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Observation of the antimatter helium-4 nucleus

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We present the observation of the antimatter ^4He nucleus, the heaviest observed antinucleus. The identification and measurement of anti-^4He relies on the mean energy loss per unit track length, the time of flight of particles, and their curvature in the magnetic field of the STAR detector. Another essential detector capability was the High Level online tracking Trigger (HLT), which helps to cope with the large data volume and greatly speeds up the search effort.
In total, 18 anti-^4He counts were detected at the STAR experiment at RHIC in 10^9 recorded Au+Au collisions at beam energies of $\sqrt{s_{NN}}$ = 200 GeV and 62 GeV. Misidentification probability is estimated to be below 10^{-11}.
The invariant differential cross section is consistent with expectations from thermodynamic and coalescent nucleosynthesis models, which has implications for future production of even heavier antimatter nuclei, as well as for experimental searches for new phenomena in the cosmos. The yield of the stable antinucleus next in line (mass number = 6) is predicted to be down by a factor of $2.6X10^6$ compared to anti-^4He and is beyond the reach of current accelerator technology.

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