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## Project ALPHA: Applying AMO Physics to Antimatter and Using Antimatter to Study AMO Physics

*Tuesday, 16 June 2015 13:45 (30 minutes)*

In 2010, the ALPHA Collaboration working at the AD Facility at CERN achieved the first capture and storage of atomic antimatter with our confinement of low temperature antihydrogen in an Ioffe-type magnetic minimum atom trap. [1] This achievement was only reached through the application of a range of tools and techniques from an interdisciplinary spectrum of fields, including AMO Physics. Examples of AMO Physics tools used in antihydrogen capture and storage include charged particle confinement and manipulation in a Penning-Malmberg trap, evaporative cooling [2], and sympathetic (i.e. charged particle collisional) processes. With the achievement of stable and long-term storage of antihydrogen, focus at ALPHA has now shifted to using antihydrogen as a system for carrying out a range of atomic physics studies, including completion of proof of principle microwave spectroscopy [3], charge neutrality, and gravitational force measurements. With the completion of commissioning of our 2nd-generation ALPHA-2 apparatus, we now aim to move into the field of high precision spectroscopy of antihydrogen.

This invited talk will focus on discussing the AMO physics aspects of the ALPHA experiment, both the tools from AMO physics used for ALPHA and the AMO physics measurements undertaken and planned for ALPHA. This will include both work completed with the ALPHA-1 apparatus, and that undertaken and planned with the ALPHA-2 system.

- Presented on behalf of the ALPHA Collaboration, CERN (<http://alpha.web.cern.ch/>).

[1] G.B. Andresen et al. (ALPHA Collaboration), *Nature Physics* 7, 558 (2011).

[2] G.B. Andresen et al. (ALPHA Collaboration), *Phys. Rev. Lett.* 105, 013003 (2010).

[3] C. Amole et al. (ALPHA Collaboration), *Nature* 483, 439 (2012).

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