T 20: Neutrinophysik (Theorie) 1

Convenor: Walter Winter

Zeit: Donnerstag 16:45–18:45 Raum: M109

T 20.1 Do 16:45 M109

The GSI anomaly — •Alexander Merle — Max-Planck-Institut für Kernphysik, Heidelberg

A recent experiment at GSI Darmstadt has measured an oscillatory modulation of the electron capture decay rates of heavy ions, which was attributed to neutrino mixing by some authors. This caused a lot of discussion in the community. Here, the experimental results are reviewed and it is shown, unsing quantum field theory why the neutrino mixing explanation cannot be the correct.

T 20.2 Do 17:00 M109

Oscillations of Mössbauer neutrinos — •Joachim Kopp — Max Planck Institut für Kernphsyik, Heidelberg

Recently, Raghavan has proposed an experiment to study neutrinos emitted and absorbed in recoil-free processes. We discuss the theory of these "Mössbauer neutrinos", paying special attention to the oscillation phenomenology. In particular, we will show that, in spite of their small energy uncertainty, Mössbauer neutrinos can oscillate. After giving quantum mechanical arguments to support this statement, we will compute the combined rate of emission, propagation and absorption of Mössbauer neutrinos in the framework of quantum field theory. This approach allows us to avoid making any a priori assumptions on the neutrino wave function, and automatically yields the appropriate decoherence and delocalization factors. It will turn out that these factors, which could in principle suppress neutrino oscillations, are irrelevant under realistic experimental conditions.

T 20.3 Do 17:15 M109

An accurate analytic description of neutrino oscillations in matter — •Viviana Niro — Max-Planck-Institut fuer Kernphysik, Heidelberg, Germany

We present a simple closed-form analytic expression for the probability of two-flavour neutrino oscillations in a matter with an arbitrary density profile. Our formula is based on a perturbative expansion and allows an easy calculation of higher order corrections. We demonstrate the validity of our results using a few model density profiles, including the PREM density profile of the Earth.

T 20.4 Do 17:30 M109

Physics reach of a high gamma Li/B BetaBeam — •Enrique Fernandez Martinez — Max-Planck-Institut fuer Physik (Werner-Heisenberg-Institut) Foehringer Ring 6 D-80805 München

We consider a β-Beam facility where ^{8}Li and ^{8}B ions are accelerated at $\gamma = 350$, accumulated in a 10 Km storage ring and let decay, so as to produce intense $\bar{\nu}_e$ and ν_e beams. These beams illuminate two magnetized iron detectors located at $L \simeq 2000$ Km and $L \simeq 7000$ Km, respectively. The physics potential of this setup is analysed in full detail as a function of the flux. We find that, for the highest flux considered (10×10^{18} ion decays per year per baseline), the sensitivity to θ_{13} reaches $\sin^2 2\theta_{13} \geq 1 \times 10^{-4}$; the sign of the atmospheric mass difference can be identified, regardless of the true hierarchy, for $\sin^2 2\theta_{13} \geq 3 \times 10^{-4}$; and, CP violation can be discovered in 70% of the δ-parameter space for $\sin^2 2\theta_{13} \geq 10^{-3}$, having some sensitivity to CP violation down to $\sin^2 2\theta_{13} \geq 2 \times 10^{-4}$ for $|\delta| \sim 90°$.

T 20.5 Do 17:45 M109

Collective supernova neutrino oscillations — •Alessandro Mirizzi — Max Planck Institute for Physics, Munich, Germany

Neutrinos emitted by core-collapse supernovae (SNe) represent an important laboratory for both particle physics and astrophysics. While propagating in the dense SN environment, they can feel not only the presence of background matter (via ordinary Mikheev-Smirnov-Wolfenstein effects) but also of the gas of neutrinos and antineutrinos (via neutrino-neutrino interaction effects). The neutrino-neutrino interactions appear to modify the flavor evolution of SN neutrinos in a collective way, completely different from the ordinary matter effects. In these conditions, the flavor evolution equations become highly nonlinear, sometimes resulting in surprising phenomena when the entire neutrino system oscillates coherently as a single collective mode.

In this talk, I will present the recent results on collective supernova neutrino flavor conversions and I will discuss about the sensitivity of these effects to the ordering of the neutrino mass spectrum.

T 20.6 Do 18:00 M109

Baseline Dependence of Active-sterile Neutrino Mixing in the Presence of Extra-dimensional Shortcuts — •Octavian Micu[1], Sebastian Hollenberg[1], Heinrich Pas[1], and Thomas Weiler[2] — [1]TU Dortmund, Dortmund, Germany — [2]Vanderbilt University, Nashville TN, USA

We investigate resonances in active-sterile neutrino oscillations arising in theories with large extra dimensions, which may be relevant in explanations of the LSND anomaly. We consider a scenario with a warped extra dimension. Neutrino oscillations appear due to the different travel times of the active neutrinos, which are confined to the brane, and the sterile neutrinos, which take shortcuts through the extra dimension. We demonstrate that the dispersion relation turns out to be baseline dependent.

T 20.7 Do 18:15 M109

Resonant active-sterile neutrino mixing in the presence of matter potentials and altered dispersion relations — •Sebastian Hollenberg and Heinrich Päs — Technische Universität Dortmund, Theoretische Physik III, 44221 Dortmund, Germany

We examine the resonance structure in a two state active-sterile neutrino oscillation scheme in the presence of matter effects and altered dispersion relations. Matter potentials in the (flavour space) Schrödinger equation describing neutrino oscillations arise due to coherent elastic forward scattering of neutrinos in matter, whereas altered dispersion relations may arise in scenarios allowing for extra-dimensional shortcuts or Lorentz invariance violation.

We show that combining matter effects and altered dispersion relations gives rise to new resonance features in the oscillation probability. The resonance structure does depend on the mass hierarchy of active and sterile neutrinos as well as on whether we are considering particles or antiparticles. Moreover it is shown that combining matter and altered dispersion relations effects lead to narrower resonances as compared to altered dispersion relations in vacuo.

T 20.8 Do 18:30 M109

Confusing neutrino NSI with non-zero leptonic θ_{13} — •Mattias Blennow — MPI für Physik, München, Germany

We will discuss the phenomenology of neutrino non-standard interactions (NSI). Special attention will be given to degeneracies between NSI and the standard neutrino oscillation parameters at present and future experiments. In particular, we will discuss how the small leptonic mixing angle θ_{13} can be confused with NSI in different scenarios.