T 87: Neutrinophysik (Theorie)

Convenor: W. Rodejohann

Zeit: Mittwoch 16:45–19:00 Raum: VSH 05

T 87.1 Mi 16:45 VSH 05

Coherent Neutrino-Nucleus Scattering and new Neutrino Interactions — •Xunjie Xu, Manfred Lindner, and Werner Rodejohann — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

We investigate the potential to probe new neutrino physics with future experiments measuring coherent neutrino-nucleus scattering. Experiments with high statistics should become feasible soon and allow to constrain parameters with unprecedented precision. Using a benchmark setup for a future experiment probing reactor neutrinos, we study the sensitivity on neutrino non-standard interactions and new exotic neutral currents (scalar, tensor, etc). Compared to Fermi interaction, percent and permille level strengths of the new interactions can be probed, superseding for some observables the limits from future neutrino oscillation experiments by up to two orders of magnitude.

T 87.2 Mi 17:00 VSH 05

Discriminating sterile neutrinos and unitarity violation with CP invariants — •Philipp Sicking and Heinrich Päs — TU Dortmund

We present a new method to analyze upcoming results in the search for CP violating neutrino oscillations. The CP violating amplitudes $\mathcal{A}^{kj}_{\alpha\beta}$ provide parametrization independent observables, which will be accessible by experiments soon. The strong prediction of a unique $\mathcal{A}^{kj}_{\alpha\beta}$, the Jarlskog invariant, in case of the standard three neutrino model does not hold in models with new physics beyond the Standard Model. Nevertheless there are still correlations among the amplitudes depending on the specific model. Due to these correlations it is possible to reject specific new physics model by determining only 3 of the CP violating amplitudes.

T 87.3 Mi 17:15 VSH 05

Sizable NSI from the SU(2)_L scalar doublet-singlet mixing and the implications in DUNE — •Wei-Chih Huang — Technische Universitaet Dortmund, Dortmund, Germany

We propose a novel and simple mechanism where sizable effects of non-standard interactions (NSI) in neutrino propagation are induced from the mixing between an electrophilic second Higgs doublet and a charged singlet. The mixing arises from a dimensionful coupling of the scalar doublet and singlet to the standard model Higgs boson. In light of the small mass, the light mass eigenstate from the doublet-singlet mixing can generate much larger NSI than those induced by the heavy eigenstate. We show that a sizable NSI (~0.3) can be attained without being excluded by a variety of experimental constraints. Furthermore, we demonstrate that NSI can mimic effects of the Dirac CP phase in the neutrino mixing matrix but they can potentially be disentangled by future long-baseline neutrino experiments, such as the Deep Underground Neutrino Experiment (DUNE).

T 87.4 Mi 17:30 VSH 05

Charged-lepton decays from soft flavour violation in a two-Higgs doublet seesaw model — •Elke Aeikens[1], Walter Grimus[1], and Luís Lavoura[2] — [1]University of Vienna — [2]CFTP Lisboa

Extensions of the Standard Model with right-handed neutrinos ν_R in the framework of the seesaw mechanism are popular to explain the smallness of the neutrino masses. In our model, we additionally allow a second Higgs double. And to avoid lepton flavour-changing neutral-scalar interactions at tree level, we impose lepton flavour violation solely in the non-flavour-diagonal Majorana mass matrix of the right-handed neutrinos whereas all Yukawa-coupling matrices are lepton flavour-diagonal. We show explicit in framework that the branching ratios of the charged-lepton decays $\ell_1^- \to \ell_2^- \ell_3^+ \ell_3^-$ are close to their experimental upper bounds, while the branching ratios of other lepton flavour-changing decays, are invisible because they are suppressed by m_R^{-4}, where m_R is the seesaw scale. Considering the anomalous magnetic moment of the muon, in our model the contributions from the extra scalars can remove the discrepancy between its experimental and theoretical values.

