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Direct test for matter–antimatter imbalance in the universe and experimental methods for testing it

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One of the mysteries in modern physics is that antimatter seems to have been disappeared from the universe. According to the standard model of physics, there should have been equal amount of matter and antimatter produced in the Big Bang. However, we don't see any trace of antimatter; at least in the observable universe. One possible explanation is that CPT–symmetry, the corner stone of the standard model is somehow violated. The ALPHA–experiment, situated at CERN's Antiproton Decelerator, has now developed a direct way to precisely address this question. This is done by comparing the properties of hydrogen atom to its anti-world counterpart, antihydrogen. The most recent findings by the collaboration indicate that antihydrogen behaves similarly to hydrogen, in precision of few parts per quadtrillion. However, properties of hydrogen have been measured three orders of magnitude beyond this. ALPHA is currently aiming to improve precision of the measurements of antihydrogen to see if there are any statistically observably differences in the properties in these two atoms. In this talk, a review of recent progress, along with methods to create neutral antimatter, how to trap it, how to diagnose and detect it, will be discussed. A review of the progress in the field of low energy antimatters physics will also be discussed.

Biography

Petteri Pusa received his PhD from the University of Helsinki, Accelerator Laboratory (2004) in the field of applications of theoretical nuclear physics methods in ion beam analysis targeting in materials science research. He further developed his expertise to study various semiconductor materials, especially for high luminosity experiments in high energy physics. In 2006, he joined University of Liverpool, part of CERN's ALPHA collaboration as a Team Leader for developing and commissioning of dedicated annihilation detectors for the purpose of this experiment.

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