T 20: Neutrinophysik (Theorie)

Convenor: Stefan Antusch

Zeit: Montag 16:45–18:30 Raum: 30.23: 3-1

T 20.1 Mo 16:45 30.23: 3-1

$\sin^2\theta_{12}$ and $0\nu\beta\beta$–decay: Excluding the inverted neutrino–mass hierarchy — •Alexander Dueck — Max-Planck-Institut für Kernphysik, Postfach 103980, D-69029 Heidelberg, Germany

The observation of $0\nu\beta\beta$–decay would establish the nature of the neutrino as a Majorana particle. Furthermore, the $0\nu\beta\beta$–decay rate, or limits on it, will provide information about the absolute neutrino–mass scale and possibly determine the neutrino mass hierarchy. To convert experimental half–lifes to an effective electron neutrino mass m_ν, one needs to know the nuclear matrix elements (NME) of the considered decay. After reviewing how to get half–lifes from NMEs we point out the difficulties which can arise thereby and present NME values from different calculations. We scaled these NMEs to make them directly comparable.

But also of great importance is knowledge of the neutrino mixing parameters. We examine the influence of the solar neutrino mixing angle θ_{12} on the prospects to exclude the inverted neutrino–mass hierarchy by $0\nu\beta\beta$–decay experiments and emphasize that a better knowledge of $\sin^2\theta_{12}$ is desirable. Predictions for the half–life sensitivity which is needed to exclude the IH are shown for different $0\nu\beta\beta$–decay candidate isotopes. NMEs from the Nuclear Shell Model, the Quasiparticle Random Phase Approximation, and the Interacting Boson Model are used and the half–lifes obtained for different values of the solar neutrino mixing angle θ_{12} are compared.

T 20.2 Mo 17:00 30.23: 3-1

Lepton Number Violating New Physics and Neutrinoless Double Beta Decay — •Michael Duerr[1], Manfred Lindner[1], and Alexander Merle[1,2] — [1]Max-Planck-Institut für Kernphysik, Heidelberg, Germany — [2]Royal Institute of Technology (KTH), Stockholm, Sweden

Neutrinoless double beta decay is a very sensitive experimental probe for lepton number violating ($\Delta L = 2$) physics beyond the Standard Model. Whatever the new physics mechanism is that triggers the decay, according to the well known Schechter-Valle (or Black Box) theorem, it will induce a Majorana mass term for neutrinos. Neutrinoless double beta decay is therefore the only known possibility to ascertain in the foreseeable future whether the neutrino is a Dirac or a Majorana particle. We discuss the relation between various lepton number violating operators, Majorana neutrino masses, and future experiments.

T 20.3 Mo 17:15 30.23: 3-1

The role of neutrino mass observables in distinguishing neutrino mass models — •James Barry — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

Knowledge of the nature of neutrino mass is crucial in making progress in the search for beyond the Standard Model physics. The current literature contains a plethora of models attempting to explain this phenomenon, but since those models generally make similar predictions, one needs a method to distinguish them. Although no single method can provide this discriminating power, the three neutrino mass observables play an important role. These are: the sum of absolute neutrino masses ($\sum m_i$), the kinematic electron neutrino mass in beta decay (m_β) and the effective mass for neutrino-less double beta decay ($\langle m_{ee}\rangle$).

The $\sum m_i - m_\beta - \langle m_{ee}\rangle$ parameter space has been studied for two different A_4 flavour symmetry models, and for models that contain a sum-rule between light neutrino masses. A simultaneous measurement of two or more observables could in principle be used to rule out certain cases. In addition, a non-standard model for neutrino mass has been analysed, where neutrino mass eigenstates can be either Dirac or Majorana (the bimodal flavour hypothesis). In this case distinct features emerge for $\langle m_{ee}\rangle$, so that the model could be excluded by the next generation of double beta decay experiments.

T 20.4 Mo 17:30 30.23: 3-1

Neutrino masses and a generic 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 provides a natural way to generate experimentally viable neutrino masses. In the most general case this adds 48 new complex parameters to the superpotential of the MSSM. We present an economic way based on two generic flavor symmetries to reduce the number of independent new couplings to six and investigate the resulting phenomenological consequences arising from the requirement to correctly reproduce neutrino oscillations.

T 20.5 Mo 17:45 30.23: 3-1

Constraints on fourth generation Majorana neutrinos — •Dario Schalla[1], Heinrich Päs[1], and Alexander Lenz[2] — [1]Department of Physics, TU Dortmund, D-44221 Dortmund, Germany — [2]Institut für Theoretische Physik, Universität Regensburg, D-93040 Regensburg, Germany

We investigate the possibility of a fourth sequential generation in the lepton sector. Assuming neutrinos to be Majorana particles and starting from a recent - albeit weak - evidence for a non-zero admixture of a fourth generation neutrino from fits to weak lepton and meson decays we discuss constraints from neutrinoless double beta decay, radiative lepton decay and like-sign dilepton production at hadron colliders.

T 20.6 Mo 18:00 30.23: 3-1

New physics searches at near detectors of neutrino oscillation experiments — Stefan Antusch, Mattias Blennow, Enrique Fernandez-Martinez, and •Toshihiko Ota — Max-Planck-Institut fuer Physik, Muenchen, Germany

We systematically investigate the prospects of testing new physics with tau sensitive near detectors at neutrino oscillation facilities. For neutrino beams from pion decay, from the decay of radiative ions, as well as from the decays of muons in a storage ring at a neutrino factory, we discuss which effective operators can lead to new physics effects. Furthermore, we discuss the present bounds on such operators set by other experimental data currently available. For operators with two leptons and two quarks we present the first complete analysis including all relevant operators simultaneously and performing a Markov Chain Monte Carlo fit to the data. We find that these effects can induce tau neutrino appearance probabilities as large as the order of ten to minus fourth, which are within reach of forthcoming experiments. We highlight to which kind of new physics a tau sensitive near detector would be most sensitive.

T 20.7 Mo 18:15 30.23: 3-1

Where is the optimized neutrino factory? — •jian tang — Institute of Theoretical Physics and Astrophysics, Wuerzburg University, 97074 Wuerzburg, Germany

We perform the baseline and energy optimization of the Neutrino Factory including the latest analysis of the magnetized iron detector (MIND). We also consider the impact of τ decays, generated by $\nu_\mu \to \nu_\tau$ or $\nu_e \to \nu_\tau$ appearance, on the mass hierarchy, CP violation, and θ_{13} discovery reaches, which we find to be negligible for the considered detector.

Apart from a green-field study of the new detector performance, we discuss specific implementations for the two-baseline Neutrino Factory, where the detector sites considered are taken to be the currently discussed underground laboratories all over the world. We find that reasonable setups can be found for the Neutrino Factory independent of the continent the neutrino source is located at.