T 111: Theoretische Astroteilchenphysik und Kosmologie

Zeit: Donnerstag 16:45–19:00 Raum: P101

T 111.1 Do 16:45 P101

Dark Radiation constraints on minicharged particles in models with a hidden photon — Javier Redondo[1,2] and •Hendrik Vogel[1] — [1]Max-Planck-Institut für Physik, Munich, Germany — [2]Arnold Sommerfeld Center - LMU, Munich, Germany

We compute the thermalization of a hidden sector consisting of minicharged particles (MCPs) and massless hidden photons in the early Universe. The precise measurement of the anisotropies of the cosmic microwave background by Planck and the relic abundance of light nuclei produced during big bang nucleosynthesis constrain the amount of dark radiation of this hidden sector through the effective number of neutrino species, $N_{\rm eff}$. In this talk we present accurate predictions of dark radiation in the strongly and weakly coupled regime for a wide range of model parameters. We give the value of $N_{\rm eff}$ for MCP masses between ~ 100 keV and 10 GeV and minicharges in the range $10^{-11} - 0.1$. Our results can be used to put bounds on MCPs from the current data and it is also a valuable indicator for future experimental searches, should the hint for dark radiation manifest itself in the next release of Planck's data.

T 111.2 Do 17:00 P101

Ekpyrotic Perturbations With Small Non-Gaussian Corrections — •Angelika Fertig, Jean-Luc Lehners, and Enno Mallwitz — Max-Planck-Institute for Gravitational Physics (Albert-Einstein-Institute), 14476 Potsdam, Germany

A new variant of the entropic mechanism for producing nearly scale-invariant density perturbations in a contracting ekpyrotic universe is presented. Instead of an unstable scalar potential which is required in the standard entropic mechanism, there exists a non-trivial coupling between adiabatic and entropic fields. In the talk it will be shown how this leads to exactly Gaussian entropy perturbations which are then converted into nearly-Gaussian curvature perturbations. The only distinguishing feature compared to single-field slow-roll inflationary models is an absence of primordial gravitational waves. Thus the present model provides a perfect match to current data from the PLANCK satellite.

T 111.3 Do 17:15 P101

Non-relativistic leptogenesis — Dietrich Bödeker and •Mirco Wörmann — Fakultät für Physik, Universität Bielefeld, D-33615 Bielefeld, Germany

Leptogenesis is an appealing scenario which can explain the baryon asymmetry of the Universe. It requires the existence of sufficiently heavy right-handed, or sterile neutrinos in addition to the particles of the Standard Model. The decays of these neutrinos can produce a lepton asymmetry which is partially converted to a baryon asymmetry by sphaleron processes.

The heavy neutrinos decay when the temperature of the universe becomes smaller than their mass. At that time the neutrinos become non-relativistic. Thus it seems reasonable to try a non-relativistic description of leptogenesis. This is what we have done in our work. In my talk I will show how one approximates the rate equations and how one systematically calculates corrections. We found that the first relativistic corrections are already small. Therefore, this approximation works very well and is profitable because the rate equations are much simpler compared to an approach using momentum dependent Boltzmann equations.

T 111.4 Do 17:30 P101

SuperWimp Baryogenesis — •Giorgio Arcadi — University of Goettingen, Friedrich-Hund-Platz 1, Goettingen, Germany

I will discuss the possibility for a common and contemporary generation of the baryon asymmetry and of the Dark Matter content of the Universe through the SuperWimp mechanism, namely the out-of-equilibrium decay of a mother particle. Although this mechanism can be effective in general particle physics frameworks, a natural playground is constituted by the Supersymmetric extensions of the Standard Model with gravitino Dark Matter. I will present several realizations of the mechanism featuring the generation of Dark Matter and baryon asymmetry at the Electroweak scale as well as at very high scales, typical of the popular thermal leptogenesis scenarios.

T 111.5 Do 17:45 P101

Constraints on internal bremsstrahlung in leptophilic dark matter models — •Juri Smirnov, Jochim Kopp, and Lisa Michaels — Max Planck Institut für Kernphysik

Due to technological advances of the last years the search for peaked gamma ray signals has become one of the most promising methods for Dark Matter search. Among the models proposed, those with a prominent gamma ray signal involving virtual internal bremsstrahlung have attracted a lot of interest recently. While the scenarios with Dark Matter coupling to quarks have been studied and constrained by several groups the leptophilic scenario is believed to be nearly unconstrained by direct detection experiments so far. We show in this paper that despite the fact that there is no direct Dark Matter nucleon coupling on tree level, at the one loop level an electromagnetic interaction occurs, which increases at the resonant point of the virtual internal bremsstrahlung process. This allows us to put new limits on this class of Dark Matter models. We investigate furthermore, several constraints from high precision experiments on the leptophilic DM scenario. To this end we calculate the expected effects on lepton flavour violation, Di-Lepton systems and anomalous magnetic moments.

