# T 110: Search for Dark Matter 5

Time: Friday 9:00–10:30 Location: Geb. 30.22: Gaede-HS

T 110.1 Fri 9:00 Geb. 30.22: Gaede-HS

**Boosting the production of sterile neutrino dark matter with self-interactions** — •Maria Dias and Stefan Vogl — Institute of Physics, University of Freiburg, Herrmann-Herder-Str. 3, 79104 Freiburg, Germany

Sterile neutrinos are well-motivated and simple dark matter (DM) candidates. However, sterile neutrino DM produced through oscillations by the Dodelson-Widrow mechanism is excluded by current X-ray observations and bounds from structure formation. One minimal extension, that preserves the attractive features of this scenario, is self-interactions among sterile neutrinos. In this work, we analyze how sterile neutrino self-interactions mediated by a scalar affect the production of keV sterile neutrinos for a wide range of mediator masses. We find four distinct regimes of production characterized by different phenomena, including partial thermalization for low and intermediate masses and resonant production for heavier mediators. We show that significant new regions of parameter space become available which provide a target for future observations.

T 110.2 Fri 9:15 Geb. 30.22: Gaede-HS

**MHz to TeV expectations from scotogenic WIMP dark matter** — •Laura Eisenberger, Thomas Siegert, Karl Mannheim, and Werner Porod — University of Würzburg

Most efforts on the indirect search for dark matter (DM) focus on the high-energy photons directly produced by DM annihilation. However, such prompt signals alone are too weak to be measurable in large astrophysical fore- and backgrounds. Following a multiwavelength approach, the secondary emission from charged annihilation products should be also taken into account.

In our study, we investigate scotogenic DM with a mass around 1 TeV which is consistent with various experimental limits. Scotogenic WIMPs arise in models where an additional symmetry ensures both the existence of a stable DM candidate and the generation of neutrinos masses through couplings to the dark sector.

We present our calculations of the DM photon spectrum in 27 dwarf galaxies of the Milky Way reaching from synchrotron emission in the MHz range to the Inverse Compton peak at MeV energies and to the prompt signature in the GeV up to TeV regime. This unique "triple hump" structure will be easily distinguishable from any other source. We estimate the fore- and background emission from the Milky Way and AGN along the line-of-sight. We find signal-to-background ratios on the order of 1e-3 between 1 keV and 100 GeV. In the light of upcoming observatories like COSI-SMEX and CTA, the detection of faint DM signals is within reach if a coherent analysis across the MeV to GeV range is applied.

T 110.3 Fri 9:30 Geb. 30.22: Gaede-HS

**Riding the dark matter wave: Novel limits on general dark photons from LISA Pathfinder** — •Jonas Frerick — DESY Theory, Hamburg, Germany

We note the possibility to perform a parametrically improved search for gauged baryon ($B$) and baryon minus lepton ($B-L$) Dark Photon Dark Matter (DPDM) using auxiliary channel data from LISA Pathfinder. In particular we use the measurement of the differential movement between the test masses (TMs) and the space craft (SC) which is nearly as sensitive as the tracking between the two TMs. TMs and SC are made from different materials and therefore have different charge-to-mass ratios for both $B-L$ and $B$. Thus, the surrounding DPDM field induces a relative acceleration of nearly constant frequency. For the case of $B-L$, we find that LISA Pathfinder can constrain previously unexplored parameter space, providing the world leading limits in the mass range $4 \cdot 10^{-19}\,\mathrm{eV} < m < 3 \cdot 10^{-17}\,\mathrm{eV}$. This limit can easily be recast also for dark photons that arise from gauging other global symmetries of the SM.

T 110.4 Fri 9:45 Geb. 30.22: Gaede-HS

**Cavity response to time dependent dark matter signals** — •Althea Cappelli[1] and Elina Fuchs[2] — [1]Leibniz Universität Hannover, Hannover — [2]Leibniz Universität Hannover, Hannover

The search for Dark Matter remains a prominent focus in particle physics. There are already good Dark Matter candidates, one positive example being the Goldstone bosons axions, which also offer a resolution to the strong CP problem. However, axions have not been experimentally found yet, compounded by the challenge of determining their mass, a free variable. While some experiments target specific mass ranges, the range to scan is still very broad. For putting more bounds, cavities emerge as a helpful tool, as they can probe different masses using their resonance frequency. Although much progress has been done in the past couple of years, further optimizations can be done, using for instance different and/or entangled cavities. Moreover, such cavity experiments offer a dual-purpose platform, expanding their probing also to gravitational waves from primordial black holes, an additional Dark Matter candidate. Using the Heisenberg equations for a two cavity experiment derived in "Cavity entanglement and state swapping to accelerate the search for axion dark matter" by K. Wurtz et al, it is interesting to look at the response of the output cavity signal when putting different time dependent signals for different Dark Matter candidates in the equations. Evaluating the cavity's susceptibility to the signal given a certain noise could lead, together with parameter estimation of the constants, to predictions for experimental optimizations, enhancing the sensitivity to Dark Matter signals.

T 110.5 Fri 10:00 Geb. 30.22: Gaede-HS

**Modeling of self-interacting dark matter signatures in dwarf galaxies** — •Athithya Aravinthan[1,2], Julia Becker Tjus[1,2,3], and Lukas Merten[1,2] — [1]Theoretische Physik IV, Ruhr-Universität Bochum, Bochum, Germany — [2]RAPP-Center, Ruhr-Universität Bochum, Bochum, Germany — [3]Department of Space, Earth and Environment, Chalmers University of Technology, 412 96 Gothenburg, Sweden

Dwarf galaxies are a convenient testing ground in the search for Dark Matter (DM), due to their low, astrophysical background of electromagnetic emission in radio and gamma rays. While multi-messenger signatures of dwarf galaxies can lead to a more precise estimation of the astrophysical background, the modelling of the expected DM annihilation signals, and therefore the DM foreground, is necessary to derive constraints on DM parameters.

In this work, based on the J-factor, which describes the distribution of DM, the gamma-ray fluxes from DM annihilation in several dwarf spheroidal galaxies are determined. This is done using varying DM masses, distributions, and J-factor models, such as the canonical case for cold DM and the generalized case for self-interacting DM. *Supported by DFG (SFB 1491).

T 110.6 Fri 10:15 Geb. 30.22: Gaede-HS

**Einstein's basement - A model of dark matter and dark energy?** — •Fritz Riehle and Sebastian Ulbricht — Physikalisch-Technische Bundesanstalt, Braunschweig

The energy-momentum relationship (EMR) of a free particle in special relativity is regarded as the upper branch of an avoided crossing between the mass of the particle and its momentum. The corresponding EMR for the lower branch - a regime dubbed as Einstein's basement - is derived. From the associated Lagrangian and the conventional gravitational interaction a new kinematics in Einstein's basement is determined. It is shown that this can lead to a repulsion of the basement particles and a modified interaction with regular matter. The model suggests the identification of the basement particles with dark matter accompanied with a missing interaction with light. The expansion of the basement particles and the regular mass that is carried along could be interpreted as an expansion of the universe. Tests of the model by astronomical observations are suggested.