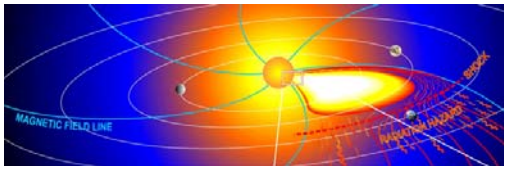
Media Relations

October 15, 2012

UNH Scientists Provide Window on Space Radiation Hazards



In this artist's rendition, particle radiation from a solar flare speeds away from the sun along curved magnetic field lines (blue lines) and arrives before the coronal mass ejection (orange mass from the sun) and its driven shock. PREDICCS provides a real-time window on space weather events like this, which allows situational awareness of the hazards posed by the space radiation environment. Image courtesy of Nathan Schwadron, UNH-EOS. .

DURHAM, N.H. – Astrophysicists from the University of New Hampshire's Space Science Center (SSC) have created the first online system for predicting and forecasting the radiation environment in near-Earth, lunar, and Martian space environments. The near real-time tool will provide critical information as preparations are made for potential future manned missions to the moon and Mars.

"If we send human beings back to the moon, and especially if we're able to go to Mars, it will be critical to have a system like this in place to protect astronauts from radiation hazards," says associate professor of physics Nathan Schwadron of the UNH Institute for the Study of Earth, Oceans, and Space (EOS), which houses the SSC.

Schwadron is the lead developer of the new web-based tool known as PREDICCS, which for the first time integrates numerical models of space radiation, a host of real-time measurements being made by satellites currently in space, and "propagation codes" that can accurately project radiation levels out as far as Mars. The tool was made possible through NASA's Living With A Star (LWS) Targeted Research and Technology program.

The website provides updates of the radiation environment on an hourly basis and archives the data weekly, monthly, and yearly. This historical record provides a clear picture of when a safe radiation dose limit is reached for skin or blood-forming organs, for example.

Says Schwadron, "What we really need to know is how hazardous this *cycle* of radiation is. How often do we see large events that have significant risk associated with them? Those questions can only be answered if you're continually building up the database of events and the risk associated with them."

He notes further that the space science community has traditionally viewed radiation hazards in space as a "showstopper" and that until PREDICCS there has never been an extremely accurate, nearly real-time means of challenging that.

"There hasn't been enough work done to ask, 'Is it really a showstopper and, if so, why, and what are the problems we need to solve so that it isn't a showstopper?'"

That work has now been done, and the proof is in PREDICCS.

Among other satellite measurements used by PREDICCS are solar energetic particle data from the Cosmic Ray Telescope for the Effects of Radiation
(CRaTER) instrument on NASA's Lunar Reconnaissance Orbiter. CRaTER, whose principal investigator is Harlan Spence, director of EOS and a co-developer of PREDICCS, has made the most accurate and comprehensive measurements of radiation at the moon since the dawn of the space age.

During several recent large solar events in which the sun, waking from an unusually long quiet period, sent billions of tons of high-energy particles rippling through space, the radiation levels measured by CRaTER as it orbited the moon were matched almost perfectly by PREDICCS.

"For the whopping solar events of January 23 and March 27 of this year, our predictions seem to be within 20 to 30 percent of what was observed, which is incredible. These types of highly accurate comparisons have never been made before," Schwadron says.

CRaTER, which gauges radiation doses using a high-tech material called "tissue-equivalent plastic" that mimics human muscle, has thus not only provided the validation that PREDICCS models are accurate, but has done so in the context of how the radiation data would impact human beings on the moon or on a mission to Mars.

"We needed to accurately assess what the biological impacts are to make the best quantitative comparisons between models and observations," says Schwadron, "and having a system like this in place now is sort of like flying a trial balloon in preparation for a return to the moon and a trip to Mars."

To make its radiation assessments, PREDICCS integrates two radiation environment models, including the Earth-Moon-Mars Radiation Environment Module (EMMREM) developed at UNH.

"Complex applications like EMMREM are able to leverage observations from all relevant space missions," notes NASA's Madhulika Guhathakurta, LWS program scientist.

A blog has been developed for PREDICCS that allows people to understand how the tool works and how to interpret the various graphs of radiation dosage.

Note's Schwadron, "For the first time people are able to see the affects of space radiation playing out in near real-time, and this opens a new window to an otherwise invisible world."

To view the PREDICCS website, visit http://prediccs.sr.unh.edu/.

The goal of the LWS is to develop the scientific understanding needed for the U.S. to effectively address those aspects of the connected sun-Earth system that may affect life and society. The program's Targeted Research and Technology objectives can be achieved by data analysis, theory and modeling, and the development of tools and methods.

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 12,200 undergraduate and 2,300 graduate students.

Photograph to download: http://www.eos.unh.edu/newsimage/radiationhazard_lg.jpg

Caption: In this artist's rendition, particle radiation from a solar flare speeds away from the sun along curved magnetic field lines (blue lines) and arrives before the coronal mass ejection (orange mass from the sun) and its driven shock. PREDICCS provides a real-time window on space weather events like this, which allows situational awareness of the hazards posed by the space radiation environment. Image courtesy of Nathan Schwadron, UNH-EOS.

-30-

Editors and reporters: Nathan Schwadron can be reached at (210) 632-6451 and nschwadron@quero.sr.unh.edu

Media Contact: David Sims | 603-862-5369 | Institute for the Study of Earth, Oceans, and Space