T 22: Neutrinophysik (Theorie) II

Convenor: Werner Rodejohann

Zeit: Dienstag 16:45–18:45 Raum: HG XV

T 22.1 Di 16:45 HG XV

Neutrino masses from higher than d=5 effective operators — •Toshihiko Ota[1], Florian Bonnet[2], Daniel Hernandez[3], and Walter Winter[4] — [1]Max-Planck-Institut fuer Physik, Muenchen — [2]Universite Paris-Sud, Orsay, France — [3]Universidad Autonoma de Madrid, Spain — [4]Universitaet Wuerzburg, Wuerzburg

We discuss the generation of small neutrino masses from effective operators higher than dimension five, which open new possibilities for low scale see-saw mechanisms. In order to forbid the radiative generation of neutrino mass by lower dimensional operators, extra fields are required, which are charged under a new symmetry. We discuss this mechanism in the framework of a two Higgs doublet model. We demonstrate that the tree level generation of neutrino mass from higher dimensional operators often leads to inverse see-saw scenarios in which small lepton number violating terms are naturally suppressed by the new physics scale. Furthermore, we systematically discuss tree level generalizations of the standard see-saw scenarios from higher dimensional operators. Finally, we point out that higher dimensional operators can also be generated at the loop level. In this case, we obtain the TeV scale as new physics scale even with order one couplings.

T 22.2 Di 17:00 HG XV

keV sterile neutrino Dark Matter in gauge extensions of the Standard Model — •Hans Hettmansperger, Fedor Bezrukov, and Manfred Lindner — Max- Planck- Institut für Kernphysik, Postfach 103980, D-69029 Heidelberg, Germany

It is known, that a keV scale sterile neutrino is a good Warm Dark Matter (WDM) candidate. We realise this WDM possibility in the context of gauge extensions of the Standard Model (SM). The naive expectation leads to large thermal overproduction of sterile neutrinos in this setup. We find, that it is possible to use out-of-equilibrium decay of the other right-handed neutrinos of the model to dilute the present density of the keV sterile neutrinos and achieve the observed DM density. We present the universal requirements that should be satisfied by the gauge extensions of the SM, containing right handed neutrinos, to be viable models of WDM, and provide a simple example in the context of the Left-Right symmetric model.

T 22.3 Di 17:15 HG XV

Inverse seesaw mechanism in low-scale minimal trinification — •Christophe Cauet[1], Heinrich Päs[1], and Sören Wiesenfeldt[2] — [1]Institut für Physik, TU Dortmund, 44221 Dortmund, Germany — [2]Helmholtz Gemeinschaft, Anna-Louisa-Karsch-Straße 2, 10178 Berlin, Germany

We present a variation of the minimal $[SU(3)]^3 \times \mathbb{Z}_3$ trinification model with a low-scale mechanism for neutrino mass generation.

This is useful in scenarios where loop induced masses are supressed above some cut-off scale or high scales are absent in the theory in the first place, such as supersymmetry, extra dimensions, models implementing a large number of standard model copies or being motivated by AdS/CFT. For this purpose an inverse seesaw mechanism is specified, allowing the generation of light neutrino masses via a radiative seesaw with $\mathcal{O}(10^5 - 10^6\,\mathrm{GeV})$ loop contributions. It is remarkable that the parameter regions remaining allowed after requiring small neutrino mass generation in the inverse seesaw mechanism, also prevent fast proton decays.

T 22.4 Di 17:30 HG XV

Radiative Transmission of Lepton Flavor Hierarchies — •Adisorn Adulpravitchai[1], Manfred Lindner[1], Alexander Merle[1], and Rabindra Mohapatra[2] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Maryland Center for Fundamental Physics and Department of Physics, Maryland, USA

We discuss a one loop model for neutrino masses which leads to a seesaw-like formula with the difference that the charged lepton masses replace the unknown Dirac mass matrix present in the usual seesaw case. This is a considerable reduction of parameters in the neutrino sector and predicts a strong hierarchical pattern in the right handed neutrino mass matrix that is easily derived from a $U(1)_H$ family symmetry. The model is based on the left-right gauge group with an additional Z_4 discrete symmetry which gives vanishing neutrino Dirac masses and finite Majorana masses arising at the one loop level. Furthermore, it is one of the few models that naturally allow for large (but not necessarily maximal) mixing angles in the lepton sector. A generalization of the model to the quark sector requires three iso-spin singlet vector-like down type quarks, as in E_6. The model predicts an inert doublet type scalar dark matter.

