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Rydberg positronium for pulsed antihydrogen production

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The foreseen production of cold antihydrogen atoms at CERN's Antiproton Decelerator (AD) opened up the possibility to perform direct measurements of Earth's gravitational acceleration on antimatter bodies. This is one of the goals of the AEGIS collaboration: measure the value of g using a pulsed source of cold antihydrogen and a moiré deflectometer/Talbot-Lau interferometer. The milestones achieved so far by AEGIS, on the way of developing a pulsed cold antihydrogen source using resonant charge-exchange between antiprotons and cold Rydberg positronium, are presented.

First, the procedure developed to capture, manipulate and prepare a cold plasma of antiprotons for antihydrogen production is summarized. Antiprotons were captured from the AD using aluminum degraders and cooled with electrons. These mixed e^-/p^+ plasma were radially compressed to sub-mm radii applying a rotating-wall drive and progressively reducing the number of cooling electrons. Antiprotons were finally transferred in high numbers to the antihydrogen production trap using an efficient in-flight launch and recapture procedure.

Second, the many milestones achieved by AEGIS in producing, manipulating and studying Ps are summarized. Ps has been first studied in a dedicated setup for spectroscopy experiments at room temperature using nanoporous silica positron-positronium converters in a reflection geometry. The spectroscopy of its 1-3 and 3-15 transitions was carried out, first showing the feasibility of AEGIS' proof-of-concept in-flight laser excitation. These experiments yielded as a byproduct the development of a pulsed long-lived source of $23S$ Ps atoms, which may be considered in the future to directly probe gravity on positronium. Ps was subsequently formed also from the 10K cryogenic converter inside the main AEGIS experiment, leading to the first Ps laser excitation to the Rydberg levels in a 1T magnetic field and to the detailed characterization of the Ps source for antihydrogen production.

Is this abstract from experiment?

Yes

Internet talk

Yes

Name of experiment and experimental site

AEGIS experiment, Antiproton Decelerator, CERN

Is the speaker for that presentation defined?

Yes

Details

Dr. Ruggero Caravita, PhD
TIFPA - INFN
c/o Dip. di Fisica
Università di Trento
via Sommarive, 14
38123 Povo, Trento
Italy
Dr. Ruggero Caravita, PhD
TIFPA - INFN
c/o Dip. di Fisica
Università di Trento
via Sommarive, 14
38123 Povo, Trento
Italy

Primary author: CARAVITA, Ruggero (Universita degli Studi di Trento and INFN (IT))

Presenter: CARAVITA, Ruggero (Universita degli Studi di Trento and INFN (IT))

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