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The Lepton Symmetry Experiment: LSym

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One of the prevailing enigmas in contemporary physics is the observed disparity between the abundance of matter and antimatter in the universe, posing a fundamental challenge to the principles of the Standard Model of particle physics.

Within the LSym experiment we plan to compare the fundamental properties, specifically the charge-to-mass ratios and the g-factors, of the electron and the positron in a cryogenic Penning trap to 14 digits precision and thereby performing a highly sensitive test of matter-antimatter symmetry in the lepton sector [1]. This precision can be achieved by simultaneously trapping both the particles in the same trap. Once the positron is cooled to the ground state of motion in a millikelvin-cooled Penning trap that forms a custom-tailored millimeter-wave cavity, we can measure the coherent difference of the spin precession frequencies of the matter and antimatter particles [2].

In the contribution, the experimental setup, techniques and challenges will be presented.

References:

[1] E. Widmann *et al.*, Hyperfine Interact **240**, 5 (2019)

[2] Tim Sailer *et al.*, Nature **606**, 479–483 (2022)

Author: Dr SASIDHARAN, Sangeetha (Max-Planck-Institut für Kernphysik, Heidelberg, Germany)

Co-authors: PASINETTI, Maria (Max-Planck-Institut für Kernphysik, Heidelberg, Germany); RAAB, Fabian (Max-Planck-Institut für Kernphysik, Heidelberg, Germany); HOLTMANN, Lukas (Max-Planck-Institut für Kernphysik, Heidelberg, Germany); THOMA, Andreas (Max-Planck-Institut für Kernphysik, Heidelberg, Germany); Dr STURM, Sven (Max-Planck-Institut für Kernphysik, Heidelberg, Germany)

Presenter: Dr SASIDHARAN, Sangeetha (Max-Planck-Institut für Kernphysik, Heidelberg, Germany)

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