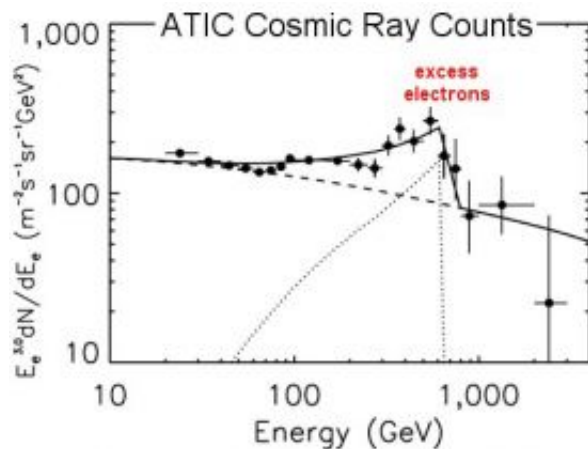


Mysterious Source of High-Energy Cosmic Radiation Discovered

November 19 2008



ATIC high-energy electron counts. The triangular curve fitted to the data comes from a model of dark-matter annihilation featuring a Kaluza-Klein particle of mass near 620 GeV. Details may be found in the Nov. 20, 2008, edition of *Nature*: "An excess of cosmic ray electrons at energies of 300-800 Gev," by J. Chang et al.

(PhysOrg.com) -- Scientists announced Wednesday the discovery of a previously unidentified nearby source of high-energy cosmic rays. The finding was made with a NASA-funded balloon-borne instrument high over Antarctica.

Researchers from the Advanced Thin Ionization Calorimeter (ATIC) collaboration, led by scientists at Louisiana State University, Baton Rouge, published the results in the Nov. 20 issue of the journal *Nature*.

The new results show an unexpected surplus of cosmic ray electrons at very high energy -- 300-800 billion electron volts -- that must come from a previously unidentified source or from the annihilation of very exotic theoretical particles used to explain dark matter.

"This electron excess cannot be explained by the standard model of cosmic ray origin," said John P. Wefel, ATIC project principal investigator and a professor at Louisiana State. "There must be another source relatively near us that is producing these additional particles."

According to the research, this source would need to be within about 3,000 light years of the sun. It could be an exotic object such as a pulsar, mini-quasar, supernova remnant or an intermediate mass black hole.

"Cosmic ray electrons lose energy during their journey through the galaxy," said Jim Adams, ATIC research lead at NASA's Marshall Space Flight Center in Huntsville, Ala. "These losses increase with the energy of the electrons. At the energies measured by our instrument, these energy losses suppress the flow of particles from distant sources, which helps nearby sources stand out."

The scientists point out, however, that there are few such objects close to our solar system.

"These results may be the first indication of a very interesting object near our solar system waiting to be studied by other instruments," Wefel said.

An alternative explanation is that the surplus of high energy electrons might result from the annihilation of very exotic particles put forward to explain dark matter. In recent decades, scientists have learned that the kind of material making up the universe around us only accounts for about five percent of its mass composition. Close to 70 percent of the

universe is composed of dark energy (so called because its nature is unknown). The remaining 25 percent of the mass acts gravitationally just like regular matter, but does little else, so it is normally not visible.

The nature of dark matter is not understood, but several theories that describe how gravity works at very small, quantum distances predict exotic particles that could be good dark matter candidates.

"The annihilation of these exotic particles with each other would produce normal particles such as electrons, positrons, protons and antiprotons that can be observed by scientists," said Eun-Suk Seo, ATIC lead at the University of Maryland, College Park.

The 4,300-pound ATIC experiment was designed to be carried to an altitude of about 124,000 feet above Antarctica using a helium-filled balloon about as large as the interior of the New Orleans Superdome. The goal was to study cosmic rays that otherwise would be absorbed into the atmosphere.

For information on NASA's scientific balloon program, visit:
sites.wff.nasa.gov/code820/

Provided by NASA

Citation: Mysterious Source of High-Energy Cosmic Radiation Discovered (2008, November 19) retrieved 23 April 2024 from
<https://phys.org/news/2008-11-mysterious-source-high-energy-cosmic.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.