T 21: Neutrinophysik / Astroteilchenphysik und Kosmologie (Theorie)

Convenor: Stefan Antusch / Alejandro Ibarra

Zeit: Dienstag 16:45–19:00 Raum: 30.23: 3-1

T 21.1 Di 16:45 30.23: 3-1

Leptogenese — Eine vollständige quantenmechanische Berechnung vor thermischem Hintergrund — •Janine Hütig, Sebastian Mendizabal und Owe Philipsen — Institut für theoretische Physik, Goethe-Universität Frankfurt am Main, Deutschland

Die beobachtete Baryonenasymmetrie des Universums lässt sich mit Hilfe der thermischen Leptogenese durch den Zerfall schwerer Majorana Neutrinos außerhalb des thermischen Gleichgewichts im Plasma des frühen Universums erkären. Dies steht im Einklang mit bisherigen Experimenten zur Neutrinooszillation und erklärt die geringe Masse der bekannten Neutrinos. Mittels Kadanoff-Baym-Gleichungen lässt sich die Leptonenasymmetrie vollständig quantenmechanisch berechnen. Da jedoch die derzeitigen konventionellen Ergebnisse eine Unsicherheit von mindestens einer Größenordnung besitzen, ist eine systematische Betrachtung von Eichwechselwirkungen mit dem thermischen Bad zur genauen Beschreibung des Szenarios unabkömmlich.

T 21.2 Di 17:00 30.23: 3-1

Quantum effects in the generation of the matter-antimatter asymmetry — •Alexander Kartavtsev[1], Tibor Frossard[1], Mathias Garny[2], Andreas Hohenegger[1], and Manfred Lindner[1] — [1]Max-Planck-Institut fuer Kernphysik, Saupfercheckweg 1, 69117 Heidelberg, Germany — [2]Technische Universitat Munchen, James-Franck-Strasse, 85748 Garching, Germany

According to leptogenesis scenario, the observed excess of matter over antimatter has been produced by the decay of heavy Majorana neutrinos. If masses of the heavy neutrinos are quasi-degenerate then the self-energy contribution to the CP-violating parameter is resonantly enhanced and it is possible to have successful leptogenesis at a relatively low scale. In the canonical approach the CP-violating parameter is calculated in vacuum, which is a questionable approximation for processes in hot and dense early Universe. Using methods of non-equilibrium quantum field theory we find that the canonical expression for the CP-violating parameter is only applicable in the hierarchical case even though it does not diverge in the limit of degenerate masses. In the resonant regime one has to take into account medium corrections to the masses and decay widths, which yields a modified expression for the CP-violating parameter. Another important effect is the resonant and medium enhancement of the total decay widths. It leads to a faster decay of the heavy particles and increased washout of the generated asymmetry. Therefore, the amplified asymmetry production due to the enhancement of the CP-violating parameter is partially compensated by the increase of the in-medium decay widths.

T 21.3 Di 17:15 30.23: 3-1

Sneutrino Hybrid Inflation and Nonthermal Leptogenesis — Stefan Antusch, Jochen Baumann, •Valerie Domcke, and Philipp Kostka — Max-Planck-Institut für Physik, München, Germany

In sneutrino hybrid inflation, the superpartner of one of the right-handed neutrinos involved in the seesaw mechanism plays the role of the inflaton field. It obtains a large mass at the so-called waterfall phase transition which ends hybrid inflation. After this phase transition, the oscillations of the sneutrino inflaton field may dominate the universe and efficiently produce the observed baryon asymmetry via nonthermal leptogenesis.

In this framework, we derive the predictions for the cosmic microwave background observables and investigate the conditions under which both inflation and leptogenesis, in agreement with latest experimental results, can be realised. At the same time, this framework can satisfy the bounds imposed on the reheat temperature by the gravitino problem.

We point out which constraints successful inflation and leptogenesis impose on the seesaw parameters, i.e. on the neutrino Yukawa couplings and the mass of the right-handed neutrino, and thus obtain an upper bound for the mass of the lightest lefthanded neutrino in this framework.

T 21.4 Di 17:30 30.23: 3-1

Sommerfeld enhancements in sneutrino Dark Matter annihilation — •Laura van den Aarssen, Torsten Bringmann, and Mitsuru Kakizaki — II. Institut für Theoretische Physik, Universität Hamburg, Deutschland

A natural extension of the MSSM consists of introducing Dirac neutrino masses and provides us with an interesting scalar Dark Matter (DM) candidate: a left-right mixed sneutrino. We have studied the properties of sneutrino DM, mainly focusing on the prospects for indirect DM detection. Since the parameter space allows for a (multi-)TeV scale DM candidate, it is important to take into account Sommerfeld effects which is a generic mechanism in the annihilation of heavy dark matter particles that can boost the annihilation cross-section by the repeated exchange of virtual particles. In this talk I will summarize our results for sneutrino DM, paying special attention to the effect of Sommerfeld enhancements in this particular model.

