Astrophysicists cast doubt on link between excess positrons and dark matter

April 16 2010

(PhysOrg.com) -- Astrophysicists are looking everywhere - inside the Large Hadron Collider, in deep mines and far out into space - for evidence of dark matter, which makes up about 25 percent of the energy density of the universe.

Despite the recent tantalizing observation of excess high-energy positrons - thought to be due to dark matter - UC Irvine researchers say we're not quite there yet.

Models predict that when dark-matter particles collide, they'll annihilate some of the time into electrons and positrons, said Manoj Kaplinghat, physics & astronomy associate professor. Scientists working on a satellite experiment called PAMELA recently identified a large excess of positrons, causing a flurry of excitement about having detected dark matter.

Kaplinghat - working with Jonathan Feng, UCI physics & astronomy professor, and Hai-Bo Yu, postdoctoral researcher - evaluated the dark-matter explanation for the PAMELA finding. "What we concluded is that the detection of so many positrons makes it unlikely they're all from dark matter," Kaplinghat said.

The UCI study sharpens predictions of what scientists can expect to detect from the annihilation of dark-matter particles in our galaxy. While it shows that currently popular models cannot account for the excess positrons observed, it leaves open the possibility that discovery of dark-matter evidence could be right around the corner, perhaps within reach of current and planned experiments.

The UCI team's study was published April 15 in *Physical Review Letters* and is suggested reading by the editor.

Worldwide and at UCI, the hunt for dark matter is in full swing. In the 17-mile-long tunnel of the Large Hadron Collider near Geneva, Switzerland, scientists are smashing together subatomic particles at nearly light speed in a quest for insight into the nature of the universe.

In dark mine shafts, researchers are registering faint hints of subatomic particles that they surmise could be dark matter. There are satellite, balloon-borne and ground-based endeavors to find high-energy gamma rays, neutrinos and antimatter that could be signatures of dark-matter particles.

Success in these multipronged efforts would bring astronomers closer to identifying the invisible material that constitutes a quarter of the world and determines the architecture of the visible universe. And physicists would have the first evidence supporting the theory that all forces of nature can be unified under one mathematical expression.

"For now, we're left with no convincing dark-matter explanation for excess positrons," Yu said. "Data from the LHC and experiments deep underground, on the Antarctic ice and in space will throw more light on these issues in the next couple of years - and perhaps we'll even detect the dark-matter particle."

Provided by University of California - Irvine