T 22.5 Di 17:45 HG XV

Fourth Generation Neutrinos — •Dario Schalla and Heinrich Päs — Fakultät für Physik, TU Dortmund, D-44221 Dortmund, Germany

The number of fermion generations is treated as a parameter within the standard model and is fixed to three by experimental observations. The possibility of a yet undiscovered fourth sequential fermion generation will be discussed and motivated for the neutrino sector by considering constraints from direct searches, dark matter searches, neutrinoless double beta decay and leptogenesis. An enhancement of the latter one by the introduction of a fourth generation is investigated in the usual see-saw picture as well as with conformal neutrinos.

T 22.6 Di 18:00 HG XV

Finite Density Aspects of Leptogenesis — Mathias Garny[2], •Andreas Hohenegger[1], Alexander Kartavtsev[1], and Manfred Lindner[1] — [1]Max-Planck-Institut für Kernphysik — [2]Technische Universität München

Leptogenesis scenarios are based on the out-of-equilibrium decay of heavy Majorana neutrinos. This process takes place in the early universe at very high temperatures and a deviation from equilibrium is a fundamental requirement for the formation of the asymmetry. The equations used for its description originate from classical Boltzmann equations, which were refined using thermal propagators in the computation of the CP-violating parameter. In view of the basic restrictions of Boltzmann equations, it is desirable to develop an approach which uses non-equilibrium quantum field theory as starting point. On the other hand, it is simpler to solve Boltzmann equations rather than the corresponding quantum field theoretical ones. Therefore, we use modified Boltzmann equations which are derived from first principles in the Kadanoff-Baym formalism. The results found for a simple toy model are applied to a popular phenomenological scenario by analogy. This approach uncovers the structure of the corrected Boltzmann equations and leads to a new result for the form of the thermal contributions to the CP-violating parameter, so that the established derivation must be reconsidered. In contrast to the conventional result, the new form predicts an enhancement of the asymmetry even in the limit of massless decay products.

T 22.7 Di 18:15 HG XV

Baseline-dependent neutrino oscillations with extra-dimensional shortcuts — •Sebastian Hollenberg[1], Octavian Micu[1], Heinrich Päs[1], and Thomas J. Weiler[2] — [1]Fakultät für Physik, Technische Universität Dortmund, D-44221 Dortmund, Germany — [2]Department of Physics and Astronomy, Vanderbilt University, Nashville, Tennessee 37235, USA

In extra-dimensional scenarios oscillations between active and sterile neutrinos can be governed by a new resonance in the oscillation amplitude. This resonance results when cancelation occurs between two phase differences, the usual kinematic one coming from the neutrino mass-squared difference, and a new geometric one coming from the difference in travel times of the sterile neutrino through the bulk relative to the active neutrino confined to the brane. An asymmetrically-warped 4+1 dimensional metric is introduced for the brane-bulk system. In this case it is found that the resonance condition involves both the neutrino energy E and the travel distance L on the brane; to a good approximation the resonance condition is on the product LE. The model is rich in implications, including the possibility of multiple solutions to the resonance condition, with ramifications for existing data sets, e.g., LSND and MiniBooNE.

T 22.8 Di 18:30 HG XV

Neutrino-antineutrino oscillations as a possible solution for the LSND and MiniBooNE anomalies — •Octavian Micu, Se-

bastian Hollenberg, and Heinrich Pas — TU Dortmund

The LSND data the low energy signal in the MinibooNE data might be explained by CPT and Lorentz symmetry violating terms in the neutrino oscillations Hamiltonian. Resonance structures in CPT and Lorentz symmetry violating neutrino-antineutrino oscillations in a two generation framework are investigated.