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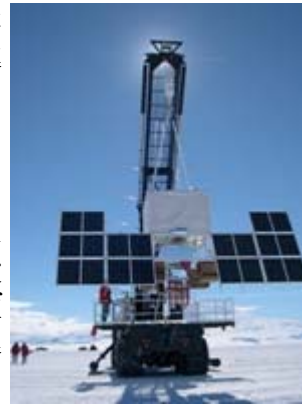
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UM Conceived Experiment Finds Mysterious Cosmic Radiation

COLLEGE PARK, Md. -- An international research project conceived by University of Maryland physicist Eun-Suk Seo has discovered an unexpected surplus of cosmic ray high energy electrons that appear to come from a previously unidentified and relatively nearby cosmic source.



The discovery was made using an instrument conceived and modeled by Seo, an associate professor in the Institute for Physical Science and Technology and the department of physics at the University of Maryland. Called the Advanced Thin Ionization Calorimeter, or ATIC, this instrument was flown high above the Antarctic on-board a NASA balloon as part of an ATIC collaboration led by John P. Wefel, a professor in the department of physics & astronomy at LSU.

In the November 20 issue of the journal Nature, Wefel, Seo and other project scientists report finding an unexpected surplus of cosmic ray electrons with a high energy of 300 - 800 Giga electron volts. This source for these electrons they write would need to be within 1 kilo parsec (3,260 light years) of the sun and could be an exotic object such as a pulsar, mini-quasar, supernova remnant or even an intermediate mass black hole.

The authors say the electron surplus might also result from the annihilation of exotic dark matter particles. Dark matter now is estimated to comprise about 25 percent of the universe, while, amazingly, the ordinary matter that makes up stars, planets, people and other familiar, and visible, parts of the visible universe is thought to account for only about 5 percent of the universe's total mass.

"Although the nature of dark matter is not understood, several theories predict that it could consist of exotic particles," said Seo. "The annihilation of these particles by each other would produce normal particles, such as electrons, positrons, protons, and antiprotons that can be observed by scientists." said Maryland's Seo.

Creating a Unique Cosmic Ray Calorimeter for High Altitude Balloons

In 1997 Seo received the Presidential Early Career Award for Science and Engineers (PECASE) for her "insight in designing and modeling practical experiments to make the fundamental



measurements required to understand cosmic ray acceleration in shock waves from exploding stars." Her concept for the ATIC instrument was optimized to identify and make energy measurements of all cosmic ray elements from hydrogen to iron, in order to test the standard supernova acceleration model.

Seo, Eun-Suk
Associate
Professor

"The totally active bismuth-germinate BGO calorimeter provides the best energy resolution for electron measurements, and successful long duration balloon flights in Antarctica provided the exposure necessary for spectral measurements of the relatively rare cosmic electrons," said Seo, who has been to Antarctica four times. The ATIC instrument has been exposed in a series of three long duration balloon flights around Antarctica to investigate the mechanisms of cosmic ray acceleration, propagation, and confinement. The results reported in the Nature paper are based on data from the first two flights. Data from the last flight still need to be analyzed.

CREAM: Measuring Cosmic Rays with Higher Energy

Seo is principal investigator for a new project for detecting cosmic rays that is known as CREAM (Cosmic Ray Energetics and Mass). Like ATIC, CREAM is a NASA-supported project that uses balloons to fly particle detectors high above the Antarctic ice at the outer reaches of Earth's atmosphere, where such particles can be intercepted before they collide with molecules of air, which obscures their origin. However CREAM carries more complex and durable instrumentation designed to be able to detect and measure cosmic ray particles of even higher energies than those detectable with ATIC. CREAM also is designed to fly aboard balloons capable of much longer duration Antarctic flights than those that carry ATIC. CREAM carries several instruments for measuring the charge and energy of cosmic ray particles, including an advanced calorimeter, this one built at the University of Maryland by Seo's students and staff.

Unique atmospheric circulation over Antarctica during its summer months allows scientists to launch balloons from a site near McMurdo Station, the Foundation's logistics hub in Antarctica, and recover them from nearly the same spot weeks later. CREAM has launched three times on NASA balloons, in December 2004, December 2005, and December 2007. On its first flight in 2004, CREAM circumnavigated the South Pole three times, which set a flight duration record for Antarctic balloons of 42 days. It circled the South Pole twice during the second flight for duration of 28 days. A record-setting cumulative duration of almost 100 days within 3 years was achieved when the third flight was completed in 29 days. It is scheduled to fly again this December (2008) and Seo will leave on November 23 to join University of Maryland team members already on-site at McMurdo Station.

Supported by NASA, the Antarctic balloon flights of both ATIC and CREAM have been conducted by the staff of the Columbia Scientific Balloon Facility under the auspices of the Balloon Program Office at the Goddard Space Flights Center Wallops Flight Facility. The National Science Foundation Office of Polar Programs and the U.S. Antarctic Program provide Antarctic logistics. The ATIC investigation is conducted by an international collaboration of researchers from Louisiana State University, University of Maryland, Marshall Space Flight Center, the Purple

Mountain Observatory in China, Moscow State University in Russia, and Max-Planck Institute for Solar System Research in Germany.

CREAM researchers are from the University of Maryland, Penn State University, the University of Chicago, Ohio State University, NASA's Goddard Space Flight Center, the University of Siena & INFN, Italy, Ewha Woman's University, KyungPook National University, and KAIST, Korea, LPSC Grenoble and CESR Toulouse, France, and UNAM Mexico. Contact Eun-Suk Seo at 301-405-4855 or seo@umd.edu.

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