T 22: Astroteilchenphysik und Kosmologie (Theorie)

Convenor: Alejandro Ibarra

Zeit: Mittwoch 16:45–19:00 Raum: 30.23: 3-1

T 22.1 Mi 16:45 30.23: 3-1

Dark Matter and Dark Forces from a Hidden Sector with Gravity Mediation — •Sarah Andreas, Mark Goodsell, and Andreas Ringwald — Deutsches Elektronen-Synchrotron DESY, 22607 Hamburg, Germany

Hidden sectors arise naturally in various extensions of the standard model and from string compactifications. Scenarios containing a dark matter particle coupled to a hidden U(1) gauge boson which kinetically mixes with the SM photon are of great interest since they could explain recent terrestrial and astrophysical anomalies, like the e^+e^- excesses observed by PAMELA, the annual modulation signal reported by DAMA/LIBRA and the low energy events seen by CoGeNT. The latter two direct detection observations seem to point towards a light dark matter candidate. String theory provides an additional motivation for hidden sectors but interestingly seems to favour models with gravity mediation, rather than gauge mediation which has been generally assumed in the context of light hidden dark matter. Therefore, we construct a light hidden sector in a simple supersymmetric model in which the supersymmetry breaking effects are dominated by gravity mediation and study the phenomenology of the corresponding dark matter particle and the hidden photon, the "Dark Force".

T 22.2 Mi 17:00 30.23: 3-1

Discrete D3 Dark Matter — •Adisorn Adulpravitchai[1], Brian Batell[2], and Josef Pradler[2] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Perimeter Institute for Theoretical Physics, Waterloo, Canada

We consider the minimal model of dark matter stabilized by a non-abelian discrete symmetry. The symmetry group is taken to be D3 (or S3), which is the smallest non-abelian finite group. The minimal model contains (nontrivial) singlet and doublet scalar representations of D3 which couple to the Standard Model fields via the Higgs portal. This construction predicts multi-component dark matter over much of the parameter space. Non-trival interactions under D3 may affect the thermal history of the dark matter candidates, while the dual nature of dark matter can potentially be unraveled by direct detection experiments. Finally, the Higgs boson may decay invisibly if the dark matter states are light.

T 22.3 Mi 17:15 30.23: 3-1

Gamma-Ray Lines from Radiative Dark Matter Decay — Mathias Garny[1], Alejandro Ibarra[1], •David Tran[1], and Christoph Weniger[2] — [1]Technische Universität München — [2]Max-Planck-Institut für Physik

The decay of dark matter particles which are coupled predominantly to charged leptons has been proposed as a possible origin of excess high-energy positrons and electrons observed by cosmic-ray telescopes PAMELA and Fermi LAT. Even though the dark matter itself is electrically neutral, the tree-level decay of dark matter into charged lepton pairs will generically induce radiative two-body decays of dark matter at the quantum level. Using an effective theory of leptophilic dark matter decay, we calculate the rates of radiative two-body decays for scalar and fermionic dark matter particles. Due to the absence of astrophysical sources of monochromatic gamma rays, the observation of a line in the diffuse gamma-ray spectrum would constitute a strong indication of a particle physics origin of these photons. We estimate the intensity of the gamma-ray line that may be present in the energy range of a few TeV if the dark matter decay interpretation of the leptonic cosmic-ray anomalies is correct and comment on observational prospects of present and future Imaging Cherenkov Telescopes, in particular the CTA.

T 22.4 Mi 17:30 30.23: 3-1

Fermi-LAT gamma rays and dark matter indirect detection — •Francesca Calore[1], Fiorenza Donato[2], Torsten Bringmann[1], and Valentina De Romeri[3] — [1]II. Institute for Theoretical Physics, University of Hamburg, Luruper Chausse 149, D-22761 Hamburg, Germany — [2]Dept. of Theoretical Physics and INFN, via Giuria 1, 10125 Torino, Italy — [3]IFIC edificio institutos de investigacion Paterna Valenciatigación. Paterna. Valencia. E-46071 (ESPAÑA)

Focusing on DM indirect detection through gamma-rays, we provide upper limits on the galactic annihilation flux, by means of the measured isotropic diffuse gamma-ray emission at high latitudes, coming from the first year observations of the Fermi-LAT telescope.

We study the sensitivity of the DM signal to the astrophysical known background (galactic and extragalactic), starting from modeling the underlying galactic diffuse emission and we extend previous analysis estimating a residual extragalactic background (EGB) intensity. Finally, we set updated upper bounds on the DM annihilation cross section, which improve by roughly an order of magnitude the constraints arising from the EGB derived by the Fermi-LAT Collaboration.

T 22.5 Mi 17:45 30.23: 3-1

Non-linear perturbations for Dark Matter — •Ninetta Saviano[1], Gianpiero Mangano[2], Massimo Pietroni[3], and Matteo Viel[4] — [1]University of Hamburg, II institute for theoretical physics — [2]INFN, Sezione di Napoli, Dipartimento di scienze fisiche di Napoli — [3]INFN,sezione di Padova, — [4]INAF Osservatorio Astronomico di Trieste

New generation galaxy surveys are measuring the statistical properties of the matter distribution with high precision, providing information about the dark side of the Universe. In this contest, a reliable comparison between theoretical models and observations requires going beyond the linear order in perturbation theory.

