T 4: Dark matter: theory

Time: Monday 16:30–18:00 Location: H-HS II

T 4.1 Mon 16:30 H-HS II

Impact of SUSY parameters on dark matter prediction — •Marten Berger and Gudrid Moortgat-Pick — II. Institute of Theoretical Physics, University of Hamburg, 22761 Hamburg, Germany

The Minimal Supersymmetric Standard Model (MSSM) is one of the best motivated extensions of the Standard Model (SM): it is of high predictive power and can explain the main open questions of the SM. For instance, if offers a well-motivated cold dark matter candidate. A crucial question is therefore whether this model can explain the correct amount of relic density with its cold dark matter candidate. For calculations of the relic density within the MSSM information about the mass of the lightest supersymmetric particle (LSP) as well as the mass of other particles which play a key role in the dominant mechanisms of annihilation are needed. Since the mixing character can rapidly change depending on the actual parameter point and consequently has immediate influence on the relic density contribution it is necessary to include one-loop corrections in the calculations of the dark matter observables. In this talk the determination of the fundamental SUSY parameter determinations from chargino production at a linear collider will be discussed with the focus on its impact on the contribution on the corresponding relic density.

T 4.2 Mon 16:45 H-HS II

Compatibility of Naturalness with Dark Matter constraints in a recent pMSSM scan — Samuel Bein[1], •Malte Mrowietz[1], Harrison Prosper[2], Peter Schleper[1], and Bogdan Wiederspan[1] — [1]Universität Hamburg, Hamburg, Deutschland — [2]Florida State University, Tallahassee, USA

The viability of weak-scale supersymmetry is studied in the context of a pMSSM scan. The tension of supersymmetric models with LHC results, low-energy constraints, flavor anomalies, dark matter relic density and naturalness are studied. It is exemplified that supersymmetric parameter regions can simultaneously accommodate some, though not all, of the considered observations.

T 4.3 Mon 17:00 H-HS II

One-loop EW corrections to Direct Detection in the Vector Dark Matter Model — Seraina Glaus[1], Margarete Mühlleitner[1], •Jonas Müller[1], Shruti Patel[1], and Rui Santos[2,3,4] — [1]Karlsruher Institut für Technologie, ITP, Karlsruhe, Deutschland — [2]Instituto Politécnico de Lisboa, ISEL, Portugal — [3]Centro de Física Teórica e Computacional, Faculdade de Ciências, Portugal — [4]LIP, Departamento de Física, Universidade do Minho, Portugal

Recent dark matter (DM) direct searches place very stringent constraints on possible DM candidates proposed in extensions of the Standard Model (SM). Driven by the steadily increasing precision in DM direct detection searches, we present the one-loop electroweak corrections to the spin-independent DM scattering cross-section with nucleons in the simplified vector DM model (VDM). The VDM extends the SM with an additional complex singlet and a dark gauged $U(1)_X$ yielding a vector-like DM particle which is stabilised by a Z_2 symmetry. The loop corrections are essential to discuss the sensitivities of the direct detection experiments for the model prediction and might allow for reopening parameter space which is excluded by tree-level analyses.

T 4.4 Mon 17:15 H-HS II

Higher-Order Electroweak Corrections to Dark Matter Direct Detection in the Dark Complex Extension of the Standard Model — Seraina Glaus[1,2], Margarete Mühlleitner[1], Jonas Müller[1], Shruti Patel[1,2], •Tizian Römer[1], and Rui Santos[3,4] — [1]Institute for Theoretical Physics, Karlsruhe Institute of Technology, 76128 Karlsruhe, Germany — [2]Institute for Nuclear Physics, Karlsruhe Institute of Technology, 76344 Karlsruhe, Germany — [3]Centro de Física Téorica e Computacional, Faculdade de Ciências, Universidade de Lisboa, Campo Grande, Edifício C8 1749-016 Lisboa, Portugal — [4]ISEL - Instituto Superior de Engenharia de Lisboa, Instituto Politécnico de Lisboa 1959-007 Lisboa, Portugal

While there is evidence for the existence of Dark Matter, its nature remains unknown. Assuming Dark Matter being constituted of weakly interacting particles, we investigate a minimal extension of the Standard Model, the Dark Complex extension of the Standard Model (DCxSM). In the DCxSM, an additional complex scalar field with a softly broken U(1) symmetry gives rise to a massive pseudo Nambu-Goldstone boson, which is the Dark Matter candidate. We compute the electroweak corrections for the spin-independent direct detection process of this Dark Matter candidate. Since the leading-order cross section of this process vanishes in the non-relativistic limit, the electroweak corrections are essential to discuss the sensitivity of the experimental results of Xenon-1T. We will present the phenomenological implications of the electroweak corrections for the direct detection limits.

T 4.5 Mon 17:30 H-HS II

MeV neutrino dark matter: Relic density, lepton flavour violation and electron recoil — Juri Fiaschi[1], Michael Klasen[1], Miguel Vargas[2], Christian Weinheimer[2], and •Sybrand Zeinstra[1] — [1]Institut für Theoretische Physik, WWU Münster — [2]Institut für Kernphysik, WWU Münster

Right-handed neutrinos with MeV to GeV mass are very promising candidates for dark matter (DM). Not only can they solve the missing satellite puzzle, the cusp-core problem of inner DM density profiles, and the too-big-to fail problem, but they can also account for the Standard Model (SM) neutrino masses at one loop. We perform a comprehensive study of the right-handed neutrino parameter space and impose the correct observed relic density and SM neutrino mass differences and mixings. We find that the DM masses are in agreement with bounds from big-bang nucleosynthesis, but that these constraints induce sizeable DM couplings to the charged SM leptons. We then point out that previously overlooked limits from current and future lepton flavour violation experiments such as MEG and SINDRUM heavily constrain the allowed parameter space. Since the DM is leptophilic, we also investigate electron recoil as a possible direct detection signal, in particular in the XENON1T experiment. We find that despite the large coupling and low backgrounds, the energy thresholds are still too high and the predicted cross sections too low due to the heavy charged mediator, whose mass is constrained by LEP limits. - This work was funded by the Deutsche Forschungsgemeinschaft (GRK 2149).

T 4.6 Mon 17:45 H-HS II

Finding Hints of New Physics in Tritium Molecular Spectra — Wolfgang G. Hollik[1,2], •Matthias Linster[1], Ulrich Nierste[1], Sonia Rani[3], Aman Sardwal[3], and Mustafa Tabet[1] — [1]Institut für Theoretische Teilchenphysik (TTP), Karlsruher Institut für Technologie (KIT) — [2]Institut für Kernphysik (IKP), Karlsruher Institut für Technologie (KIT) — [3]Indian Institute of Technology Bombay (IITB)

Strong limits on the coupling of new light particles can be obtained indirectly from astrophysical observations. Complementary and more direct searches for keV scale particles are given through molecular spectroscopy, which is—in contrast to astrophysics—in a controlled laboratory environment. In this talk, we present details on the calculation of the effects of different types of new particles on the rovibrational modes of hydrogen-like molecules, especially in the light of a current discrepancy between the best theory prediction and the most precise measurement of Tritium molecular spectra.