UNH Research 2014

A digest of the year’s research news from the University of New Hampshire

- Agriculture & Biological Sciences
- Business & Technology
- Engineering & Physical Sciences
- Health, Behavioral & Social Sciences
- Humanities & the Arts
- Marine & Ocean Sciences
- Space Science
- Sustainability & the Environment

This report is produced by the Research Development and Communications unit of the UNH Research Office.
Find it on the Web at http://www.unh.edu/research/UNH-Research-Digest.
**Space Science**

**Astrophysicist Available To Discuss Powerful Solar Flares**

Nathan Schwadron, an astrophysicist in the Space Science Center within the UNH Institute for the Study of Earth, Oceans, and Space, is available to discuss the implications of and provide context for the powerful solar flare that erupted from the sun on September 10, 2014. Schwadron is the project director for both the Cosmic Ray Telescope for the Effects of Radiation (CRaTER) instrument on board the National Aeronautics and Space Administration’s Lunar Reconnaissance Orbiter mission and the Earth-Moon-Mars Radiation Environment Module under development at UNH.


**Cosmic Tower of Babel**

James Ryan, astrophysicist in the Space Science Center in the UNH Institute for the Study of Earth, Oceans, and Space, is converting a century’s worth of data from neutron monitoring stations into a common format for the Neutron Monitor Database (NMDB). The NMDB was created to establish an international system for representing cosmic ray data, a previously subjective field with measurement and representation approaches varying greatly from station to station around the globe. With the help of UNH undergraduate students, Ryan is standardizing data from stations on Mount Washington and in Durham, NH; Colorado; and Hawaii for inclusion in the NMDB.

http://www.eos.unh.edu/Spheres_0314/neutronmon.shtml

**Electric Sparks May Alter Evolution of Lunar Soil**

A recent study by UNH scientists and NASA may alter contemporary understanding of the evolution of planetary surfaces in our solar system. Published in the *Journal of Geophysical Research – Planets*, the new research suggests that solar storms may electrically charge the soil on the surface of the moon, a process that may also occur on the surfaces of other planets throughout the solar system, especially in extremely cold regions that are exposed to harsh radiation from space. The data for this study was collected in part by the UNH-led CRaTER project. Coauthors from the UNH CRaTER team include Jody Wilson, research scientist (lunar science); physics graduate student Colin Joyce; Nathan Schwadron, associate professor of physics; and Harlan Spence, professor of physics and director of UNH’s Institute for the Study of Earth, Oceans, and Space.

In Search of the Solar Black Swan

Scientists from the UNH Institute for the Study of Earth, Oceans, and Space (EOS) are leading the National Science Foundation’s Sun-to-Ice project, a five-year, interdisciplinary study exploring whether solar events such as coronal mass ejections contribute to chemical signatures in polar ice cores. A connection would mean that signals in the ice could help scientists predict a devastating "Black Swan" event – a rare, unexpected occurrence of large magnitude and consequence – that would cripple global power grids, render satellites useless, and bring modern-day society to its knees. In just the second year, the group has discovered that nitrate signatures in ice are caused by sources other than solar energetic particles, thus cannot be used to understand the sun’s history or predict future events. The Sun-to-Ice project, which crosses the boundaries between space physics, atmospheric science, and ice core science, is led by Harlan Spence, director of EOS.

http://www.eos.unh.edu/Spheres_0314/sunice.shtml

Lightning Researcher Is New Peter T. Paul Chair in Space Sciences at UNH

Joseph Dwyer, a leading expert on lightning, has been named the Peter T. Paul Chair in Space Sciences within the Institute for the Study of Earth, Oceans, and Space at UNH and the College of Engineering and Physical Sciences. He will join the UNH faculty at the start of the fall semester in 2014. Dwyer was most recently department head and professor of physics and space sciences at the Florida Institute of Technology.

http://www.unh.edu/news/releases/2014/05/ds27dwyer.cfm

Luna Tunes

Marty Quinn, computer scientist and team member of the UNH-led Cosmic Ray Telescope for the Effects of Radiation instrument onboard the National Aeronautics and Space Administration’s Lunar Reconnaissance Orbiter, is making scientific data more accessible and meaningful to people who are blind or visually impaired by allowing them to hear what goes on in space. He has “sonified” the mission’s raw data into musical tones that represent radiation around the moon. Auditory explanations accompany the radiation “notes” that are represented by instruments such as piano, strings, and steel drums. The often soothing tunes change based on the calmness or intensity of current radiation conditions.

http://www.unh.edu/unhtoday/veterans/Crater-radio

Mark McConnell – Ballooning for Science

Mark McConnell, professor of physics, uses high altitude balloons to position detectors 130,000 feet above the Earth’s surface. At this height, the balloons hover between the edge of space and the outermost limits of the Earth’s atmosphere. This allows for collection of unhindered measurements of gamma radiation from space. “We are attempting a type of measurement that gives new insights into high energy phenomena in the Universe and provides training for the next generation of scientists,” he explains. The current experiment is known as the Gamma Ray Polarimeter Experiment, or GRAPE.

