ALPHA: Antihydrogen and Fundamental Physics

Prof. Niels Madsen
Department of Physics, Swansea University, United Kingdom

Abstract:
Detailed comparisons of antihydrogen with hydrogen promise to be a fruitful test bed of fundamental symmetries such as the CPT theorem for quantum field theory or studies of gravitational influence on antimatter. With a string of recent successes with trapped antiatoms, starting with the first measurement of a quantum transition in antihydrogen, followed by proof-of-principle work on the gravitational influence and the neutrality of antihydrogen, the ALPHA collaboration is well on its way to perform such precision comparisons.

I will discuss the key innovative steps that have made these feats possible and in particular focus on the detailed work on positron and antiproton preparation to achieve antihydrogen cold enough to trap as well as the unique features of the ALPHA apparatus that has allowed the first quantum transitions in antihydrogen to be measured with only a single trapped antihydrogen atom per experiment. We will also look at how ALPHA plans to step from here towards more precise comparisons of matter and antimatter.