO, Pasquale (LAPTH, Annecy-le-vieux)

Track Classification: Indirect Dark Matter Detection

Contribution ID: **104** Type: **Invited talk**

Dark Matter Searches at CMS and Future Plans

Thursday, 28 July 2016 10:00 (30 minutes)

The existence of dark matter, indicated by astronomical observations, is one of the main proofs of physics beyond the standard model. Despite its abundance, dark matter has not been directly observed yet. This talk reviews the latest results and future plans of searches for dark matter at the CMS experiment at the LHC.

Summary

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Based on (arXiv number)

Primary author: PINNA, Deborah (Universitaet Zuerich (CH))

Presenter: PINNA, Deborah (Universitaet Zuerich (CH))

Track Classification: Dark Matter at Particle Colliders

Contribution ID: **105** Type: **Contributed talk**

Enhancing dark-matter self interaction by a Higgs resonance

Tuesday, 26 July 2016 17:15 (15 minutes)

Summary

A possibility of enhancing the dark-matter self-interaction cross-section ($\sigma_{\rm self}$) by a Higgs boson resonance is discussed within a model of Abelian vector dark matter. The model assumes extra $U(1)$ symmetry group factor and an additional complex Higgs field needed to generate a mass for the dark vector boson via the Higgs mechanism. The scalar sector contains an extra neutral Higgs boson h_2. If $2M_{DM} \approx M_{h_2}$ then $\sigma_{\rm self}$ could be amplified by s-channel resonance and the observed dark matter abundance could be properly reproduced. Consequences of such a scenario will be discussed.

Based on (arXiv number)

Primary author: GRZADKOWSKI, Bohdan (University of Warsaw)

Co-author: DUCH, Mateusz (University of Warsaw)

Presenter: GRZADKOWSKI, Bohdan (University of Warsaw)

Session Classification: Alternatives to LambdaCDM Cosmology

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **107** Type: **Invited talk**

Dark matter searches in ATLAS

Thursday, 28 July 2016 09:30 (30 minutes)

Dark matter particles may be produced at the LHC in combination with other particles, typically from initial state radiation. We present results from the ATLAS experiment from searches for phenomena with jets, photons, heavy quarks, electroweak gauge bosons, or Higgs bosons recoiling against large missing transverse momentum. The measurements are interpreted using several theoretical frameworks including simplified models with pair production of Weakly Interacting Massive Particles, effective field theories, and other beyond the Standard Model scenarios. Constraints from dijet searches are compared with results from the "Mono-X"searches to provide a combined interpretation in the context of simplified models.

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Based on (arXiv number)

Primary author: DIEHL, Edward (University of Michigan (US))

Presenter: DIEHL, Edward (University of Michigan (US))

Track Classification: Dark Matter at Particle Colliders

Contribution ID: **109** Type: **Invited talk**

Unitarity and Dark Matter – implications for collider searches and indirect detection

Thursday, 28 July 2016 11:00 (30 minutes)

Will discuss issues related to unitarity and gauge invariance of DM interactions, covering both collider searches and indirect detection.

Summary

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Based on (arXiv number)

Primary author: BELL, Nicole (University of Melbourne)

Presenter: BELL, Nicole (University of Melbourne)

Track Classification: Dark Matter at Particle Colliders

Contribution ID: **111** Type: **Invited talk**

How to stop worrying about pulsars and start looking for dark matter: The Fermi Galactic center GeV excess and beyond

Monday, 25 July 2016 14:00 (30 minutes)

One of the long-standing challenges in indirect dark matter searches is to understand the origin of the pronounced emission of 1-3 GeV photons that is seen in Fermi LAT data in the Galactic bulge and at the Galactic center. The arguably most exciting interpretation is that it is caused by the annihilation of dark matter particles. However, before making such a claim all possible backgrounds need to be assessed with utmost care. I will here show that in contrast to previous claims millisecond pulsars (MSPs) are a valid and rather likely explanation. What is more, the MSP hypothesis can explain the non-Gaussian noise that we detected in the gamma-ray emission from the inner Galaxy, with at least 10 sigma significance, using a new dedicated wavelet decomposition analysis. The power spectrum of dust-traced gas at small angular scales, as well as the projected density of other Galactic sources is far too low to account for this signal. I will present realistic strategies of how upcoming targeted radio searches and surveys can establish or refute the MSP hypothesis with high statistical significance. If we fail to find bulge MSPs in radio soon, the dark matter interpretation of the Fermi GeV excess will become much more likely again. I will close with an outlook on indirect dark matter searches in the next ten years.

