Media Relations

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UNH Research Helps Unravel Mysteries of Earth's Radiation Belts

Caption: The twin Van Allen Probes were launched on August 30, 2012 into elliptical, near-equatorial orbits around the Earth. Remarkably, rather than seeing just the well-known two-belt structure, the mission found almost immediate evidence of the clear three-belt structure portrayed in green in this diagram. Image courtesy of Andy Kale, University of Alberta.

DURHAM, N.H. – Researchers from the University of New Hampshire are unraveling the longstanding mysteries of the Van Allen radiation belts that circle Earth, improving predictions of space weather conditions and offering better protections to orbiting satellites and astronauts.

The latest discovery, detailed in a paper published recently in the journal Nature Communications, uses measurements taken by a UNH-led instrument on board NASA's Van Allen Probes twin spacecraft to reveal that the high-energy particles populating the radiation belts can be accelerated to nearly the speed of light.

This mode of action is analogous to that of a particle accelerator like the Large Hadron Collider. However, in this case, the Earth's vast magnetic field, or magnetosphere, which contains the Van Allen belts, revs up drifting electrons to ever-higher speeds as they circle the planet from west to east.

The recent finding comes on the heels of a related discovery—also made by the UNH-led Energetic Particle, Composition, and Thermal Plasma (ECT) instrument suite—showing similar particle acceleration but on a microscopic rather than a planetary scale.

"The acceleration we first reported operates on the scale size of an electron's gyromotion—it is a really local process, maybe only a few hundred meters in size," notes Harlan Spence, director of the UNH Institute for the Study of Earth, Oceans, and Space, principal scientist for the ECT, and coauthor on the Nature Communications paper. "Now we're seeing this large-scale, global motion involving ultra low-frequency waves pulsing through Earth's magnetosphere and operating across vast distances up to hundreds of thousands of kilometers."

Having twin spacecraft making simultaneous measurements in different regions of nearby space is a key part of the mission, as it allows the scientists to look at data separated in both space and time.

"With the Van Allen Probes, I like to think there's no place for these particles to hide because each spacecraft is spinning and 'glimpses' the entire sky with its detector 'eyes', so we're essentially getting a 360-degree view in terms of direction, position, energy, and time," Spence says.

Adds Ian Mann of the University of Alberta and first author of the Nature Communications paper, "People have considered that this acceleration process might be present but we haven't been able to see it clearly until the Van Allen Probes."

The Johns Hopkins University Applied Physics Laboratory built and operates the twin Van Allen Probes for NASA. The Van Allen Probes comprise the second mission in NASA's Living With a Star program, managed by Goddard, to explore aspects of the connected sun-Earth system that directly affect life and society.

For more information on the Van Allen Probes, visit:
http://www.nasa.gov/mission_pages/rbsp/main/index.html#.Up4lX4X6aUd

For more information on the Energetic Particle, Composition, and Thermal Plasma (ECT) instrument suite, visit http://rbsp-ect.sr.unh.edu

The University of New Hampshire, founded in 1866, is a world-class public research university with the feel of a New England liberal arts college. A land, sea, and space-grant university, UNH is the state's flagship public institution, enrolling 12,300 undergraduate and 2,200 graduate students.

Image to download: http://www.eos.unh.edu/newsimage/rfi_lg.jpg

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