

SONDERSEMINAR/SPECIAL SEMINAR
MPQ/LMU

Date: Thursday, December 14, 2017

Time: 9:30 a.m.s.t.

Presentation: H el ene Fleurbaey (PhD)
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Title: Frequency Metrology of the 1S-3S Transition of Hydrogen

Location: Discussion/Seminar Room H 311
Faculty of Physics/Ludwig Maximilians University (LMU)

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Ludwig-Maximilians Universit at/Ludwig-Maximilians University (LMU)
CHAIR of Laserspectroscopy / Director Professor Professor Theodor W. H ANSCH

Frequency metrology of the 1S-3S transition of hydrogen

The precise measurement of the 1S-3S transition frequency of hydrogen could have a great impact on the proton charge radius puzzle, which results from the recent spectroscopy of muonic hydrogen. In our experiment, the two-photon 1S-3S transition is excited in a hydrogen atomic beam, with a continuous-wave 205-nm laser which is obtained by sum frequency generation in a non-linear crystal. The transition frequency is measured with respect to the LNE-SYRTE Cs clock by means of a frequency comb.

Recording the signal for several values of an applied magnetic field allows to estimate the velocity distribution of the atoms in the beam and deduce the second-order Doppler shift. Other frequency-shifting systematic effects have been taken into account: cross-damping, light shift, collisions. In this talk, I will present our latest results.

A complete study has shown that the velocity distribution does not depend significantly on the pressure, and allowed to determine the collisional shift. Eventually, a value of the 1S-3S transition frequency is obtained with a relative uncertainty on the order of 10^{-12} . It is in very good agreement with the CODATA-recommended value. This new measurement contributes to the ongoing search to solve the proton radius puzzle.