T 24: Theoretische Astroteilchenphysik und Kosmologie II

Convenor: Frank Steffen

Zeit: Donnerstag 16:45–19:00 Raum: HG XV

T 24.1 Do 16:45 HG XV

Preheating Dark Matter — •Ole Bjaelde — RWTH Aachen

From simulations of structure formation with cold dark matter (CDM) it is becoming clear that the CDM paradigm cannot be the ultimate truth. More specifically simulations with CDM over-predict the amount of small galaxies orbiting a typically-sized galaxy like the Milky Way and predict too cuspy density profiles in the inner region of CDM halos.

Here we present a novel approach to alleviate these problems in which a coherently oscillating scalar field, interpreted as dark matter, can decay into standard model particles. Specifically, we consider a scalar field with sub-eV mass decaying into a Fermi sea of neutrinos. Like the case of fermionic preheating, we find that Pauli blocking controls the dark matter decay into the neutrino sea. The radius of the Fermi sphere depends on the expansion of the universe leading to a time-varying equation of state of dark matter. This makes the scenario very rich and we show that the decay rate might be different at different cosmological epochs. We categorize this in two interesting regimes and then study the cosmological perturbations to find the impact on structure formation.

T 24.2 Do 17:00 HG XV

Cold Dark Matter decoupling in the presence of Warm Dark Matter self-interaction energy density — •Rainer Stiele and Jürgen Schaffner-Bielich — Institut für Theoretische Physik, Ruprecht-Karls-Universität Heidelberg

We investigated a two component dark matter scenario: collisionless cold dark matter and self-interacting warm dark matter. The elastic warm dark matter self-interaction contributes an additional energy density that can dominate in the early universe. Hence, chemical cold dark matter decoupling can occure in a so-called self-interaction dominated era, instead of the standard assumption of radiation domination.

In this talk we present our results on the properties of thermal cold dark matter relics for decoupling in a self-interaction dominated universe. We find that the natural scale of the collisionless cold dark matter annihilation cross-section depends linearly on the cold dark matter particle mass and exceeds the weak scale. This casts new light on the so-called 'WIMP miracle' and interestingly enough, such boosted cold dark matter annihilation cross-sections are able to explain the high energy cosmic-ray electron-plus-positron spectrum measured by Fermi-LAT and the excess in the PAMELA data on the positron fraction. We use the unitary bound and neutrino induced constraints on the dark matter annihilation cross-section to extract allowed combinations of dark matter particle parameters and elastic warm dark matter self-interaction strengths.

T 24.3 Do 17:15 HG XV

Gravitino Dark Matter and General Neutralino NLSP — Laura Covi[1], •Jasper Hasenkamp[1,2], Stefan Pokorski[3], and Jonathan Roberts[4] — [1]Deutsches Elektronen-Synchrotron DESY, Hamburg, Germany — [2]Institute for Theoretical Physics, Hamburg University, Hamburg, Germany — [3]Institute of Theoretical Physics, Warsaw University, Warsaw, Poland — [4]Center for Cosmology and Particle Physics, New York University, New York, U.S.A.

We study the scenario of gravitino dark matter with a general neutralino next-to-lightest supersymmetric particle (NLSP) in a model independent way. We consider all neutralino decay channels and compare them with the most recent Big Bang nucleosynthesis (BBN) constraints. We check how those bounds are relaxed for a Higgsino or a wino NLSP in comparison to the bino neutralino case and look for possible loopholes in the general parameter space of the Minimal Supersymmetric Standard Model (MSSM). We determine constraints on the gravitino and neutralino NLSP mass and comment on the possibility of detecting these scenarios at colliders.

T 24.4 Do 17:30 HG XV

Embedding the DFSZ–Axino in mSUGRA with R–Parity Violation through Baryon Triality — •Herbi Dreiner and Branislav Poletanovic — Physikalisches Institut der Universität Bonn, Bethe Center for Theoretical Physics, Nußallee 12, 53115 Bonn, Germany

We embed the DFSZ axion in supersymmetry with broken R–parity. We restrict ourselves to the lepton–number violating case, which is motivated by the anomaly–free discrete gauge symmetry B_3. We present the Lagrangian and determine the axino interactions. In particular focusing on the mixing of the axino with the neutrinos and neutralinos. We keep the axino mass as a free parameter. In this model the axino can decay. We show the dominant decay processes as a function of the supersymmetric unification scale parameters, as well as the axino mass. We show implications for the axino as cold dark matter particle.

