Towards an antihydrogen beam production by using a cusp trap

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Antihydrogen is the simplest anti-atom made by antiproton and positron. Symmetry between matter and antimatter is known as the CPT symmetry. Spectroscopic investigations of antihydrogen atom potentially pave a path towards the test of the symmetry. The ASACUSA collaboration at CERN has developed a cusp trap which consists of a superconducting anti-Helmholtz coil and Multiple Ring Electrodes (MRE) [1]. The cusp magnetic field gradient preferentially focuses the low-field-seeking states of antihydrogen atom [1, 2], which will accordingly form an antihydrogen beam. Combined with a microwave cavity and a sextupole magnet, a Rabi-like anti-atomic beam spectroscopy is aimed to investigate ground-state hyperfine splitting of antihydrogen atom [3].

We have been succeeded in synthesizing antihydrogen atoms by the cusp trap [4]. An ultraslow antiproton beam from the MUSASHI trap [5] was directly injected into a positron plasma prepared in the cusp trap. The kinetic energy of antiproton was matched to be slightly above the positron potential energy. Using this direct ultraslow beam injection method antihydrogen atoms were synthesized [4]. The recent results of antihydrogen beam experiment will be presented.

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