Oct 8th Science Café in Portsmouth: Space Weather: Radiation with a Chance of Solar Flares
Harlan Spence, professor of physics and director of UNH’s Institute for the Study of Earth, Oceans, and Space, and research professor of physics Antoinette Galvin discussed solar storms, flares, and eruptions, also known as space weather, at the Science Café held at the Portsmouth Brewery’s Jimmy LaPanza Lounge on October 8, 2014. The two astrophysicists offered insight into space weather and its possible impacts on humanity. The Portsmouth Science Café series, hosted by UNH faculty member Cameron Wake, is free and open to the public.

http://nhepscor.org/events/space-weather-radiation-chance-solar-flares

Scientific Sojourn: From the Hands of High-Schoolers, a Balloon Takes Flight
Tenth- and eleventh-grade students spent three weeks working in UNH’s physics laboratories as part of Project SMART (Science and Mathematics Achievement through Research Training), a four-week, science-intensive camp for high-schoolers. They built and launched an octagonal flight vehicle for a high-altitude balloon that took photos and video and gathered atmospheric data. The balloon build and launch was the team element of Project SMART’s space science module headed up by research professor of physics Charles Smith. Smith works with UNH faculty, graduate and undergraduate students, and science educators from three New Hampshire high schools to deliver the annual program.

http://www.unh.edu/unhtoday/2014/07/scientific-sojourn

Scientists Reveal Cosmic Roadmap to Galactic Magnetic Field
Nathan Schwadron, lead scientist for NASA’s Interstellar Boundary Explorer (IBEX) Science Operations Center at the UNH Institute for the Study of Earth, Oceans, and Space, and his collaborators have identified a “ribbon” of energy and particles at the edge of the solar system. The findings, published in Science Express in February 2014, are not consistent with data collected by the National Aeronautics and Space Administration’s Voyager 1 mission, but Schwadron considers the discrepancies to be clues to further understanding how interstellar magnetic fields shape, deform, and transform Earth’s heliosphere. Learning more about these magnetic fields is crucial to understanding not only the environment of our galaxy, but also of the environment on Earth.

http://www.unh.edu/news/releases/2014/02/ds13roadmap.cfm
http://www.unh.edu/campusjournal/2014/02/scientists-reveal-cosmic-roadmap-galactic-magnetic-field

Scientists Using UNH Detector Illuminate Cause of Sun’s “Perfect Storm”
Noé Lugaz, Charles Farrugia, and Antoinette Galvin, researchers in UNH’s Space Science Center within the Institute for the Study of Earth, Oceans, and Space, are members of an international team of scientists studying the extreme weather storm that occurred on the Sun on July 22, 2012. A UNH-designed instrument onboard the National Aeronautics and Space Administration’s twin-satellite Solar Terrestrial Relations Observatory (STEREO) mission made new, essential
measurements of this rare, powerful storm event triggered by two successive solar eruptions known as coronal mass ejections (CMEs). The goal of the STEREO mission is to gain a better understanding of what causes these space storms to form and evolve in order to prevent potential damage the storms may cause to technological systems such as satellites and ground-based electricity grids.

http://www.unh.edu/news/releases/2014/03/ds18storm.cfm
http://www.unh.edu/campusjournal/2014/03/scientists-using-unh-detector-illuminate-cause-sun%E2%80%99s%E2%80%9Cperfect-storm%E2%80%9D

UNH Scientific Balloon Set to Measure Gamma Rays from the Crab Pulsar

In September 2014, UNH scientists launched a massive weather balloon carrying instruments that will measure gamma rays from the Crab Pulsar, the remains of a supernova explosion that occurred in 1054 A.D. over 6,500 light years from Earth. The Gamma Ray Polarimeter Experiment (GRAPE) is led by Mark McConnell, a professor in the Space Science Center within the UNH Institute for the Study of Earth, Oceans, and Space and chair of the UNH department of physics. The team hopes the data collected with GRAPE’s new type of detector technology will provide information about the cause of the gamma rays and, ultimately, more insight into the poorly-understood process of particle acceleration.


UNH Scientist: Cosmic Rays Threaten Future Deep-Space Astronaut Missions

In a paper published online in the journal *Space Weather*, associate professor Nathan Schwadron of the UNH Institute for the Study of Earth, Oceans, and Space and the department of physics presents data and critical information on the radiation hazards that will be faced by astronauts on extended missions to deep space such as Mars. The study is the capstone article in the *Space Weather* CRaTER Special Issue, which provides comprehensive findings on space-based radiation as measured by the UNH-led Cosmic Ray Telescope for the Effects of Radiation (CRaTER) on the National Aeronautics and Space Administration’s Lunar Reconnaissance Orbiter. Schwadron is lead author of the paper and project director for CRaTER.

http://www.unh.edu/news/releases/2014/10/ds21nasa.cfm

UNH Space Scientist Honored by European Geosciences Union

Noé Lugaz, research assistant professor in the UNH Institute for the Study of Earth, Oceans, and Space, has received the Arne Richter Award for Outstanding Young Scientists from the European Geosciences Union (EGU). Lugaz was recognized for his work studying coronal mass ejections, which are eruptions on the sun that can impact technology on Earth. He has been involved in the STEREO mission, a National Aeronautics and Space Administration initiative to construct three-dimensional views of the sun using satellite-mounted instrumentation built at UNH. Lugaz accepted his award and delivered the award lecture at the EGU 2014 General Assembly meeting in Vienna, Austria.

http://www.unh.edu/campusjournal/2014/04/unh-space-scientist-honored-european-geosciences-union