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Hyperfine spectroscopy (and more) of antihydrogen (I)

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The hydrogen atom has played a fundamental role in the development of our understanding of the universe and of quantum mechanics. This makes antihydrogen a natural candidate for testing symmetries between matter and antimatter. The goal of the ALPHA (Antihydrogen Laser PHysics Apparatus) collaboration is to synthesize, trap, and study antihydrogen atoms. ALPHA has made significant progress recently in measuring the 1S - 2S transition in antihydrogen [1], exciting the 1S - 2P transition (a laser cooling transition), and is currently constructing a new apparatus designed to measure the gravitational free fall of antihydrogen.

In addition, ALPHA is working towards high precision measurements of antihydrogen's ground-state hyperfine splitting frequency. Following an initial proof-of-principle experiment in 2012 [2], ALPHA has recently measured the hyperfine splitting in antihydrogen to be 1420.4 +/- 0.5 MHz [3]. In this talk, I will present a brief overview of ALPHA's physics program and a detailed summary of our hyperfine splitting experiments.

[1] M. Ahmadi et al. (ALPHA collaboration), Nature 541, 506 (2017).
[2] C. Amole et al. (ALPHA collaboration), Nature 483, 439 (2012).
[3] M. Ahmadi et al. (ALPHA collaboration), Nature 548, 66 (2017).

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