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Toward a Measurement of the Antihydrogen Free Fall

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In recent years, increasingly larger amounts of cold antihydrogen has been confined in the ALPHA magnetic trap [1] and has become available to perform precise measurements of its spectrum [2, 3]. Owing to this advancement, the Universality of Free Fall, a pillar of General Relativity, is put to test in a novel apparatus, named ALPHA-g, scheduled to take its first data in 2018. The ALPHA-g apparatus is designed to confine antihydrogen in a magnetic trap whose axis is aligned to the Earth's gravitational field, i.e., it is vertical. The magnetic trap is constituted by an octupole magnet, which provides the radial confinement, and a set of "mirror" coils, which provide the vertical confinement. The antihydrogen gravitational mass can be inferred via the measurement of the annihilation distribution of antihydrogen under the influence of gravity. A crucial piece of equipment to perform this measurement is the radial Time Projection Chamber, or rTPC, that enables the identification of the antihydrogen annihilation position.

In this talk, I will give an overview of the ALPHA-g experiment, with an emphasis on the annihilation detectors.

[1] Ahmadi, M. et al., Nature Comm. 8, 681 (2017)

[2] Ahmadi, M. et al., Nature 541, 66 (2017)

[3] Ahmadi, M. et al., Nature 557, (2018)

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