

Ramsey set-up for (anti-)hydrogen hyperfine spectroscopy

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In the framework of the Standard Model, CPT symmetry demands the same fundamental properties for matter and antimatter. The precise measurement of the ground state hyperfine structure of antihydrogen and its comparison to that of hydrogen is a sensitive test of CPT invariance. A Ramsey type beam spectroscopy method [1] has the potential to improve this precision by a factor of 10 over the existing Rabi type setup [2] at CERN. The design phase for this new set-up is underway and the case studies considering the microwave cavities and surface coils, which shall be used for perturbations will be presented. The most optimal solution from these cases will govern the decision whether to adapt to a longitudinal or transverse static magnetic field design. Although the characterisation of the spectrometer line will be done using hydrogen, its scalability for the case of antihydrogen shall also be discussed.

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- [1] Ramsey, Norman F. A Molecular Beam Resonance Method with Separated Oscillating Fields. *Phys. Rev.* **78**, 695 (1950).
- [2] Diermaier, M. et al. In-beam measurement of the hydrogen hyperfine splitting and prospects for antihydrogen spectroscopy. *Nat. Commun.* **8**, 15749 doi: 10.1038/ncomms15749 (2017).