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Based on (arXiv number)

Primary author: WENIGER, Christoph (University of Amsterdam)

Presenter: WENIGER, Christoph (University of Amsterdam)

Track Classification: Indirect Dark Matter Detection

Contribution ID: **112** Type: **Invited talk**

Dark Energy Theory Overview

Tuesday, 26 July 2016 10:00 (30 minutes)

The problem facing us with dark energy has manifested itself through the many theoretical models that have been published, all with the same goal, to explain the late time acceleration of the Universe. I will try and summarise the state of play with the models, recap the original cosmological constant problem which prevents many of us from simply accepting there is a constant energy density driving the acceleration, and discuss some recent attempts to address the problem. Throughout we will see the need for fine tuning which enters with pretty much every model, and we will see how particle physics considerations can have a huge impact on the type of models that are consistent with the data.

Summary

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Based on (arXiv number)

Primary author: COPELAND, Ed (Nottingham University)

Presenter: COPELAND, Ed (Nottingham University)

Track Classification: Dark Energy and Modified Gravity

Contribution ID: **113** Type: **Invited talk**

Probing the nature of dark matter with gamma rays: status of the Fermi LAT searches and prospects for the CTA

Thursday, 28 July 2016 14:30 (45 minutes)

High-energy gamma rays are one of the most promising tools to constrain or reveal the nature of Dark Matter (DM), in particular the Weakly Interacting Massive Particles (WIMP) models. During the almost eight years of the Fermi satellite mission, the data from its Large Area Telescope (LAT) were used to set constraints on the WIMP annihilation cross section which cut well into the theoretically-motivated region of parameter space for WIMP masses below 100 GeV. At the same time, the Cherenkov Telescope Array (CTA) is well into its prototyping phase and will soon offer a chance to probe a complementary parameter space of heavier dark matter (from O(200 GeV) up to several tens of TeV), with unprecedented sensitivity.

In this talk I will describe methods used to search for evidence of dark matter with the LAT, and review the status of the searches. I will discuss projections of the expected sensitivities with continued LAT data taking, together with the latest sensitivity predictions on the various targets with CTA.

Based on (arXiv number)

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Primary author: Dr ZAHARIJAS, Gabrijela (University of Nova Gorica)

Presenter: Dr ZAHARIJAS, Gabrijela (University of Nova Gorica)

Track Classification: Indirect Dark Matter Detection

Contribution ID: **114** Type: **Invited talk**

The case for dark matter self interactions

Friday, 29 July 2016 14:00 (30 minutes)

I will review motivations for the existence of self interacting dark matter and discuss possible astrophysical observables.
Self-interactions of dark matter particles can potentially lead to an observable separation between the dark matter halo
and the stars of a galaxy moving through a region of large dark matter density. Such a separation has recently been
observed in a galaxy falling into the core of the galaxy cluster Abell 3827.
I discuss the DM self-interaction cross section needed to reproduce the observed effects.

Based on (arXiv number)

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Primary author: SCHMIDT-HOBERG, Kai Ronald (Deutsches Elektronen-Synchrotron (DE))

Presenter: SCHMIDT-HOBERG, Kai Ronald (Deutsches Elektronen-Synchrotron (DE))

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **115** Type: **Contributed talk**

Majorana fermion dark matter from discrete flavor symmetry

Thursday, 28 July 2016 18:00 (15 minutes)

Summary

We consider the possibility of right-handed neutrino dark matter from the discrete non-Abelian flavor symmetry based on a model proposed by M.Hirsch et al. They may obtain the DM desired relic abundance through the thermal freeze out and the imposed flavor symmetry could remain a good symmetry among low energy observables. The implications to several experiments are briefly discussed.

Based on (arXiv number)

arXiv:1405.3592v4 and arXiv:1505.07636

Primary author: Prof. TAKAYAMA, Fumihiro (Yukawa Institute for Theoretical Physics, Kyoto U.)

Presenter: Prof. TAKAYAMA, Fumihiro (Yukawa Institute for Theoretical Physics, Kyoto U.)

Session Classification: Dark Matter Models

Track Classification: Dark Matter Models

Contribution ID: **118** Type: **Invited talk**

Anomalies and tensions in current cosmological data and hints for new physics

Friday, 29 July 2016 14:45 (20 minutes)

In this talk I will briefly review the tensions and anomalies in current cosmological data that hint for possible extensions to the "concordance" LCDM model.

Based on (arXiv number)

Summary

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Primary author: MELCHIORRI, Alessandro

Presenter: MELCHIORRI, Alessandro

Session Classification: Alternatives to LambdaCDM Cosmology

Track Classification: Alternatives to LambdaCDM Cosmology

Contribution ID: **119** Type: **not specified**

Announcements about the Social Program

Wednesday, 27 July 2016 12:20 (10 minutes)

Presenter: KERSTEN, Joern (University of Bergen)

Contribution ID: **120** Type: **not specified**

Welcome and practical information

Monday, 25 July 2016 09:45 (5 minutes)

Presenter: BRINGMANN, Torsten