Status of laser spectroscopy of antiprotonic helium at CERN

Thursday 4 April 2024 18:00 (2 hours)

Metastable antiprotonic helium is a neutral three-body atom [1-6] that contains a helium nucleus, an electron occupying the 1s state, and an antiproton in a Rydberg state of large principal ($n\approx38$) and orbital angular momentum (l=n-1) quantum numbers. Whereas spectroscopy of antihydrogen atoms probes the interaction between an antihadron and antilepton, the antiprotonic helium atom is a hadron-antihadron quantum bound system having the longest known lifetime that can be readily produced. The ASACUSA collaboration at CERN will utilize the unprecedented high-quality beam of the ELENA facility and the latest laser metrology techniques to carry out sub-Doppler two-photon laser spectroscopy of narrow resonances of antiprotonic helium atoms. By comparing the results with three-body QED calculations the antiproton-to-electron mass ratio and upper limits on exotic forces that can arise between the constituent particles will be precisely determined.

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Author: HORI, Masaki (Imperial College London)

Presenter: HORI, Masaki (Imperial College London)

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