T 21.5 Di 17:45 30.23: 3-1

Neutrinos and Dark Matter Within an Extended Zee-Babu Model — •Daniel Schmidt and Thomas Schwetz-Mangold — Max-Planck-Institut für Kernphysik, Heidelberg, Germany

The two main problems of astroparticle physics can be summarized by the statement *Neutrinos have mass and the universe has dark matter.* Our aim is to juggle both of these shortcomings of the standard model within one theory. Therefore, we start with the Zee-Babu model for generating light neutrino masses and add a complex scalar singlet φ and right-handed Majorana neutrinos N_R to its particle content. Containing φ, the model enjoys a lepton number symmetry. N_R is the candidate for particle dark matter. Spontaneous breaking of the lepton number symmetry generates neutrino masses. Thus we have found a common energy scale for light neutrino masses and the mass of dark matter.

T 21.6 Di 18:00 30.23: 3-1

Flavor Symmetry and Split Seesaw Mechanism — •Adisorn Adulpravitchai, Manfred Lindner, and Ryo Takahashi — Max Planck Institut für Kernphysik, Heidelberg, Germany

We discuss an A4 flavor symmetry model in the context of the split seesaw mechanism. The model leads to one keV sterile neutrino as the warm dark matter and two heavy right-handed neutrinos being responsible for leptogenesis to explain the observed baryon asymmetry of the Universe. The A4 flavor symmetry predicts nearly tri-bimaximal mixing in the lepton sector. Combining the split seesaw mechanism with the flavor symmetry leads to an interesting correlation between the neutrino oscillation data and the cosmological constraint from X-ray observation.

T 21.7 Di 18:15 30.23: 3-1

Inverse see-saw from higher than d=5 effective operatos in SUSY, and its phenomenological implications at the LHC — •Martin Bernhard Krauss[1], Toshihiko Ota[2], Werner Porod[1], and Walter Winter[1] — [1]Institut für Theoretische Physik und Astrophysik, Universität Würzburg, Am Hubland, 97074 Würzburg, Germany — [2]Max-Planck-Institut für Physik (Werner-Heisenberg-Institut), Föhringer Ring 6, 80805 München, Germany

We discuss neutrino masses generated by higher than d=5 effective operators in a supersymmetric framework. We illustrate that at tree level, many possibilities lead to inverse see-saw scenarios with the lepton number violating term naturally suppressed by a heavy mediator mass. We show one example with heavy fermion doublets as additional mediators. This scenario may have LHC-observable phenomenology, since the added fermions lead to lepton number violating processes with displaced vertices.

T 21.8 Di 18:30 30.23: 3-1

The Higgs as a harbinger of discrete flavor symmetry — Gautam Bhattacharyya[1], •Philipp Leser[2], and Heinrich Päs[2] — [1]Saha Institute of Nuclear Physics, 1/AF Bidhan Nagar, Kolkata 700064, India — [2]Fakultät für Physik, TU Dortmund, 44221 Dortmund, Germany

Discrete symmetries employed to explain neutrino mixing and mass hierarchies are often associated with an enlarged scalar sector which might lead to exotic Higgs decay modes. We explore such a possibility in a scenario with S_3 flavor symmetry which requires three scalar

$SU(2)$ doublets. The spectrum is fixed by minimizing the scalar potential, and we observe that the symmetry of the model leads to tantalizing Higgs decay modes potentially observable at the CERN Large Hadron Collider (LHC).

T 21.9 Di 18:45 30.23: 3-1

The 27 representation of E_6 and neutrino physics — •Christophe Cauet[1], Thomas Kephart[2], Heinrich Päs[1], and Ivo de Medeiros Varzielas[1] — [1]Institut für Physik, TU Dortmund, 44221 Dortmund, Germany — [2]Vanderbilt University, 6301 Stevenson Center, Nashville, TN 37235, USA

A successful grand unified theory has to explain neutrino masses and mixing naturally, without the need for additional conditions. We present a systematic approach to classify models based on the exceptional group E_6, e.g. $[SU(3)]^3$ trinification, and show possible mechanism to generate neutrino masses in the 0.1 eV region.