Giant balloon flying high over Atlantic to catch cosmic rays

May 21 2009

This picture shows the high-altitude balloon fully expanded to a diameter of 459 feet. The red immediately below the balloon is the parachute. The LEE payload of cosmic ray detectors is at the bottom of the chute shrouds. This photo was taken through a telescope by Drew Denney, NASA Columbia Scientific Balloon Facility.

(PhysOrg.com) -- University of Delaware researchers in Sweden have launched a giant balloon taller than a football field that is now flying at the edge of space to collect data on cosmic rays -- the most super-charged particles in the universe.

The balloon, which is 396 feet tall and 459 feet in diameter when fully inflated, was set aloft at 4:34 a.m. on May 17 from Esrange Space Center near Kiruna, Sweden, in the Arctic Circle. It is flying at a speed of more than 40 knots and an altitude of nearly 27 miles. Its payload of

cosmic ray detectors, housed in a pressurized shell, will be cut free in northwestern Canada and float back down to Earth on a parachute, and then secured and recovered, likely by helicopter.

Cosmic rays are extraterrestrial high-energy electrons, protons, and heavier nuclei that enter our atmosphere.

“The bulk of cosmic rays are likely produced by strong shock waves from Supernova explosions within our galaxy,” said John Clem, research associate professor of physics and astronomy at the University of Delaware's Bartol Research Institute. “It is well documented that these high-energy particles can threaten the health of astronauts in space and expose airline workers to radiation,” Clem noted.

Launch of high-altitude balloon carrying cosmic ray detectors over Kiruna, Sweden, May 17, 2009. The balloon is made of a polyethylene film (the same material used to make trash bags) and weighs 4,150 pounds without its payload. Photo by James Roth/University of Delaware

With support from a $961,710 grant from NASA, Clem is leading a research team from UD and NASA's Columbia Scientific Balloon Facility in Palestine, Texas, to learn more about cosmic rays. The effort entails launching two helium-filled high-altitude balloons -- one to carry the “Low Energy Electrons” (LEE) instrument payload, which is now afloat, and one to carry the “Anti-Electron Sub-Orbital Payload” (AESOP), which will be in flight on May 23 and travel to the upper limits of the atmosphere.

Clem says about a thousand cosmic rays strike every square meter of Earth's atmosphere each second, depending somewhat on the location. The data from the balloon flights will be used to study solar modulation, the variation in cosmic ray intensity that is correlated with solar activity.

AESOP can detect electrons with energies up to about 10 gigaelectron volts, according to Clem. The instrument utilizes a system of different radiation detectors and a magnetic spectrometer to identify the particle's electric charge, energy, and mass. The major component in the magnetic spectrometer is the spark chamber.

AESOP's chambers contain five parallel aluminum plates connected, in alternate order, to ground and a high-voltage pulser. The medium between the plates is a slow-moving mixture of neon and helium. As a charged particle passes through a chamber, it leaves behind an ion trail in the gas. In the presence of a high electric field, the ions in the gas are accelerated toward the plate surface, resulting in a bright red vertical spark, which is digitized and recorded by a linear charge-coupled device (CCD) camera.

According to Clem, the level of solar activity rises and falls over a period of approximately 11 years and influences cosmic ray intensity. As solar activity rises, cosmic ray activity decreases. Currently, solar activity is low, and we are in a period of high cosmic ray intensity, Clem

said.

“We're working to better understand how the sun's changing magnetic field affects cosmic ray propagation through the solar system,” Clem noted.

More information: You can follow the flight's path online.

Provided by University of Delaware (news : web)