Experiments offer tantalizing clues as to why matter prevails in the universe

August 16 2010

A large collaboration of physicists working at the Fermilab Tevatron particle collider has discovered evidence of an explanation for the prevalence of matter over antimatter in the universe. They found that colliding protons in their experiment produced short-lived B meson particles that almost immediately broke down into debris that included slightly more matter than antimatter. The two types of matter annihilate each other, so most of the material coming from these sorts of decays would disappear, leaving an excess of regular matter behind.

This sort of matter/antimatter asymmetry accounts for the fact that just about all the material in the universe is made of the normal matter we're familiar with. The results are being published this week in papers appearing simultaneously in the APS journals Physical Review Letters and Physical Review D.

Physicists have long known about processes described by current physics theory that would produce tiny excesses of matter, but the amounts the theories predict are far smaller than necessary to create the universe we observe. The Tevatron experiments suggest that we are on the verge of accounting for the quantities of matter that exist today. But the truly exciting implication is that the experiment implies that there is new physics, beyond the widely accepted Standard Model, that must be at work. If that's the case, major scientific developments lie ahead.

The results emerge from a complicated and challenging analysis, and have yet to be confirmed by other experiments. If the matter/antimatter

imbalance holds up under the scrutiny of researchers at the Large Hadron Collider in Europe and competing research groups at Fermilab, it will likely stand as one of the most significant milestones in high-energy physics, according to Roy Briere of Carnegie Mellon University in Pittsburgh. Briere summarizes the experimental results and their implications in a Viewpoint article in the current edition of *APS Physics*.

More information: physics.aps.org/

Provided by American Physical Society