ÖAW
Austrian Academy of Sciences

# HEPHY-SMI seminar

on fundamental interactions and symmetries

## Muonic hydrogen and the proton radius puzzle

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## ABSTRACT:

Muonic hydrogen is (μp) is the exotic hydrogen atom made from a proton and a negative muon $\mu^-$. Due to the large muon mass $m_\mu \approx 200 m_e$, the Bohr orbits are about 200 times smaller in muonic hydrogen, compared to regular hydrogen. This results in a $200^3 \approx 10^7$ times larger overlap of the muon's wave function with the proton, dramatically enhancing the sensitivity of μp energy levels to nuclear properties.
The finite size contribution to the Lamb shift in muonic hydrogen is as large as 2% of the total 2S Lamb shift.
This makes muonic hydrogen the ideal, clean, atomic system to study the proton rms charge radius.
We have recently measured two 2S-2P transitions in muonic hydrogen. From the Lamb shift we obtain a proton rms charge radius that is 10 times more accurate than the CODATA-2010 world average extracted from electronic measurements (hydrogen spectroscopy and elastic electron proton scattering), but differs by 7 standard deviations from it. This is what's now known as the "Proton Radius Puzzle". This talk will give an overview of the muonic Lamb shift measurement, and review the situation around the radius puzzle.

## DATE:

Wednesday, 12.06.2013 - 17:00 s.t.

## VENUE:

Stefan Meyer Institute
for subatomic Physics
1090 Wien, Boltzmanngasse 3
Seminarraum 2.08

http://www.smi.oeaw.ac.at/groups/hephysmiseminar/

Stefan-Meyer-Institut
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