T 79: Searches/BSM IV

Time: Thursday 16:15–17:45 Location: KH 02.018

T 79.1 Thu 16:15 KH 02.018

Quantum work for deriving and explaining the Lorentz transformations — •Grit Kalies[1], Duong D. Do[2], and Cornelia Breitkopf[3] — [1]HTW University of Applied Sciences, Dresden, Germany — [2]The University of Queensland, Brisbane, Australia — [3]Technical University of Dresden, Dresden, Germany

The Lorentz transformations of mass and time are derived and explained within the framework of quantum-process thermodynamics. To this end, we use various forms of quantum work for describing the behavior of an accelerated particle, for example an electron. We find that during acceleration, a particle does not only change its velocity and (external) motion energy, but also its internal energies and structure. A new equation for the motion energy of an object is presented, which generalizes kinetic and electromagnetic energy. We compare our results with those of special relativity and discuss various microscopic and macroscopic experiments. Since energetic explanations are provided, quantum-process thermodynamics seems well suited to establishing a direct link between classical thermodynamics and quantum physics.

T 79.2 Thu 16:30 KH 02.018

Constraining a Beyond Standard Model Theory with Neutrino Public Data — •Sofia Lonardi[1,2] and Philipp Eller[2] — [1]Arnold Sommerfeld Center, Ludwig-Maximilians-Universität (LMU), Theresienstraße 37, 80333 Munich, Germany — [2]Technical University Munich (TUM), James-Franck-Strasse 1, 85748 Garching, Germany

Neutrino experiments provide a powerful window into physics beyond the Standard Model. While oscillation measurements precisely determine mixing angles and mass splitting parameters, non-oscillation experiments constrain absolute neutrino masses, together offering complementary probes of new physics.

This work relies on a global analysis framework that combines publicly available data from leading experiments: Daya Bay, MINOS, KamLAND, KATRIN, GERDA, and JUNO. These data are used to test the "Nnaturalness" theory, a Beyond Standard Model theory that simultaneously addresses neutrino mass generation and the electroweak hierarchy problem through multiple copies of the Standard Model in hidden sectors with varying Higgs masses.

By fitting the data with this model across different neutrino mass orderings and Majorana or Dirac scenarios, we establish lower bounds on the number of hidden sectors and on the theory's fine-tuning parameter, effectively constraining the parameter space and excluding a class of theory realisations.

T 79.3 Thu 16:45 KH 02.018

Collisionoperators in electroweak baryogenesis — •Johann Plotnikov[1], Margarete Mühlleitner[1], Rui Santos[2], and João Viana[2] — [1]KIT, Karlsruhe, Germany — [2]Universidade de Lisboa, Lisboa, Portugal

It is known that extensions of the Standard Model are necessary to explain the observed Baryon Asymmetry of the Universe (BAU) as they are able to provide a strong first-order phase transition needed for electroweak baryogenesis. During the phase transition bubbles are created which separate the true vacuum from the broken vacuum. As the particles of the plasma collide with the bubble wall, the particles and anti-particles scatter differently to create the BAU. However, at the same time the surrounding plasma tries to wash out this asymmetry via collisions between the plasma particles. In our work we perform a careful derivation of the strength of these collisions and study their influence on the resulting BAU.

T 79.4 Thu 17:00 KH 02.018

Interplay between Dark Matter and the Electroweak Phase Transition — •Tim Vincent Krause[1], André Milagre[2], Johann Plotnikov[1], Milada Magarete Mühlleitner[1], Rui Santos[3], and João Silva[2] — [1]Karlsruher Institut für Technologie — [2]Instituto Superior Técnico, Universidade de Lisboa — [3]Universidade de Lisboa, Campo Grande

Current extensions to the scalar sector of the Standard Model (SM) are able to explain the matter anti-matter asymmetry in the universe via Electroweak Baryogenesis (EWBG) and simultaneously provide a dark matter candidate. In many cases these two phenomena are treated separately as they usually take place at different times in the evolution of the universe. However, there are scenarios where the electroweak phase transition necessary for EWBG and the production of DM take place during the same time period. As the phase transition influences the mass evolution of the SM particles it also plays a crucial role in the calculation of the relic density for DM. In our work we study the interplay between EWBG and DM generation as well as analyze it's impact on the final relic abundance.

T 79.5 Thu 17:15 KH 02.018

Parameter determination for singlino dark matter scenarios in the NMSSM — •Laurenz Kriege[3], Gudrid Moortgat-Pick[1], and Sven Heinemeyer[2] — [1]DESY and Hamburg U., Inst. Theor. Phys. II — [2]Madrid, IFT — [3]UHH

We study the reconstruction of the underlying parameters of the Next-to-Minimal Supersymmetric Standard Model (NMSSM) by assuming certain chargino and neutralino measurements at a future e+e- collider. We take scenarios with singlino dominated dark matter, with bino, wino, and gluino masses obeying the approximate GUT relations and an overall scenario consistent with the measured excesses at ATLAS and CMS and all experimental constraints. We demonstrate that both the dark matter relic density and most of the relevant NMSSM parameters can be reconstructed.

T 79.6 Thu 17:30 KH 02.018

Testing Supersymmetric Dark Matter Scenarios through Electroweakino Parameter Determination — •Nele Peters and Gudrid Moortgat-Pick — Department of Physics, University of Hamburg

Supersymmetric models provide well-motivated candidates for particle dark matter, but testing their viability requires precise knowledge of the underlying electroweakino parameters. In this talk, we investigate how accurately a future International Linear Collider (ILC) could determine the key parameters M1, M2, and μ in dark-matter motivated supersymmetric scenarios, here evaluated for an NMSSM benchmark. Using simulated measurements of polarized chargino-pair production and the masses of the lightest chargino and neutralino, we assess the sensitivity of these observables to the electroweakino sector and quantify the achievable reconstruction precision. From the reconstructed parameter sets, the dark-matter relic density is computed and compared to the benchmark values. The study demonstrates the potential of precision lepton-collider data to constrain supersymmetric dark-matter scenarios and to evaluate their consistency with cosmological observations.