T 24.5 Do 17:45 HG XV

Cosmic-Ray Signatures of Dark Matter Decay — •David Tran[1], Alejandro Ibarra[1], and Christoph Weniger[2] — [1]Technische Universität München — [2]DESY, Hamburg

We investigate indirect signatures of unstable dark matter particles that decay with very long lifetimes. In particular, we examine the fluxes of positrons, electrons, antiprotons, gamma rays and neutrinos from dark matter decay in the light of anomalous results reported recently by a series of cosmic-ray experiments.

T 24.6 Do 18:00 HG XV

Indirect detection of Dark Matter with neutrinos — •Viviana Niro — Max-Planck-Institut fuer Kernphysik, Heidelberg, Germany

We present a detailed analysis of the neutrino-induced muon signals coming from leptophilic and neutralino Dark Matter pair-annihilations inside the Sun. We include neutrino oscillation and propagation properties in a consistent way and we compare our results with direct detection experiments, in particular with the DAMA/LIBRA annual modulation data.

T 24.7 Do 18:15 HG XV

Simplified model for photohadronic interactions in cosmic accelerators — •Svenja Hümmer, Michael Rüger, Felix Spanier, and Walter Winter — Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Germany

We present a fast analytical model for photomeson production in astrophysical sources like AGNs or GRBs which is suitable for time-dependent simulations of the sources and fit models for neutrino fluxes. It is built on basic physical principles and is simplified in such a way that secondary cooling can be included. We deal with π^+ and π^- seperately in order to predict the neutrino to antineutrino ratios.

T 24.8 Do 18:30 HG XV

Spuren des QCD-Phasenübergangs im Gravitationswellenspektrum — •Simon Schettler, Tillmann Boeckel und Jürgen Schaffner-Bielich — Ruprecht-Karls-Universität Heidelberg

Die Inflationstheorie erklärt den Ursprung der Inhomogenitäten im Universum. Neben den skalaren Störungen, die heute als Galaxienhaufen und Filamente zu sehen sind, sagt die Inflation auch tensorielle Störungen voraus. Der Theorie zufolge bilden diese einen Hintergrund von Gravitationswellen, aus denen man Informationen zum sehr frühen Unversum erhalten kann.

Wir untersuchen mögliche Spuren, die der QCD-Phasenübergang im Spektrum der Gravitationswellen hinterlässt. Für die stark wechselwirkende Materie nehmen wir zunächst das Bag-Modell an, in dem freie Quarks und Gluonen in einem Phasenübergang erster Ordnung zu Hadronen gebunden werden; dann rechnen wir mit aktuellen Gitterdaten, die einen Crossover bei niedriger Baryondichte beschreiben; schließlich verwenden wir ein Modell, das eine kurze inflationäre Phase während des Übergangs enthält und damit einen Phasenübergang bei höherer Baryondichte erlaubt.

T 24.9 Do 18:45 HG XV

Explaining supernova distances without Dark Energy: voids and Swiss Cheese — •Wessel Valkenburg — RWTH Aachen, Germany

The most widely applied cosmological model needs to invoke Dark Energy or a Cosmological Constant to be able to explain the observed distances to supernovae at high redshifts. However, as Dark Energy has some flaws from a theoretical point of view, many attempts are made to explain the distance-redshift relation in a universe containing only baryonic and dark matter. I will overview some models in which the distribution of matter is so far from perturbative, that it can potentially explain the observed distance-redshift relation. When we are living in a large local void, or in the limit where the universe is saturated with voids and structures (Swiss Cheese), we can observe the distance-redshift relation as we see it today, even without an accelerated expansion of the whole universe. Then I will point out difficulties and weaknesses for these models, and show why they may or may not be a viable alternative to Dark Energy.