T 86: Neutrino Physics (Theory) 1 and Theoretical Astroparticle Physics and Cosmology 1

Time: Thursday 16:15–18:00 Location: T-H17

T 86.1 Thu 16:15 T-H17

Majoron Models without Domain Walls — •Tim Brune — TU Dortmund

In the singlet Majoron model, neutrino masses arise due to the spontaneous violation of lepton number. Apart from providing a viable dark matter candidate, the model can also explain the generation of a baryon asymmetry via Leptogenesis. However, the Majoron model suffers from the existence of cosmological domain walls, contradicting observations. I present extensions of the Majoron model by additional right-handed doublets and triplets that render it domain wall free. Besides avoiding the existence of domain walls, the additional particles have a non-trivial effect on the Sphaleron process that converts the lepton asymmetry to a baryon asymmetry in Leptogenesis models.

T 86.2 Thu 16:30 T-H17

Search for Fermionic Dark Matter using Astrophysical Neutrinos and Quantum Gravitational Decoherence — Heinrich Päs, •Dominik Hellmann, and Erika Rani — TU Dortmund, Dortmund, Deutschland

A model involving quantum gravitationally induced decoherence is proposed to investigate on the properties of fermionic dark matter using astrophysical neutrinos.

The main assumption of the model is that interactions of particles with the spacetime foam violate global quantum numbers such as lepton number and only conserve unbroken gauge quantum numbers. Hence, if N hypothetical fermionic dark matter species exist transforming as a singlet under $SU(3)_c \times U(1)_{EM}$, quantum gravity interactions cannot distinguish between neutrinos and these unknown degrees of freedom.

Applying this phenomenological $3 + N$ flavor model to systems of high energy neutrinos shows that these effects lead to a uniform flavor distribution over all neutral fermionic species in an initially pure neutrino beam after sufficiently long distances. Therefore, fluxes of neutrinos from astrophysical origin are expected to differ drastically from the standard expectation depending on the number of additional dark matter fermions present.

Consequently, future neutrino experiments could provide new clues about the fermionic dark sector.

T 86.3 Thu 16:45 T-H17

CPT Violation in Neutrino Oscillations with Quantum-Gravitational Decoherence — •Erika Rani[1,2], Heinrich Päs[1], and Dominik Hellmann[1] — [1]TU Dortmund, Lehrstuhl für Theoretische Physik III — [2]UIN Maulana Malik Ibrahim Malang, Indonesia

Quantum gravity effects can lead to the violation of fundamental symmetries, including global symmetries such as flavor, baryon and lepton number and discrete symmetries such as CPT. In this talk, we investigate CPT violation in neutrino oscillations in the context of quantum-gravitational decoherence. By employing the Ellis, Hagelin, Nanopoulos, and Srednicki (EHNS) formalism we study a two-flavor scenario and discuss the size of the effect in different parametrizations.

T 86.4 Thu 17:00 T-H17

"Magnetic" Mass of the Neutron — •Manfred Geilhaupt — HSN, Mönchengladbach, Germany

In Quantum Physics, the Spin of an elementary particle is defined to be an intrinsic, inherent property. The same to the magnetic moment (μ) due to the spin of charged particles - like Electron (me) and Proton (mp). So the intrinsic spin (S=1/2h-bar) of the electron entails a magnetic moment because of charge (e). However, a magnetic moment of a charged particle can also be generated by a circular motion (due to spin) of an electric charge (e), forming a current. Hence the orbital motion (of charge around a mass-nucleus) generates a magnetic moment by Ampère's law. This concept must lead to an alternative way calculating the neutrino mass (mν) while looking at the beta decay of a neutron into fragments: proton, electron, neutrino and corresponding kinetic energies. The change of neutrons magnetic moment (μn) during the decay process is a fact based on energy and spin and charge conservation, so should allow to calculate the restmass of the charge-less neutrino due to a significant change of: μe= -9.2847647043(28)E-24J/T down to μev= -9.2847592533(28)E-24J/T (while assuming mv=0.30eV to be absorbed and if (g-2)/2 from QED is independent of mass). As always the last word has the experiment

T 86.5 Thu 17:15 T-H17

Impact of bound states on non-thermal dark matter production — •Julian Bollig — Albert-Ludwigs-Universität, Freiburg

In this talk I will discuss the influence of non-perturbative effects, namely Sommerfeld enhancement and bound state formation, on the cosmological production of non-thermal dark matter (DM). For this purpose, I will focus on a class of simplified models with t-channel mediators. These naturally combine the requirements for large corrections in the early Universe, i.e. beyond the Standard Model states with long range interactions, with a sizable new physics production cross section at the LHC.

I will show that the dark matter yield of the superWIMP mechanism is suppressed considerably due to the non-perturbative effects under consideration, which leads to a significant shift in the cosmologically preferred parameter space of non-thermal dark matter in these models. By revisiting the implications of LHC bounds on long-lived particles associated with non-thermal dark matter, I will conclude that testing this broad class of DM models at the LHC and its successors is a bigger challenge than previously anticipated.

T 86.6 Thu 17:30 T-H17

Constraining dark matter annihilation with cosmic ray antiprotons using neural networks — Felix Kahlhoefer[1], Michael Korsmeier[2], Michael Krämer[1], Silvia Manconi[1], and •Kathrin Nippel[1] — [1]Institute for Theoretical Particle Physics and Cosmology (TTK), RWTH Aachen University, D-52056 Aachen, Germany — [2]The Oskar Klein Centre for Cosmoparticle Physics, Department of Physics, Stockholm University, Alba Nova, 10691 Stockholm, Sweden

The interpretation of data from indirect detection experiments searching for dark matter annihilations requires computationally expensive simulations of cosmic-ray propagation. We present new methods based on Recurrent and Bayesian Neural Networks that significantly accelerate simulations of secondary and dark matter Galactic cosmic ray antiprotons by at least two orders of magnitude compared to conventional approaches while achieving excellent accuracy. This approach allows for an efficient profiling or marginalisation over the nuisance parameters of a cosmic ray propagation model in order to perform parameter scans for a wide range of dark matter models. We present resulting constraints using the most recent AMS-02 antiproton data on several models of Weakly Interacting Massive Particles.

T 86.7 Thu 17:45 T-H17

Constraining Inflationary Dynamics with the SKA — Tanmoy Modak[1], Tilman Plehn[1], •Lennart Röver[1], and Björn Malte Schäfer[2] — [1]Institut für Theoretische Physik, Universität Heidelberg, Germany — [2]Astronomisches Recheninstitut, Universität Heidelberg, Germany

The SKA allows to map the distribution of neutral hydrogen in the Universe over a vast redshift range. The three-dimensional 21cm power spectrum found through this map can be used to perform precision tests not only for several astrophysical phenomena but also for early Universe cosmology. Even considering only a small redshift range it allows to significantly improve current constraints on the Hubble slow-roll parameters when combined with the CMB anisotropies measurement of Planck.