

T 41: Neutrinophysik (Theorie)

Zeit: Montag 16:45–19:00

Raum: P108

T 41.1 Mo 16:45 P108

New Dirac Leptogenesis — ●JULIAN HEECK — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

Dirac neutrinos with lepton-number-violating interactions can give rise to a new leptogenesis mechanism. In its simplest renormalizable realization, based on a gauged $B - L$ symmetry spontaneously broken by four units, the decay of a new scalar creates an asymmetry in the right-handed neutrinos. A neutrinophilic two-Higgs-doublet model converts this asymmetry to the baryons, provides a natural explanation of the small neutrino masses, and can lead to an effective number of relativistic degrees of freedom of $N_{\text{eff}} = 3.29$ due to the entropy-suppressed contribution of the right-handed neutrinos.

T 41.2 Mo 17:00 P108

Leptogenesis and CP violation in SU(5) models with lepton flavor mixing originating from the right-handed sector — ●ERIK SCHUMACHER and HEINRICH PÄS — TU Dortmund, Deutschland

We discuss neutrino masses and mixing in the context of seesaw type I models with three right-handed Majorana neutrinos and an approximately diagonal Dirac sector. This ansatz is motivated by the idea that the flavor structure in the right-handed Majorana masses is responsible for the large mixing angles, whereas the small mixing angle θ_{13} originates from the Dirac Yukawa couplings in analogy to the quark sector. To obtain $\theta_{13} \approx 0.15$ we study a possible SU(5) GUT realization with a $U(1) \times \mathbb{Z}'_2 \times \mathbb{Z}''_2 \times \mathbb{Z}'''_2$ flavor symmetry and include a complex perturbation parameter in the Dirac mass matrix. The consequences for CP violating phases and effects on leptogenesis are investigated.

T 41.3 Mo 17:15 P108

Neutrino masses and dark matter in gauge theories for baryon and lepton numbers — ●MICHAEL DUERR¹, PAVEL FILEVIEZ PEREZ¹, MANFRED LINDNER¹, and MARK B. WISE² — ¹Max-Planck-Institut für Kernphysik, Heidelberg, Germany — ²Caltech, Pasadena, CA, USA

In the Standard Model, baryon and lepton numbers are accidental global symmetries of the renormalizable couplings. We present viable extensions of the Standard Model, in which baryon and lepton numbers are local gauge symmetries that are spontaneously broken at a low scale. Focussing on neutrino masses and dark matter, we discuss phenomenological implications of these theories.

T 41.4 Mo 17:30 P108

Dark matter and U(1)' symmetry for the right-handed neutrinos — ●MANFRED LINDNER, DANIEL SCHMIDT, and ATSUSHI WATANABE — Max-Planck-Institut für Kernphysik, Saupfercheckweg 1, 69117, Heidelberg, Germany

We consider a $U(1)'$ gauge symmetry acting on three generations of right-handed neutrinos. The $U(1)'$ symmetry is broken at the TeV scale and its remnant discrete symmetry makes one of the right-handed neutrinos stable. As a natural consequence of the anomaly cancellation, the neutrino mass matrix consists of a combination of Type I (TeV scale) seesaw and radiative correction. The stable right-handed neutrino communicates with the Standard Model via s-channel exchange of the Higgs field and the $U(1)'$ gauge boson, so that the observed relic density for dark matter is obtained in a wide range of the parameter space. The experimental signatures in collider and other experiments are briefly discussed.

T 41.5 Mo 17:45 P108

Precision tests of unitarity in leptonic mixing — ●LORENZO BASSO^{1,2}, OLIVER FISCHER², and JOCHUM J. VAN DER BIJ² — ¹IPHC Strasbourg — ²Albert-Ludwigs-Universität Freiburg

In the light of the recent LHC data, we study precision tests sensitive to the violation of lepton universality, in particular the violation of unitarity in neutrino mixing. Keeping all data we find no satisfactory fit, even allowing for violations of unitarity in neutrino mixing. Leaving out $\sin^2\theta_{\text{eff}}$ from the hadronic forward-backward asymmetry at LEP, we find a good fit to the data with some evidence of lepton universality violation at the $\mathcal{O}(10^{-3})$ level. An improvement by a factor two in the measurement of the W-boson mass and of $\sin^2\theta_{\text{eff}}$ would be sufficient to claim a discovery.

