The Lepton SYMmetry experiment

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LSym is a new cryogenic Penning trap experiment currently being designed at the Max-Planck-Institut für Kernphysik of Heidelberg. The goal of Lsym is to conduct a stringent CPT test by comparing the properties of matter and antimatter with unprecedented precision. To this end, we simultaneously trap one electron and one positron in a Penning trap and perform a decoherence-free comparison of their spin precession frequencies [1]. Currently, we are developing and testing techniques to capture positrons inside the cryogenic vacuum. This involves moderating positrons from a rather weak ²²Na β^+ source and producing positronium atoms in a high Rydberg state. These atoms are subsequently ionized in the Penning trap, where the positron is retained [2]. Finally, the positron will be cooled to the ground state of motion and can be detected with an image current detector. This poster illustrates the principles and techniques that will be used for the positron source at Lsym.



(a) Our trap stack at LSym, currently in the design phase.

(b) Our first positron dip in the LSym lab.

References

- [1] Sailer, T et al. Nature 606, 479-483 (2022)
- [2] Fogwell Hoogerheide, S and Dorr, JC and Novitski, E and Gabrielse, G Review of Scientific Instruments 86, 5 (2015).