Strange Antihyperparticle Created

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(PhysOrg.com) -- Physicists, including nine from UC Davis, working at the U.S. Department of Energy's Brookhaven National Laboratory recently created some strange matter not seen since just after the Big Bang -- an "antihypertriton" composed of antimatter and "strange" quarks. A paper describing the work was published online this month in the journal *Science*.

If researchers can create and study enough of these particles, they can start to address deep problems in physics, such as why the universe is made of matter at all, said Manuel Calderon de la Barca Sanchez, associate professor of physics at UC Davis and part of the project team.

A triton is the nucleus of the hydrogen isotope tritium: a proton and two neutrons. A neutron is made up of three quarks, two "down" and one "up." In a hypertriton, one of the neutrons is replaced by a particle called a lambda hyperon, with one "up," one "down" and one "strange" quark. A hypertriton was observed for a fleeting moment in a lab experiment about 50 years ago, Calderon said.

Calderon and his colleagues detected the antihypertriton when they used Brookhaven's Relativistic Heavy Ion Collider to slam gold atoms into each other at enormous speed. The energy released in these collisions creates new particles in a "quark-gluon plasma," similar to that which existed microseconds after the beginning of the universe.

The antihypertriton, as its name suggests, is a hypertriton in which the up, down and strange quarks are replaced with antimatter equivalents

(anti-up, anti-down and anti-strange quarks).

The particle decayed so quickly that the Brookhaven experiment could only record its distinctive decay products. The researchers collected evidence of about 70 antihypertritons from 100 million collisions.

Being able to make these antinuclei opens up a new field of nuclear physics, Calderon said.

According to theory, equal amounts of matter and antimatter should have been created in the Big Bang. However, if that were the case, the two kinds of matter would have canceled each other out, leaving nothing at all. Instead, the Big Bang yielded an observable universe made mostly of matter -- with rare and fleeting particles of antimatter. Physicists call this problem CP violation, and it is one of the biggest unsolved problems in physics.

The *Science* paper was authored by the STAR Collaboration, which is composed of 54 institutions from 13 countries. Analysis of the hypertriton data was by Jinhui Chen, Kent State University (currently at Shanghai Institute of Applied Physics). The UC Davis members besides Calderon include Daniel Cebra, professor of physics; professor emeritus Jim Draper; postdoctoral researchers Debasish Das and Haidong Liu; research physicist Juan Romero; and graduate students Brooke Haag, Rosi Reed and Evan Sangaline.

Provided by UC Davis