Contribution ID: **17** Type: **not specified**

Hyperfine Structure of Antiprotonic Helium and the Antiproton Magnetic Moment

Thursday 6 December 2012 14:50 (25 minutes)

Antiprotonic helium [1] is an exotic three-body system consisting of a helium nucleus, an electron and an antiproton. The antiproton occupies highly excited metastable states, which allows it to be studied by laser and microwave spectroscopy techniques. By comparing the experimental results with state-of-the-art three-body QED calculations, fundamental properties of the antiproton can be extracted, yielding some of the most precise tests of CPT symmetry in the hadron sector. This way the most precise value of the antiproton mass has been obtained from the laser spectroscopy of antiprotonic helium [2].

The hyperfine structure (HFS) of antiprotonic helium arises from the interaction of the magnetic moments related to the electron spin and the antiproton angular momentum and its spin. Due to the high angular momentum of metastable states, dominant splitting arises from the interaction of electron spin and antiproton angular momentum, while the interaction of the antiproton spin with other moments leads to a smaller splitting. Using a laser-microwave-laser method [3] the most precise value of the magnetic moment of the antiproton was obtained [4] in antiprotonic 4He from the difference of the observed HFS transitions. Recently also the hyperfine structure of antiprotonic 3He was observed for the first time [5]. Its more complex hyperfine structure constitutes a more rigorous test of three-body bound-state QED theory.

References

[1] R.S. Hayano, M. Hori, D. Horvath, and E. Widmann, Rep. Prog. Phys. 12, 1995 (2007).
[2] M. Hori et al., Nature 475, 484–488 (2011).
[3] E. Widmann et al., Phys. Rev. Lett, 89, 243402 (2002).
[4] T. Pask et al., Physics Letters B 678, 55 (2009).
[5] S. Friedreich et al., Physics Letters B 700, 1–6 (2011).

Primary author: WIDMANN, Eberhard (Stefan Meyer Institut)

Presenter: WIDMANN, Eberhard (Stefan Meyer Institut)

Session Classification: P12 –OTHER TOPICS