T 62: Astroteilchenphysik/Kosmologie (Theorie) 2

Convenor: M. Garny, B. Herrmann

Zeit: Dienstag 16:45–18:45 Raum: VSH 17

T 62.1 Di 16:45 VSH 17

CP-violation and baryon-asymmetry from varying Yukawas at the weak scale. — •Sebastian Bruggisser, Geraldine Servant, and Thomas Konstandin — DESY theory group / Notkestrasse 85 / 22607 Hamburg

Varying Yukawas open new possibilities for electroweak baryogenesis. In particular varying Yukawas, if somehow related to the mechanism of electro-weak symmetry breaking, can account for a strongly first order phase transition and they can provide a new source of CP-violation. In this talk I will focus on the CP-violation and the calculation of the final baryon-asymmetry. Starting from first principles, I will derive the general form of the CP-violating force and the diffusion equations for models with varying Yukawa couplings. This represents a very general framework to determine the baryon-asymmetry generated in a given model. I will discuss the necessary ingredients for successful baryogenesis and I will apply this framework to different models and discuss the CP-violation and the amount of baryon-asymmetry produced.

T 62.2 Di 17:00 VSH 17

Refined relic dark matter relic density calcuation — •Michael Gustafsson — Göttingen Univversity

A full phase-space calculation of chemical and kinetic freeze-out for annihi- lating dark matter (DM) particles has, to our knowledge, not been presented in the literature. Considering the vast literature relying on standard DM freeze-out calculations, it seems interesting to scrutinize the canonical assumptions and investigate a full phase-space freeze-out calculation. For dark matter particle candidates with an exceptionally early kinetic decoupling a full phase-space calculation seems to be needed to achieve reliable results.

T 62.3 Di 17:15 VSH 17

Dragon2 : A novel code for Cosmic-Ray transport in the Galaxy — •Andrea Vittino — Technische Universität München, Munich, Germany

We introduce Dragon2, the new version of the public software package designed to study cosmic-ray propagation in the Galaxy. Our aim is to illustrate the approach followed in the writing of the code and to present its most important features. We describe the properties of the numerical scheme that has been adopted in Dragon2 to implement the different processes related to cosmic-ray transport and we investigate its correctness by comparing our numerical results with a set of analytical solutions. Starting from these validation tests, we study in detail the performances of the code by probing the different factors that influence its accuracy and its speed under a wide range of different conditions. Lastly, we investigate the new features introduced in Dragon2 in the treatment of diffusion, energy losses and reacceleration and their impact on the predicted fluxes, in comparison also with the results given by the previous version of the code.

T 62.4 Di 17:30 VSH 17

A minimal model for dark matter and neutrino masses — •Sonja Esch[1], Carlos Yaguna[2], and Michael Klasen[1] — [1]WWU Münster — [2]MPI Heidelberg

We will present a minimal model for dark matter and neutrino masses. By adding one scalar and one fermionic doublet along with a scalar singlet and a fermion singlet to the Standard Model, it is possible to radiatively generate neutrino masses. A long with the new particles a Z2 symmetry is introduced, which stabilizes the new heavy particles, allowing the lightest one of them to be a dark matter candidate.

The coupling of the dark sector to the lepton sector, which generates the neutrino masses, on the one hand causes lepton flavour violation. On the other hand these new couplings can influence the dark matter relic density, while leaving the direct detection cross section nearly unaffected.

T 62.5 Di 17:45 VSH 17

Dark matter decay through gravity portals — Oscar Catà[1], Alejandro Ibarra[2], and •Sebastian Ingenhütt[2,3] — [1]Ludwig-Maximilians-Universität München — [2]Technische Universität München — [3]Max-Planck-Institut für Physik (Werner-Heisenberg-Institut)

Motivated by the fact that, so far, the whole body of evidence for dark matter is of gravitational origin, we study the decays of dark matter into Standard Model particles mediated by gravity portals, i.e., through nonminimal gravitational interactions of dark matter. We investigate the decays in several widely studied frameworks of scalar and fermionic dark matter where the dark matter is stabilized in flat spacetime via global symmetries. We find that the constraints on the scalar singlet dark matter candidate are remarkably strong and exclude large regions of the parameter space, suggesting that an additional stabilizing symmetry should be in place. In contrast, the scalar doublet and the fermionic singlet candidates are naturally protected against too fast decays by gauge and Lorentz symmetry, respectively. For a nonminimal coupling parameter $\xi \sim \mathcal{O}(1)$, decays through the gravity portal are consistent with observations if the dark matter mass is smaller than $\sim 10^5$ GeV, for the scalar doublet, and $\sim 10^6$ GeV, for the fermionic singlet.

T 62.6 Di 18:00 VSH 17

Gravitational Waves as a New Probe of Dark Matter — P. S. Bhupal Dev[1,2], Manfred Lindner[1], and •Sebastian Ohmer[1] — [1]Max-Planck-Institut für Kernphysik, Heidelberg — [2]Washington University, St. Louis

Dark Matter (DM) could be composed of ultralight bosons which form a Bose-Einstein condensate (BEC) in the early universe. We present a new method to test such a scenario by measuring the change of propagation speed of a gravitational wave passing through a BEC-DM halo. Current and future gravitational wave detectors can probe the entire parameter space of BEC-DM.

T 62.7 Di 18:15 VSH 17

Gravitational waves from oscillons after inflation — •Francesco Cefalà — University of Basel, Basel, Switzerland

We investigate the production of gravitational waves during the preheating process after inflation in the common case of field potentials that are asymmetric around the minimum where the universe reheats. In particular, we study the impact of oscillons, comparatively long lived and spatially localized regions where a scalar field (e.g. the inflaton) oscillates with large amplitude. Contrary to a previous study, which considered a symmetric potential, we find that oscillons in asymmetric potentials associated with a phase transition can generate a pronounced peak in the spectrum of gravitational waves, that largely exceeds the linear preheating spectrum. In my talk, I will discuss the possible implications of this enhanced amplitude of gravitational waves. For instance, for low scale inflation models, the contribution from the oscillons can strongly enhance the observation prospects at current and future gravitational wave detectors.

T 62.8 Di 18:30 VSH 17

Formation and Evolution of Axion Minicluster — Jonas Enander, •Andreas Pargner, and Thomas Schwetz — Institut für Kernphysik, Karlsruher Institut für Technologie (KIT), Germany

We study the cosmological evolution of the axion field in a scenario where the Peccei-Quinn symmetry is broken after inflation. We evolve the initial random field to the time of matter radiation equality to find the power spectrum of axions produced via the vacuum realignment mechanism. The power spectrum is used to study the subsequent gravitational collapse of overdensities into bound objects. This allows us to make a prediction for the distribution of mass and size of axion miniclusters.