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Sympathetic laser cooling of antiprotons with molecular anions. SEBASTIAN GERBER, JULIAN FESEL, INGMARI TIETJE, CHRISTIAN ZIMMER, ALEXANDER HINTERBERGER, MICHAEL DOSER, CERN, PAULINE YZOMBARD, DANIEL COMPARAT, Laboratoire Aime Cotton, University Paris-Sud, AEGIS COLLABORATION — Antimatter experiments conducted at the Antiproton Decelerator (AD) at CERN address the fundamental questions why primordial antimatter is not observed in the present Universe. The weak equivalent principle (WEP) can be tested measuring the gravitational acceleration of antihydrogen atoms in the Earth's gravitational field that are horizontally emitted from a Penning trap. The antihydrogen atoms can be produced via resonant charge exchange of Rydberg positronium and antiprotons at temperatures potentially determined by the recoil limit of the constituents To prepare an ensemble of cold antihydrogen with a narrow velocity spread we plan to extend the existing electron cooling mechanism of antiprotons by laser-cooling techniques of negative C_2^- molecules in a Penning trap in order to sympathetically cool antiprotons to the mK regime. The generation of cold antihydrogen atoms can ultimately also be used for precision spectroscopy experiments of electromagnetic interaction as a test of CPT symmetry. In this presentation the status of the experiment at CERN and a computational study of sympathetic cooling of antiprotons using photodetachment cooling, Doppler and AC Stark Sisyphus cooling of C_2^- will be presented.

Sebastian Gerber
CERN

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