T 21: Neutrinophysik (Theorie) I

Convenor: Werner Rodejohann

Zeit: Montag 16:45–18:30 Raum: HG XV

T 21.1 Mo 16:45 HG XV

Neutrino factory in stages: low energy, high energy, off-axis — •Jian Tang — Institute of theoretical physics and astrophysics, Wuerzburg University

We discuss neutrino oscillation physics with a neutrino factory in stages, including the possibility of upgrading the muon energy within the same program. We point out that a detector designed for the low energy neutrino factory may be used off-axis in a high energy neutrino factory beam. We include the re-optimization of the experiment depending on the value of θ_{13} found. As upgrade options, we consider muon energy, additional baselines, a detector mass upgrade, an off-axis detector, and the platinum (muon to electron neutrino) channels. In addition, we test the impact of Daya Bay data on the optimization. We find that for large θ_{13} (θ_13 discovered by the next generation of experiments), a low energy neutrino factory might be the most plausible minimal version to test the unknown parameters. However, if a higher muon energy is needed for new physics searches, a high energy version including an off-axis detector may be an interesting alternative. For small θ_13 (θ_13 not discovered by the next generation), a plausible program could start with a low energy neutrino factory, followed by energy upgrade, and then baseline or detector mass upgrade, depending on the outcome of the earlier phases.

T 21.2 Mo 17:00 HG XV

One pion production in electron- and neutrino- scattering on nuclei — •Olga Lalakulich, Tina Leitner, Oliver Buss, and Ulrich Mosel — Institut für Theoretische Physik, Universität Giessen

The interest in one-pion production has recently been revived by the modern long-baseline experiments, searching for neutrino oscillations. Besides being important as an exclusive channel, pion production constitutes a noticeable background for other processes. A precise knowledge of the corresponding cross sections is a prerequisite for the proper interpretation of the experimental data.

We investigate one-pion production reactions, presenting the elementary lepton–nucleon interaction vertex as the sum of the leading Δ–pole diagram and several background diagrams calculated within the non-linear σ–model. This approach does not introduce any new adjustable parameters, which allows unambiguous predictions for the observables. The analysis is done for electro- (as a benchmark) and neutrino- production. The results obtained are compared with the experimental data for various differential cross sections, including muon-nucleon and muon-pion invariant-mass distributions. Neutrino interactions with nuclei are treated within the GiBUU transport model that takes into account various nuclear effects.
Work supported by DFG.

T 21.3 Mo 17:15 HG XV

Core-collapse supernovae: when neutrinos interact each other — •Irene Tamborra — Dep. of Physics and INFN, Bari, Italy — MPI for Physics, Munich, Germany

In core-collapse supernovae, the neutrino density is high enough to render the nu-nu interactions not negligible. In particular, they can couple the flavor evolution of neutrinos and induce collective flavor changes. We discuss the most important feature observable in the energy spectra (the so called spectral split), both in the case of luminosity equipartition among flavors and for unconstrained luminosities. The spectral split pattern is shown to depend strongly on the initial luminosity for each flavor and the neutrino mass hierarchy. Pure collective three-flavor effects are analyzed also.

T 21.4 Mo 17:30 HG XV

Prospects for detection of relic neutrinos with KATRIN-like experiments — Steen Hannestad[2] and •Anna Sejersen Riis[1,2] for the KATRIN-Collaboration — [1]Institut für Kernphysik, Westfälische Wilhelms-Universität Münster, Germany — [2]Department of Physics and Astronomy, Aarhus University, Denmark

In principle the KATRIN experiment can be used to detect the relic neutrino background through neutrino capture on the Tritium molecules of the KATRIN source.

In a scenario with one standard active neutrino species and one massive sterile species we first calculate the KATRIN sensitivity to both neutrino masses using the Marcov Chain Monte Carlo methods of COSMOMC. This is performed for a large range of mass differences and mixing angles.

We then enhance the KATRIN energy resolution, background and electron count rate near the beta spectrum end point in order to put some bounds on the experimental parameters needed to detect a relic neutrino with a given mass and mixing angle in our scenario

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T 21.5 Mo 17:45 HG XV

Exotic Higgs decays in a neutrino mass model with discrete S_3 symmetry — Gautam Bhattacharyya[1], •Philipp Leser[2], and Heinrich Päs[2] — [1]Saha Institute of Nuclear Physics, Kolkata, India — [2]Technische Universität Dortmund, Germany

Exotic Higgs decays can arise in lepton flavor models with horizontal symmetries. We investigate the scalar sector of a neutrino mass model using an S_3 family symmetry as an example. The model's symmetry leads to an enlarged scalar sector with features that might be used to test the model experimentally, such as scalar particles with masses below 1 TeV and manifestly non-zero matrix elements for lepton flavor violating decays. We compare different decay channels of the scalars as well as leptonic processes that violate lepton flavor, in order to compare model predictions with experimental bounds.

T 21.6 Mo 18:00 HG XV

Deviations from TBM in A_4 neutrino mass models — •James Barry[1], Werner Rodejohann[1], and Steven Karataglidis[2] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Rhodes University, Grahamstown, South Africa

The addition of an A_4 family symmetry and extended Higgs sector to the Standard Model can generate the tri-bimaximal mixing (TBM) pattern, assuming the correct vacuum expectation value (VEV) alignment of the Higgs scalars. Deviating this alignment affects the model predictions for the neutrino oscillation and neutrino mass observables.

Models with different A_4 particle assignments have been analysed for deviations from TBM, by perturbing the VEV alignments, diagonalising the resulting neutrino and charged lepton mass matrices, and extracting the observables.

The models have been tested for any degree of fine tuning of the parameters that define the mass matrices. The effect of perturbations on the mixing angle observables, in particular $\sin^2\theta_{13}$ and $\sin^2\theta_{23}$ is studied, as well as the effect on the Jarlskog invariant, J_{CP}. Investigations of the $\langle m_{ee}\rangle - \sum m_\nu$ parameter space allow for comparison with current data from neutrinoless double beta decay experiments and cosmology, and can lead to the possible exclusion of a particular model by constraints from future data.

T 21.7 Mo 18:15 HG XV

Neutrino Mass Constraints and a Simple Model of R-Parity Violation — Gautam Bhattacharyya[1], Heinrich Päs[2], and •Daniel Pidt[2] — [1]Saha Institute of Nuclear Physics, Kolkata - 700 064, India — [2]Institut für Physik, TU Dortmund, 44221 Dortmund, Germany

Supersymmetry without R-Parity naturally leads to nonzero (Majorana-) neutrino masses without the need to introduce heavy righthanded neutrinos or additional generations. However, the most general ansatz introduces 48 new couplings to the superpotential and therefore leads to a lack of predictivity. We discuss a simple model based on the combination of two flavor symmetries which reduces the number of independent couplings to six and confront these with present experimental neutrino constraints. We further investigate the resulting implications for other processes.