Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **371** Type: **Oral (Non-Student) / Orale (non-étudiant(e))**

Laser Cooled Antihydrogen

Wednesday 9 June 2021 15:45 (10 minutes)

We present the first laser cooling of antimatter, and results of precision spectroscopy performed with laser-cooled antihydrogen atoms. The ALPHA collaboration at CERN is engaged in precision testing fundamental symmetries between matter and antimatter using antihydrogen. Recently, we have made advances in the production, collection, storage, and laser addressing of antihydrogen. These efforts have culminated in the demonstration of laser cooling of hundreds of antihydrogen atoms using a narrow-width nanosecond pulsed laser source at 121.6 nm, tuned to a cycling transition in the 1S-2P line in antihydrogen. Although the cooling laser is only applied in one dimension, we demonstrate reduction in temperature in all three dimensions, using both time-of-flight data and the narrowing of 1S-2P spectroscopic line. We also show that the cooling has an effect of narrowing the 1S-2S line in antihydrogen by a factor of 4 over the our earlier result, the most precise spectroscopic measurement in antihydrogen. Laser cooling should allow us to rapidly approach the precision of hydrogen spectroscopy, and dramatically broaden the scope of possible experiments in antihydrogen. We discuss the laser system used to achieve the cooling, the diagnostic tools used to verify it, and the prospective uses of cold, dense samples of antihydrogen to drastically improve our understanding of the antimatter world.

Authors: KHRAMOV, Alexander (BCIT); EVANS, Andrew (University of Calgary Dep. of Phys. and Astronomy (CA)); COLLISTER, Robert (University of Manitoba / TRIUMF); FUJIWARA, Makoto (TRIUMF (CA)); MOMOSE, Takamasa (University of British Columbia)

Presenter: KHRAMOV, Alexander (BCIT)

Session Classification: W3-6 Exotic Matter II (DNP) / Matière exotique II (DPN)

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