

## T 21: Neutrinophysik (Theorie) 2

Convenor: Walter Winter

Zeit: Freitag 14:00–15:45

Raum: M109

T 21.1 Fr 14:00 M109

**Non-Standard Neutrino Interactions with Matter from Physics Beyond the Standard Model** — STEFAN ANTUSCH, JOCHEN P. BAUMANN, and ENRIQUE FERNANDEZ-MARTINEZ — Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), München

We investigate how non-standard neutrino interactions (NSI) with matter can be generated by new physics beyond the Standard Model (SM) and analyse the constraints on the NSIs in these SM extensions. We focus on tree-level realisations of lepton number conserving dimension 6 and 8 operators which do not induce new interactions of four charged fermions (since these are already quite constrained) and discard the possibility of cancellations between diagrams with different messenger particles to circumvent experimental constraints. The cases studied include classes of dimension 8 operators which are often referred to as examples for ways to generate large NSIs with matter. We find that, in the considered scenarios, the NSIs with matter are considerably more constrained than often assumed in phenomenological studies, at least  $\mathcal{O}(10^{-2})$ . The constraints on the flavour-conserving NSIs turn out to be even stronger than the ones for operators which also produce interactions of four charged fermions at the same level. Furthermore, we find that in all studied cases the generation of NSIs with matter also gives rise to NSIs at the source and/or detector of a possible future Neutrino Factory.

T 21.2 Fr 14:15 M109

**Large gauge-invariant non-standard neutrino interaction** — TOSHIHIKO OTA<sup>1</sup>, BELEN GAVELA<sup>2</sup>, DANIEL HERNANDEZ<sup>2</sup>, and WALTER WINTER<sup>1</sup> — <sup>1</sup>Institut fuer Theoretische Physik und Astrophysik, Universitaet Wuerzburg, Wuerzburg, Germany — <sup>2</sup>Departamento de Fisica Teorica and Instituto de Fisica Teorica UAM/CSIC, Universidad Autonoma de Madrid, Madrid, Spain

We discuss possible models for non-standard neutrino interactions by decomposing all possible dimension six and eight effective operators by their tree-level mediators. Taking into account the constraints from four charged lepton interactions, electroweak precision data, lepton universality, and the non-unitarity of the lepton mixing matrix, we find that large non-standard neutrino interactions from dimension eight operators are phenomenologically allowed in all flavour channels, and show that at least two new mediator particles and some cancellation conditions are required.

T 21.3 Fr 14:30 M109

**Lepton Flavor and CP Violation in mSUGRA** — FRANK DEPPISCH<sup>1</sup>, FLORIAN PLENTINGER<sup>2</sup>, WERNER POROD<sup>2</sup>, REINHOLD RÜCKL<sup>2</sup>, and GERHART SEIDL<sup>2</sup> — <sup>1</sup>School of Physics and Astronomy, University of Manchester, United Kingdom — <sup>2</sup>Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Germany

We survey the lepton flavor violation decay rates  $\text{Br}(\mu \rightarrow e\gamma)$ ,  $\text{Br}(\tau \rightarrow \mu\gamma)$ , and  $\text{Br}(\tau \rightarrow e\gamma)$ , in mSUGRA at the level of the fundamental Lagrangian for a broad class of non-trivial lepton mass matrices that give nearly tribimaximal lepton mixing. SUSY SU(5) GUT models with non-Abelian discrete flavor symmetries as feasible origin will be presented. Moreover, we study the lepton flavor violation branching ratios for the most general CP-violating forms of the mass matrices. We show that the branching ratios are roughly enhanced by an order of magnitude as compared to the real case. The branching ratios exhibit, however, a strong dependence on the choice of the phases. In

particular, for general CP-phases, the LFV-rates appear to be largely uncorrelated with the possible high- and low-energy lepton mixing parameters.

T 21.4 Fr 14:45 M109

**Lepton-Flavor violation in a neutrino mass model with discrete  $S_3$  symmetry** — PHILIPP LESER and HEINRICH PÄS — Institut für Physik, TU Dortmund, 44221 Dortmund, Germany

A discrete family symmetry using the group  $S_3$  is able to explain the observed maximal mixing in the lepton sector while maintaining the ability to generate the observed CKM angles (Chen, Frigerio, Ma, hep-ph/0404084). The model requires an enlarged Higgs sector which includes features that might be used to test the model experimentally, such as scalar Higgs particles with different masses and manifestly non-zero matrix elements for lepton flavor violating decays. We investigate distinct channels, in particular lepton flavor violating ones, and compare model predictions with experimental bounds and predictions of alternative scenarios.

T 21.5 Fr 15:00 M109

**Neutrinos and Trinification** — CHRISTOPHE CAUET<sup>1</sup>, HEINRICH PÄS<sup>1</sup>, and SÖREN WIESENFELDT<sup>2</sup> — <sup>1</sup>Institut für Physik, TU Dortmund, 44221 Dortmund, Germany — <sup>2</sup>Institut für Theoretische Teilchenphysik, Universität Karlsruhe, 76128 Karlsruhe, Germany

We revisit the minimal  $SU(3)_C \times SU(3)_L \times SU(3)_R \times \mathbb{Z}_3$  Trinification model proposed by J. Sayre, S. Wiesenfeldt and S. Willenbrock in 2006. While the model predicts proton decay rates above the experimental limits and incorporates successful gauge coupling unification without the need for supersymmetry, it predicts small mixing for solar neutrinos, which has been ruled out by the KamLAND experiment. The scenario is updated in view of recent neutrino data and phenomenological consequences are discussed.

T 21.6 Fr 15:15 M109

**Neutrino masses in supersymmetric models with broken R-parity** — STEFAN LIEBLER — Institut für Theoretische Physik und Astrophysik, Universität Würzburg, D-97074 Würzburg

Supersymmetric models provide an interesting solution to neutrino physics, which intrinsically is supersymmetric namely the breaking of R-parity. We will explain the main features using the so called  $\mu\nu$ SSM. In addition we will also discuss the changes of this mechanism for neutrino masses in other models of R-parity breaking.

T 21.7 Fr 15:30 M109

**Neutrino masses and Lepton-Flavor violation in R-Parity violating Supersymmetry** — HEINRICH PÄS and DANIEL PIDT — Institut für Physik, TU Dortmund, 44221 Dortmund, Germany

Supersymmetry with trilinear R-parity violation (RPV) provides an interesting framework for the generation of neutrino masses without the need to introduce heavy right handed neutrinos. Within this framework we discuss the constraints on the RPV coupling products arising from a correct generation of the neutrino mass matrix in flavor space and the implications imposed on the decay rates of the lepton flavour violating decays  $\mu \rightarrow 3e$ ,  $\mu \rightarrow e\gamma$  and the  $\mu \rightarrow e$  conversion in nuclei. We further compare the results with the predictions in standard see-saw scenarios and investigate the two P-odd asymmetries which can be defined in the polarised  $\mu \rightarrow 3e$  decay.