T 58: Jenseits des Standardmodells 2 (Theorie)

Zeit: Dienstag 16:45–19:00 Raum: K.11.20 (K5)

T 58.1 Di 16:45 K.11.20 (K5)

Scrutinising Sterile Neutrino Dark Matter Production from Scalar Decays — Alexander Merle and •Maximilian Totzauer — Max-Planck-Institut für Physik (Heisenberg-Institut), Föhringer Ring 6, 80805 München

We investigate in detail the production of sterile neutrino dark matter from the decay of a scalar singlet to which the sterile neutrinos couple via a Yukawa-type interaction. The scalar couples to the Standard Model via a Higgs portal, the size of which determines whether or not the scalar singlet enters thermal equilibrium in the early Universe. If both couplings are chosen adequately, the mechanism can produce the correct observed relic abundance. While previous studies restricted themselves to limiting cases where the abundance and the momentum distribution are approximately accessible with analytic approaches, we present a fully numerical computation in order to cover the whole parameter space of the model. This allows us to gain deeper insight into the assumptions and simplifications usually made in the literature and it moreover yields refined results for the momentum distribution function of the sterile neutrino, which is the vital input quantity for the formation of large-scale structure in the Universe. In particular we show that the momentum distribution function can differ significantly from the analytical estimates present in the literature, which opens a wide range of possibilities for addressing the small scale problems in structure formation.

T 58.2 Di 17:00 K.11.20 (K5)

A minimal model for two-component dark matter — •Sonja Esch, Michael Klasen, and Carlos E. Yaguna — Institut für theoretische Physik, Universität Münster, Wilhelm-Klemm-Straße 9,D-48149 Münster, Germany

We propose and study a new minimal model for two-component dark matter. The model contains only three additional fields, one fermion and two scalars, all singlets under the Standard Model gauge group. Two of these fields, one fermion and one scalar, are odd under a Z_2 symmetry that renders them simultaneously stable. Thus, both particles contribute to the observed dark matter density. This model resembles the union of the singlet scalar and the singlet fermionic models but it contains some new features of its own. We analyze in some detail its dark matter phenomenology. Regarding the relic density, the main novelty is the possible annihilation of one dark matter particle into the other, which can affect the predicted relic density in a significant way. Regarding dark matter detection, we identify a new contribution that can lead either to an enhancement or to a suppression of the spin-independent cross section for the scalar dark matter particle. Finally, we define a set of five benchmarks models compatible with all present bounds and examine their direct detection prospects at planned experiments. A generic feature of this model is that both particles give rise to observable signals in 1-ton direct detection experiments. In fact, such experiments will be able to probe even a subdominant dark matter component at the percent level.

T 58.3 Di 17:15 K.11.20 (K5)

Role of electroweak radiation in predictions for dark matter indirect detection — •Leila Ali Cavasonza, Mathieu Pellen, and Michael Kraemer — RWTH Aachen, Sommerfeldstr. 16 52074 Aachen Germany

A very exciting challenge in particle and astroparticle physics is the exploration of the nature of dark matter. The evidences of the existence of dark matter are also the strongest phenomenological indications for physics beyond the Standard Model. A huge experimental effort is currently made at colliders and via astrophysical experiments to shed light on the nature of dark matter: dark matter may be produced at colliders or detected through direct and indirect detection experiments. The interplay and complementarity between these different approaches offers extraordinary opportunities to improve our understanding of the nature of dark matter or to set constraints on dark matter models.

In indirect detection one searches for dark matter annihilation products, that produce secondary antimatter particles like positrons and antiprotons. Such antimatter particles propagate through the Galaxy and can be detected at Earth by astrophysical experiments.

Particularly interesting is the importance of electroweak corrections to the predictions for the expected fluxes at Earth. The inclusion of EW radiation from the primary dark matter annihilation products can significantly affect the spectra of the secondary SM particles. The EW radiation can be described using fragmentation functions, as done for instance in QCD. We study the quality of this approximation in a simplified SUSY model and in a UED model.

T 58.4 Di 17:30 K.11.20 (K5)

Phenomenological constraints on an R-symmetric supersymmetric model — •Philip Diessner[1], Jan Kalinowski[2], Wojciech Kotlarski[1,2], and Dominik Stöckinger[1] — [1]IKTP, TU Dresden, Deutschland — [2]Universität Warschau, Polen

R-Symmetry in an additional symmetry which can be imposed on an supersymmetric model. In the Minimal R-Symmetric Supersymmetric Standard Model (MRSSM) this symmetry is incorporated and leads to interesting phenomenological consquences like the prediction of Dirac Gauginos. With an extended Higgs sector in this model it is possible to find different scenarios which can accomodate a Standard Model-like Higgs with a mass of around 125 GeV even with the absence of stop mixing.