T 41.6 Mo 18:00 P108

Oscillation phenomenology of gauged sterile neutrinos — JOACHIM KOPP and ●JOHANNES WELTER — Max-Planck-Institut für Kernphysik, Heidelberg, Deutschland

As a possible solution to currently unresolved anomalies in dark matter direct detection experiments a Standard Model extension was proposed by Pospelov in 2011, containing a sterile neutrino with mass of the order eV, which interacts with baryons via a new $U(1)_B$ gauge boson. Recently, the impact of this model on short-baseline neutrino oscillations has been studied, and it has been claimed that sterile neutrinos interacting with baryons have the possibility to explain the observed neutrino oscillation anomalies. In this talk, we investigate the oscillation phenomenology of this model. We derive analytical approximations for the oscillation probabilities and revise the results from the literature. We perform a numerical χ^2 analysis with data sets from MINOS, MiniBooNE and solar experiments. The results show that baryonic sterile neutrinos cannot resolve the tension obtained in simple sterile neutrino scenarios. Assuming that the MiniBooNE signal is due to active-sterile mixing in a three active plus one sterile neutrino framework we conclude that the interesting parameter range for the baryonic matter potential is disfavoured.

T 41.7 Mo 18:15 P108

Adiabatic active-sterile neutrino conversion in asymmetrically warped extra dimensions — ●PHILIPP SICKING and HEINRICH PÄS — Fakultät für Physik, Technische Universität Dortmund, 44221 Dortmund, Germany

The search for sterile neutrinos is motivated by the LSND and MiniBooNE, reactor and Gallium anomalies. The fact that this evidence is partly conflicting can be a consequence of either experimental systematics or of non-standard neutrino properties.

Here we discuss the 1+1 active-sterile neutrino-mixing resulting from the altered dispersion relations of sterile neutrinos oscillating around a 3+1 brane in an asymmetrically warped extra dimension.

In the adiabatic limit an MSW-like effect arises which drives the active neutrinos to be converted back and forth into sterile ones resulting in an baseline dependent conversion probability and superluminal shortcuts.

The conditions for this effect and the length of the shortcut are calculated in dependence of vacuum-mixing-angle, mass squared difference, energy and warp factor.

T 41.8 Mo 18:30 P108

Sterile neutrino altered dispersion relations in Cosmology and Astrophysics — ●ELKE AEIKENS and HEINRICH PÄS — TU Dortmund, Deutschland

Altered dispersion relations can arise from various effects such as Lorentz violation, shortcuts in extra dimensions and standard or non-standard matter effects. We analyze the effects of sterile neutrino altered dispersion relations on the flavor ratios of astrophysical neutrinos and on big bang nucleosynthesis (BBN). On the one hand additional relativistic degrees of freedom in the early Universe typically interfere with the successful prediction of the cosmological ^4He abundance. Altered dispersion relations can avoid this consequence by suppressing active-sterile neutrino mixing and thus the population of sterile neutrinos in the early Universe. On the other hand altered dispersion relations can affect the flavor ratios of astrophysical neutrino sources. We discuss the bounds obtained and possible observations for various dispersion relations.

T 41.9 Mo 18:45 P108

Investigation of neutrino-nucleon interactions in the context of IceCube — ●MIKE KROLL¹, FRANCIS HALZEN², and JULIA TJUS³ for the IceCube-Collaboration — ¹Fakultät Physik, Technische Universität Dortmund, Deutschland — ²University of Wisconsin-Madison, USA — ³Fakultät für Physik und Astronomie, Ruhr-Universität Bochum, Deutschland

Without considering absorption in the Earth, higher neutrino energy lead to easier detection because the probability that the neutrino interacts in the detector with a nucleon is proportional to the neutrino cross section, which grows with energy.

It is generally accepted that the neutrino cross section is calcula-

ble with good precision in perturbative QCD. However, the screening of the large number of partons (overwhelmingly gluons) that make up a high energy proton result into an increase (a decrease) of the neutrino-proton interaction cross section below (above) the saturation scale which corresponds to a neutrino energy close to 0.1 EeV.

The goal of this project is to evaluate this saturation effect, con-

straining its magnitude in neutrino-proton (nucleus) interactions by exploiting new high energy measurements of proton-proton collisions at the LHC and by the Auger cosmic ray experiment.

In this talk, we will discuss how this affects high-energy neutrino measurements with IceCube at extremely high energies.