T 87.5 Mi 17:45 VSH 05

Testing neutrino mass generation at the GeV scale: experimental reach versus theoretical predictions — •Rasmus Westphal Rasmussen and Walter Winter — Desy, Platanenallee 6, 15738 Zeuthen

We discuss the parameter space reach of future experiments searching for sterile neutrinos at the GeV scale in terms of neutrino mass models with three generations. We investigate two classes of models: one tends to be partially within reach, whereas the other case yield more refined predictions. We also highlight the importance to measure the flavor-dependent couplings of the sterile neutrinos as a model discriminator, and we clarify the impact of assumptions frequently used in the literature to show the parameter space reach for the active-sterile mixings.

T 87.6 Mi 18:00 VSH 05

Sterile neutrino searches at future electron-positron, proton-proton, and electron-proton colliders — Stefan Antusch[1,2], •Eros Cazzato[1], and Oliver Fischer[1] — [1]Department of Physics, University of Basel, Klingelbergstrasse 82, CH-4056 Basel, Switzerland — [2]Max-Planck-Institut Für Physik (Werner-Heisenberg-Institut), Föhringer Ring 6, D-80805 München, Germany

Sterile neutrinos are among the most attractive extensions of the SM to generate the light neutrino masses observed in neutrino oscillation experiments. When the sterile neutrinos are subject to a protective symmetry, they can have Majorana masses around the electroweak scale and potentially large neutrino Yukawa couplings, which makes them testable at the planned Future Circular Colliders. In this talk I outline a systematic assessment of the signatures for sterile neutrino searches at electron-positron, proton-proton and electron-proton colliders. I present preliminary results on foreseeable sensitivities of the most promising signatures and compare the performance of the different collider types.

T 87.7 Mi 18:15 VSH 05

From *CP* Phases to Yukawa Textures - Maximal Yukawa Hierarchies in Minimal Seesaw Models — •Thomas Rink and Kai Schmitz — Max-Planck-Institut für Kernphysik, Heidelberg, Deutschland

The type-I seesaw mechanism involving only two right-handed neutrinos represents a minimal model to account for the observed masses and mixings in the Standard Model neutrino sector. It features four real parameters that cannot be fully fixed by the current data: two *CP*-violating phases, δ and σ, as well as one complex parameter, z, that is experimentally inaccessible at low energies. We perform a systematic scan over the complex z plane and study maximal hierarchies in the neutrino Yukawa matrix that are still consistent with observations for given values of δ and σ. Our analysis generalizes previous studies of so-called texture zeros in the neutrino Yukawa matrix and demonstrates that relaxing this assumption significantly enlarges the range of possible Yukawa matrices. Allowing for small corrections, models with an approximate two-zero texture can be realized even in the case of a normally ordered light-neutrino mass spectrum, which is usually ruled out in this framework. For the inverted hierarchy, we further show that small perturbations can resurrect Yukawa textures which were inconsistent with observations. Our analysis is based on a novel *hierarchy parameter* that allows us to assess to what extent any given Yukawa matrix exhibits a certain flavor texture. Generalization of this parameter paves the way for similar studies in other neutrino mass models.

T 87.8 Mi 18:30 VSH 05

Extra Dimensional Seesaw Mechanism — •Mathias Becker — TU Dortmund, Deutschland

An extra dimensional model is presented where the brane is shifted away from the fixed points of the extra dimension and one right handed neutrino field is introduced.
The right handed neutrino is able to propagate in the extra dimension, thereby allowing for an extra dimensional seesaw mechanism.
It is investigated if this setup is capable of producing the observed neutrino masses and mixing. Additionally, some phenomenological consequences, e.g. rare lepton decays, are studied.

T 87.9 Mi 18:45 VSH 05

Neutrino assisted GUT baryogenesis - revisited — •Sinan Zeissner — TU-Dortmund, Germany

Many GUT models conserve $B - L$. This results in heavy Higgs or gauge boson decays with $\Delta(B + L) \neq 0$ but with $\Delta(B - L) = 0$. Since sphaleron processes violate $B + L$ as well, such an asymmetry will be washed out completely. We will revisit the idea to revive GUT baryogenesis where right-handed neutrinos wash out the L asymmetry before sphaleron processes can significantly wash out the original $B+L$ asymmetry. This way a total washout of the initial baryon asymmetry can be prevented. At the same time one can explain the neutrino mass differences and to combine this idea with the scotogenic model to produce DM. (arXiv:1608.04354)