In this talk, the analysis of the Higgs sector of the MRSSM will be presented. Results from scans in the parameter space of the model will be shown also taking into account other observables like the W-Boson mass and dark matter results. Also, differences and similarities of the MRSSM to the MSSM will be discussed.

T 58.5 Di 17:45 K.11.20 (K5)

Lepton Flavour violation in the RS model — •Paul Moch[1], Martin Beneke[1], and Jürgen Rohrwild[2] — [1]aPhysik Department T31, Technische Universität München, 85748 Garching, Germany — [2]Rudolf Peierls Centre for Theoretical Physics, University of Oxford, 1 Keble Road, Oxford OX1 3NP, United Kingdom

We consider charged lepton flavour observables in the Randall–Sundrum (RS) model with and without custodial protection.To this end, we apply a fully five dimensional (5D) framework to calculate the matching coefficients of the effective field theory at the electroweak scale. This enables us to compute predictions for the radiative decay $\mu \to e\gamma$ as well as the decay $\mu \to 3\,e$ and $\mu \to e$ conversion in nuclei.

T 58.6 Di 18:00 K.11.20 (K5)

Predicting Lepton Mixing Parameters including Majorana Phases from $\Delta(6n^2)$ Flavour Symmetry and Generalised CP — •Thomas Neder — University of Southampton, Southampton, UK

An important class of flavour groups that are subgroups of U(3) and that predict experimentally viable lepton mixing parameters including Majorana phases is the $\Delta(6n^2)$ series. The most well-known member is $\Delta(24)$=S_4. I present results of several extensive studies of lepton mixing predictions obtained in models with a $\Delta(6n^2)$ flavour group that preserve either the full Klein symmetry or a Z_2 subgroup for neutrinos and can include a generalised CP symmetry. Predictions include mixing angles and Dirac CP phase generally; and if invariance under a generalised CP symmetry is included, also Majorana phases. For this, the interplay of flavour group and generalised CP symmetry has to be studied carefully. Furthermore, I present results for neutrinoless double-beta decay.

T 58.7 Di 18:15 K.11.20 (K5)

Gauged Flavour Symmetry in Pati-Salam — •Florian Hartmann, Thorsten Feldmann, Wolfgang Kilian, and Christoph Luhn — Universität Siegen, Germany

We consider a grand unified theory based on the left-right symmetric Pati-Salam group. The maximal flavour symmetry of the gauge-kinetic terms, $SU(3)\times SU(3)$, is broken spontaneously by vacuum expectation values. The model contains additional fermionic quark (and lepton) partners, which introduce new sources of flavour violation in both, left- and right-handed quark transitions. These additional fermions cancel the flavour gauge anomalies and allow us to consider only renormalizable operators. The top and bottom partner can have a mass in the TeV range.

T 58.8 Di 18:30 K.11.20 (K5)

The search for Lorentz violation in the weak interaction — •K. Keri Vos, H.W. Wilschut, and R.G.E. Timmermans — van

Swinderen Insitute, University of Groningen, the Netherlands

In the last decades, the search for Lorentz symmetry violation has gained a lot of interest. Such searches are motivated by some unifying theories of quantum gravity, that predict the breakdown of Lorentz symmetry. Recently, the search has also been extended to the weak interaction, in particular beta decay. A theoretical framework was developed in which the Lorentz-violating effects on the W-boson propagator are parametrized by a general tensor $\chi^{\mu\nu}$. The strongest bounds have been found after a reanalysis of two experiments on forbidden beta decay. We discuss these bounds and the possibilities to improve them, focused on allowed beta decay.

T 58.9 Di 18:45 K.11.20 (K5)

On the Stability of the Parity Symmetry of the Scotogenic Model — Alexander Merle and •Moritz Platscher — Max-Planck-Institut fuer Physik, Foehringer Ring 6, 80805 Muenchen

We study the 1-loop structure of the scotogenic model - a simple extension of the SM by an inert scalar doublet and heavy singlet Majorana neutrino fields, all having odd charge under a Z_2 symmetry. This model can account for a variety of phenomena, such as small neutrino masses, lepton flavour violation and Dark Matter. In addition to the well-known theoretical and experimental bounds on the model's scalar sector, we consider the issue of naturalness which arises as the heavy Majorana fermions are coupled to the inert doublet and give rise to potentially large negative corrections to the corresponding scalar mass parameter. Thus, the right choice of model parameters is indespensible to keep the central parity symmetry intact.