Weighing the antiproton - laser spectroscopy of antiprotonic helium atoms

Prof. Ryugo Hayano

Department of Physics, University of Tokyo

Antiprotonic helium is a metastable three-body neutral atom consisting of an antiproton, a helium nucleus and an electron, which we serendipitously discovered some 20 years ago. The antiproton, which normally annihilates within a few picoseconds when injected into matter, can be "stored" in the antiprotonic helium atom for up to several microseconds, and laser spectroscopy is possible within this time window. From the laser transition frequency, the antiproton-to-electron mass ratio can be deduced, and in our recent measurement, we determined the antiproton-to- electron mass ratio to be 1,836.1526736(23). In the colloquium, I will discuss how we discovered this exotic system, and how we observe the laser resonances. I will then discuss implications of our recent results on the CODATA fundamental constant adjustments as well as on the matter-antimatter symmetry tests.