RESONANT MICROWAVE INTERACTIONS WITH ANTIHYDROGEN

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ALPHA is an international project at the CERN AD who's primary aim is to test fundamental symmetries between matter and antimatter using trapped antihydrogen atoms, the simplest atomic form of neutral antimatter. Cold atoms of antihydrogen promise a unique opportunity to study the properties of atomic antimatter, and via comparisons with its well-studied matter-counterpart, the possibility to test fundamental symmetries such as CPT invariance. In order to probe matter-antimatter symmetry at the highest possible precision, it is essential that the anti-atoms be suspended in vacuum to allow for detailed interrogation via laser light or microwaves.

This presentation will describe the techniques ALPHA employs to synthesize antihydrogen, the evidence that it has been successfully trapped[2] , and our recent success in observing resonant microwave interactions with the antihydrogen atoms[3].This is a proof-of-principle that spectroscopy can be performed in our present trap environment. Finally, I will offer an outlook towards the future spectroscopic studies that will be carried out on using the new apparatus that we are presently commissioning.

[1] ALPHA collaboration http://alpha-new.web.cern.ch: C. Amole, M.D. Ashkezari, M. Baquero-Ruiz, W. Bertsche, P.D. Bowe, E. Butler, A. Capra, C.L. Cesar, M. Charlton, A. Deller, P.H. Donnan, S. Eriksson, J. Fajans, T. Friesen, M.C. Fujiwara, D.R. Gill, A. Gutierrez, J.S. Hangst, W.N. Hardy, M.E. Hayden, A.J. Humphries, C.A. Isaac, S. Jonsell, L. Kurchaninov, A. Little, N. Madsen, J.T.K. McKenna, S. Menary, S.C. Napoli, P. Nolan, K. Olchanski, A. Olin, P. Pusa, C. Ø. Rasmussen, F. Robicheaux, E. Sarid, C. R. Shields, D.M. Silveira, S. Stracka, C. So, R.I. Thompson, D.P. van der Werf, J.S. Wurtele.

[2] G. Andersen *et al,* **Nature 468**, 637 (2010).

[3] C. Amole *et al,* **Nature 483 ,4**39 (2012).