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Astronomers Search for Dimension X

by Fenella Saunders

Jonathan Feng of the University of California at Irvine has put a bizarre spin on recent cosmological models. He and his collaborators propose that much of the universe's mass consists of hidden particles that travel outside the familiar three dimensions. The idea is not just idle speculation: Feng has shown that some experiments could soon put his theory to the test. "It's mind-boggling if it's true-that would change everything," he says.

Feng's group had been trying to understand dark matter, the unseen stuff inferred from its effects on visible galaxies. One possibility, they realized, is that dark matter consists of Kaluza-Klein

particles, named for two physicists who postulated the existence of extra dimensions curled up tightly outside of the three we experience. "These extra dimensions are very small, so you can't see the particles zinging around in that direction. But that extra energy would manifest itself to us like a large mass,"



Arcs appear where light was bent by the mass of galaxy cluster CL2244-02. Most of that mass is in some invisible, unknown form. Photographs courtesy of ESO.

says Feng. The result would be heavier-than-normal versions of ordinary particles that make up most atoms. These overweight particles would tend to collect in places with large gravitational pulls, like the center of the sun. There they would occasionally crash into each other and spew out unusually energetic neutrinos, which physicists could observe.

"There have been various wild ideas about dark matter in extra dimensions, none of them very testable," Feng says. But he calculates that the newest neutrino detectors, such as AMANDA near the South Pole, have a "reasonable shot" at identifying a flow of energetic neutrinos from the sun. The Alpha Magnetic Spectrometer, a detector scheduled to fly on the International Space Station in 2005, should be able to detect antimatter particles created when Kaluza-Klein particles annihilate each other. "This is not just a mathematical thing," Feng says. "We could verify it in two or five years."

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"Astronomers Search for Dimension X." Cheng, Hsin-Chia, et al. "Kaluza-Klein Dark Matter." *Physical Review Letters* 89 (November 18, 2002). See www.aps.org.