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UNH Team Wins NSF Award for "Sun-to-Ice" Study

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Media Relations

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A chain of physical processes that begins with the initiation and evolution of powerful coronal mass ejections from the Sun (left), leads to solar energetic particle acceleration and transport through space (middle), and ends up as chemical signatures in ice cores (right) is the focus of the Sun-to-Ice project. Credit: Kristi Donahue, UNH Institute for the Study of Earth, Oceans, and Space

DURHAM, N.H. -- An interdisciplinary team of scientists from the University of New Hampshire's Institute for the Study of Earth, Oceans, and Space (EOS) has been awarded a grant from the National Science Foundation's (NSF) new Frontiers in Earth-System Dynamics (FESD) program. The five-year project, which crosses the boundaries between space physics, atmospheric, and ice core science, will investigate, model, and test the complex, interlinked physical processes at the frontier of the dynamic Sun-Earth system.

This chain of processes begins with the initiation and evolution of the powerful coronal mass ejections thrown off by the Sun, moves to solar energetic particle (SEP) acceleration and transport through space, and, finally, leads to SEP access to the polar caps and effects in the atmosphere, and chemical signatures in ice cores.

"The Sun-to-Ice project ultimately seeks to understand this chain, looking for signals frozen in polar ice as a history of extreme solar events that have affected our planet," says astrophysicist Harlan Spence, EOS director and principal investigator on the multi-institution project. "If we are able to confirm the link, we will calibrate nitrate enhancements in ice cores, thereby unlocking historic information of extreme events and associated atmospheric transport, photochemistry, ozone destruction, and other Earth impacts." The award amount was $5 million.

Spence notes that each link in this chain is fraught with controversy from a scientific perspective and that, as such, the project is one of "high risk, high payoff."

Nitrate spikes in polar ice are thought by some to be associated with the process whereby highly energetic particles driven by solar events penetrate Earth's atmospheric layers and interact with chemical components to, eventually, be deposited as nitrate. By confirming a link between extreme solar activity and the ice core record, scientists would be able to use deep ice cores as a means for unraveling the history of ancient solar activity and establishing the range of extreme solar events. To date, making this connection has been highly controversial and difficult to prove.

Notes UNH provost and vice president for academic affairs John Aber, "Dr. Spence and this team cross a number of traditional disciplines to address challenging and important research questions with major implications for the Earth as a system. There a very few places in the country where the combination of expertise exists to address such complex and fascinating questions."

The interdisciplinary EOS science team includes space physicist Nathan Schwadron and astrophysicist Terry Forbes of the Space Science Center and environmental chemist Jack Dibb and biogeochemist Ruth

Varner of the Earth Systems Research Center. Dibb specializes in atmospheric and snow chemistry, and Varner is director of the UNH Center for Excellence in Geosciences Education (CEGE) and will, with education and outreach specialist Erik Froburg of CEGE and the UNH Joan and James Leitzel Center, bring a strong outreach and student engagement effort to the project – a key, strategic component for both UNH and NSF.

The FESD program is central to the NSF's new decadal strategic plan to, among other things, foster an interdisciplinary and multi-scale understanding of the interplay among and within the various sub-systems of the Earth. Says Tim Killeen, NSF assistant director for Geosciences, "FESD will support teams of scientists focused on attacking some of the most important scientific challenges of our time."

Partner institutions in the project include the National Center for Atmospheric Research, the University of Colorado, NASA Goddard Space Flight Center, the University of Arizona, Predictive Sciences, Inc., and Southwest Research Institute.

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.

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Image to download:
http://www.nsf.gov/news/mmg/media/images/fesd1_h.jpg
Caption: A chain of physical processes that begins with the initiation and evolution of powerful coronal mass ejections from the Sun (left), leads to solar energetic particle acceleration and transport through space (middle), and ends up as chemical signatures in ice cores (right) is the focus of the Sun-to-Ice project.
Credit: Kristi Donahue, UNH Institute for the Study of Earth, Oceans, and Space

NSF press release on the Frontiers in Earth-System Dynamics awards:
http://www.nsf.gov/news/news_summ.jsp?cntn_id=121842

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