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The GBAR antimatter gravity experiment

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The GBAR experiment (Gravitational Behaviour of Anti hydrogen at Rest) at CERN, aims to measure the free fall acceleration of ultracold neutral anti hydrogen atoms in the gravity field of the Earth [1]. Anti hydrogen ions (one antiproton and two positrons) are produced in the interaction of antiprotons and positronium in two subsequent charge exchange reactions. These ions will be sympathetically cooled with Be+ ions to less than 10 microK. The ultracold ions will then be photo-ionized just above threshold, to produce ultracold atoms, i.e. in the neV range. The free fall time over a known distance is then measured. The experiment will use the 100 keV antiprotons from the ELENA decelerator that is being built at CERN to produce bunches of 100 keV kinetic energy. The first antiproton beam is expected in autumn 2017. We will describe the project, the accuracy that can be reached by standard techniques, and discuss a possible improvement to reduce the vertical velocity spread.

[1] G. Chardin et al., CERN-SPSC-P-342, 30/09/2011; P. Pérez and Y. Sacquin, Class.Quant.Grav. 29 (2012) 184008.

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