Observation of the Antimatter Hypernucleus $^{4}_{\bar{\Lambda}}\overline{\mathrm{H}}$

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Abstract

Matter-antimatter asymmetry is a research topic of fundamental interest, as it is the basis for the existence of the matter world, which survived annihilation with antimatter in the early Universe. High energy nuclear collisions create conditions similar to the Universe microseconds after the Big Bang, with comparable amounts of matter and antimatter. Much of the antimatter created escapes the rapidly expanding fireball without annihilation, making such collisions an effective experimental tool to create heavy antimatter nuclear objects and study their properties. In this talk, we report the the discovery of the heaviest antimatter particle ($^{4}_{\bar{\Lambda}}\overline{\mathrm{H}}$) ever seen on Earth, composed of an anti-Lambda ($\bar{\Lambda}$), an antiproton and two antineutrons. $^{4}_{\bar{\Lambda}}\overline{\mathrm{H}}$ is reconstructed through its two-body decay in ultrarelativistic heavy ion collisions at the STAR experiment at the Relativistic Heavy Ion Collider. The measurement of antihypernuclei $^{4}_{\bar{\Lambda}}\overline{\mathrm{H}}$ lifetime is achieved for the first time and compared with lifetime of their corresponding hypernuclei $^{4}_{\Lambda}\mathrm{H}$, which allows for further tests of the CPT symmetry. Production yield ratios among (anti)hypernuclei and (anti)nuclei are also measured and compared with theoretical model predictions, shedding light on their production mechanism.