"Long before it's in the papers"

Galaxy-sized twist in time may explain cosmic conundrum

July 19, 2011
Courtesy of the University of Warwick
and World Science staff

A physicist has devised a galaxy-sized solution to one of the outstanding puzzles of subatomic physics: why certain subatomic particles differ unexpectedly from their "antimatter" forms.

Antimatter particles are "twins" of the subatomic particles that make up ordinary matter. Normal particles and their "antiparticle" counterparts have similar properties except for opposite electrical charge. One would expect, then, that every particle and its antiparticle behave the same way, except those differences caused by the opposite charge. Unfortunately, that's not quite the case, and the lack of a clear reason why has annoyed physicists for years.

An artist's illustration shows the "grid" of spacetime being twisted by a turning galaxy. (U. of Warwick / Mark A Garlick)

Studies of particles known as Kaons and B Mesons have found unexplained differences in the way their matter and antimatter versions decay, or naturally disintegrate. The discrepancy is called charge parity violation or CP violation. It's an awkward problem, but some physicists feel solving it might also lead to cracking a deeper mystery: why there is far less antimatter than matter. It appears more of the latter survived the birth of the universe.

Physicist Mark Hadley at the University of Warwick, U.K., now says he has found a testable explanation for these particles' strange behavior, showing that the "violation" is illusory. The answer seems to be that the rotation of our galaxy changes the way subatomic particles break down, Hadley explains.

The "asymmetry," he said, is "a consequence of galactic rotation twisting our local space time. If that is shown to be correct then nature would be fundamentally symmetric after all."

Experiments have found that—as Einstein predicted—a massive, spinning body twists space and time in its vicinity, "dragging" them around in an effect akin to spinning a top inside a cup of honey. Time is affected because it is ultimately inseparable from space; as a result, time moves at slightly different rates under different conditions in the affected area.

This can explain the difference in particle decay rates, Hadley said: different structures within each subatomic particle experience time differently depending on whether they are matter or antimatter. Curiously, the average decay rates of the particles are the same; it's the amount of variation in these rates that differs, something that Hadley maintains is also a factor of the galactic motion.

The beauty of the theory is that it can be tested, he said. Abundant data already exists showing apparent CP violation in some decays; this can be re-checked for a pattern aligned with the galactic rotation, he said. The findings could also open the door to explaining why there is more matter than antimatter, he added; the earliest structures in the universe may have also generated similar frame-dragging effects, affecting the distribution of the two substances.

Separate study findings announced earlier this month indicated that more galaxies spin counterclockwise than clockwise, possibly accounting for some types of asymmetry in the universe and hinting that the cosmos itself may spin.

The new research is published in the journal *Europhysics Letters*.