We propose a method to calculate the correlation functions for the density, velocity and pressure fields. We find that the correlation functions evolve in time according to a truncated system of integro-differential equations.

The starting point is constituted by the non-linear integro-differential Boltzmann equation which governs the time evolution of the Dark Matter particle phase space distribution. This equation is translated in a set of coupled equations for the moments of the distribution which has been truncated to the second order but including the stress tensor. Going in Fourier space, we obtain the time evolution for these fluctuation fields and so the Power Spectrum and Bispectrum.

T 22.6 Mi 18:00 30.23: 3-1

Unified Matter Inflation in SUSY GUTs — Stefan Antusch[1], Mar Bastero-Gil[2], •Jochen Baumann[1], Koushik Dutta[3], Steve King[4], and Philipp Kostka[1] — [1]Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München — [2]Universidad de Granada, Granada — [3]DESY, Hamburg — [4]University of Southampton, Southampton

In this talk we explore the novel possibility that the inflaton responsible for cosmological inflation is a gauge non-singlet matter field in supersymmetric (SUSY) Grand Unified Theories (GUTs). We consider hybrid-like inflation models in SUSY where we show that the scalar components of gauge non-singlet superfields, together with fields in conjugate representations, may form a D-flat direction suitable for inflation. We apply these ideas to SUSY models with an Abelian gauge group, a Pati-Salam gauge group and finally Grand Unified Theories based on $SO(10)$. Here, the scalar components of the matter superfields in the 16s may combine with a single $\overline{16}$ to form the inflaton. Focusing on the special case of sneutrino inflation, we calculate the one-loop Coleman-Weinberg corrections and the two-loop corrections from gauge interactions giving rise to the "gauge η-problem" and show that both corrections do not spoil inflation, and the monopole problem can be resolved. The usual η-problem may also be resolved in supergravity by the use of a Heisenberg symmetry.

T 22.7 Mi 18:15 30.23: 3-1

Higgs Inflation and Unitarity — •Christian Steinwachs[1], Andrei Barvinsky[2], Alexander Kamenshchik[3], Claus Kiefer[1], and Alexei Starobinsky[4] — [1]Institut für Theoretische Physik, Universität zu Köln, Zülpicher Strasse 77, 50937 Köln, Germany — [2]Theory Department, Lebedev Physics Institute, Leninsky Prospect 53, Moscow 119991, Russia — [3]Dipartimento di Fisica and INFN, via Irnerio 46, 40126 Bologna, Italy L. D. Landau Institute for Theoretical Physics, Moscow 119334, Russia — [4]L. D. Landau Institute for Theoretical Physics, Moscow 119334, Russia RESCEU, Graduate School of Science, The University of Tokyo, Tokyo 113-0033, Japan

The *Higgs-Inflation* scenario provides an elegant way to connect the

low energy physics of the Standard Model with the high energy phenomenom of inflation. Its predictions can be tested in future experiments at the LHC and with the Planck satellite.
I discuss this scenario and also adress the question of naturalness and the reliability of the model at the energy scale of inflation.
Ref.: [arXiv:0910.1041v2] (2010)

T 22.8 Mi 18:30 30.23: 3-1

B polarization of cosmic background radiation from second-order scattering sources at recombination — Martin Beneke, •Christian Fidler, and Klaus Klingmueller — RWTH Aachen

The CMB provides detailed information about the early Universe. Temperature anisotropies and E-mode polarization have been measured and provide insight into the composition and evolution of the Universe. B-mode polarization is especially interesting, as it is connected to the presence of primordial gravitational waves (tensor perturbations) from inflation at first order in cosmological perturbation theory. However, at second order it can be induced from purely scalar sources. We calculate the B-mode power spectrum induced by the second-order scattering term and find results which compete with a scalar-to-tensor ratio of 10^{-6} at $l = 100$ and 10^{-4} at $l = 1000$.

T 22.9 Mi 18:45 30.23: 3-1

Comparison of hadronic-interaction models for cosmic-ray physics with first LHC data — •Tanguy Pierog[1], David D'Enterria[2], Ralph Engel[1], Sergey Ostapchenko[3,4], and Klaus Werner[5] — [1]Karlsruhe Institut of Technology, Institut für Kernphysik, Karlsruhe, Germany — [2]CERN, PH Department, Geneva, Switzerland — [3]NTNU, Inst. for Fysikk, Trondheim, Norway — [4]D.V. Skobeltsyn Inst. Nuc. Phys, Moscow State Univ., Moscow, Russia — [5]SUBATECH, Nantes, France

The determination of the primary energy and type of high-energy cosmic-rays, generating extensive air-showers in the Earth's atmosphere, relies on the detailed modeling of hadronic multiparticle production. The first LHC results have extended considerably the energy range in which we have direct measurements available. In this work we compare the LHC data on inclusive particle production at center of mass energies 0.9, 2.36, and 7 TeV to predictions of various hadronic Monte Carlo models used commonly in cosmic-ray physics. For comparison with a standard collider physics model we also show PYTHIA predictions with various parameter settings. While reasonable overall agreement is found for some of the models, none of them reproduces consistently the energy evolution of all the observables. We discuss implications of the new LHC data for the description of cosmic-ray interactions at very high energy and point out some measurements that can be done to further reduce the uncertainties of air-shower modeling.