Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **3073** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Advances in the Spectroscopy of the 1S-2S Transition in Antihydrogen

Wednesday 8 June 2022 14:15 (15 minutes)

The antimatter equivalent of the hydrogen atom, antihydrogen, is an outstanding testbed for studies of matter-antimatter symmetry. Here we report the first simultaneous observation, with few ppt precision, of the d⟶d and c⟶c hyperfine components of the 1S-2S transition in antihydrogen trapped in a 1T magnetic field. Our c⟶c measurement is the first in either hydrogen or antihydrogen, while the d⟶d measurement is in agreement with our previous measurement and with measurements in hydrogen. Together with our ground state hyperfine splitting measurement we have determined the antihydrogen 2S hyperfine splitting with 0.3% precision.

These results were obtained using a new experimental protocol which allows characterization of the relevant spectral lines in just one day, representing a 70-fold improvement in the data-taking rate and improved control of systematics compared to our previous work. We show that this protocol is applicable to laser cooled antihydrogen with dramatic implications for both the speed and precision of future tests of fundamental symmetries.

ALPHA Collaboration: C. J. Baker, W. Bertsche, A. Capra, C. Carruth, C. L. Cesar, M. Charlton, A. Christensen, R.Collister, A. Cridland Mathad, S. Eriksson, A. Evans, N. Evetts, J. Fajans, T. Friesen, M. C.Fujiwara†, D. R. Gill, P. Grandemange, P. Granum, J. S. Hangst, W. N. Hardy, M. E. Hayden, D. Hodgkinson, E. Hunter, C. A. Isaac, M. A. Johnson, J. M. Jones, S. A. Jones, S. Jonsell, A.Khramov, P. Knapp, L. Kurchaninov, N. Madsen, D. Maxwell, J. T. K. McKenna, S.
Menary, J. M. Michan, T. Momose, P. S. Mullan, J. J. Munich, K. Olchanski, A. Olin, J. Peszka, A. Powell, P. Pusa, C. Ø. Rasmussen, F. Robicheaux, R. L. Sacramento, M. Sameed, E. Sarid, D. M. Silveira, D. M. Starko, C. So, G. Stutter, T. D. Tharp, A. Thibeault, R. I.Thompson, D. P. van der Werf & J. S. Wurtele

Author: OLIN, Art (TRIUMF (CA))

Co-author: ALPHA COLLABORATION

Presenter: OLIN, Art (TRIUMF (CA))

Session Classification: W2-4 Fundamental Symmetries and new physics at low energy II (DNP) | Symétries fondamentales et nouvelle physique à basse énergie II (DPN)

Track Classification: Technical Sessions / Sessions techniques: Nuclear Physics / Physique nucléaire (DNP-DPN)