T 111.6 Do 18:00 P101

Detection Prospects of singlet fermionic dark matter — •Sonja Esch, Michael Klasen, and Carlos E. Yaguna — Institut für Theoretische Physik, Universität Münster, Wilhelm-Klemm Straße 9, D-48149 Münster

A singlet fermion which interacts only with a new singlet scalar provides a viable and minimal scenario that can explain the dark matter. The singlet fermion is the dark matter particle whereas the new scalar mixes with the Higgs boson providing a link between the dark matter sector and the Standard Model.

In this talk, we present an updated analysis of this model focused on its detection prospects. Both, the parity-conserving case and the most general case are considered.

First, the full parameter space of the model is analyzed, and the regions compatible with the dark matter constraint are obtained and characterized. Then, the implications of current and future direct detection experiments are taken into account. Specifically, we determine the regions of the multidimensional parameter space that are currently excluded and those that are going to be probed by next generation experiments.

Finally, indirect detection prospects are discussed and the expected signal at neutrino telescopes is calculated.

T 111.7 Do 18:15 P101

Gaugino annihilation and co-annihilation into light and heavy quarks — Björn Herrmann[1], Michael Klasen[2], Karol Kovarik[2], Moritz Meinecke[2], and •Patrick Steppeler[2] — [1]LAPTh, Université de Savoie/CNRS, 9 Chemin de Bellevue, B.P. 110, F-74941 Annecy-le-Vieux, France — [2]Institut für Theoretische Physik, Westfälische Wilhelms-Universität Münster, Wilhelm-Klemm-Straße 9, D-48149 Münster, Germany

We present the full $\mathcal{O}(\alpha_s)$ supersymmetric QCD corrections for gaugino annihilation and co-annihilation into light and heavy quarks in the Minimal Supersymmetric Standard Model (MSSM). We demonstrate that these channels are phenomenologically relevant within the so-called phenomenological MSSM. Numerical results for the (co-)annihilation cross sections and the predicted neutralino relic density are presented. We show that the impact of including the corrections on the cosmologically preferred region of parameter space is larger than the current experimental uncertainty from PLANCK data.

T 111.8 Do 18:30 P101

The impact of SUSY-QCD-corrections to (co-)annihilation-processes on Neutralino Dark Matter — Julia Harz[1], Björn Herrmann[2], Michael Klasen[3], Karol Kovarik[3], •Moritz Meinecke[3], and Patrick Steppeler[3] — [1]University College London — [2]Laboratoire d'Annecy de Physique Théorique — [3]Institute of Theoretical Physics Münster

A powerful method to constrain the parameter space of theories beyond the Standard Model is to compare the predicted dark matter relic density with cosmological precision measurements, in particular

the Planck-data. On the particle physics side, the main uncertainty on the relic density arises from the (co-)annihilation cross sections of the dark matter particle. After a motivation for including higher order corrections in the prediction of the relic density, new results on the impact of stop-coannihilation on Neutralino-dark matter, calculated at the 1-loop-level in SUSY-QCD, as well as the importance of the so called Sommerfeld-enhancement will be discussed.

T 111.9 Do 18:45 P101

Higher Dimensional Effective Operators for Direct Dark Matter Detection — •Martin B. Krauss, Stefano Morisi, Werner Porod, and Walter Winter — Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Am Hubland, 97074 Würzburg, Germany

We discuss higher dimensional effective operators describing interactions between fermionic dark matter and Standard Model particles. They are typically suppressed compared to the leading order effective operators, which can explain why no conclusive direct dark matter detection has been made so far. The ultraviolet completions of the effective operators, which we systematically study, require new particles. These particles can potentially have masses at the TeV scale and can therefore be phenomenologically interesting for LHC physics. We demonstrate that the lowest order options require Higgs-portal interactions generated by dimension six operators. We list all possible tree-level completions with extra fermions and scalars, and we discuss the LHC phenomenology of a specific example with extra heavy fermion doublets.