



# EOS SPHERES

Institute for the Study of Earth, Oceans, and Space • A University of New Hampshire Research Institute • Morse Hall, Durham, NH

## Updated EOS Website

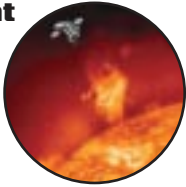
Check out our new format and additional information pages. Go to [www.eos.unh.edu](http://www.eos.unh.edu).



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## Space Scientists Develop PLASTIC Instrument

to be launched on NASA's STEREO spacecrafts.



6

## Peter T. Paul Chair

in Space Science has been established. UNH receives \$10 million gift.



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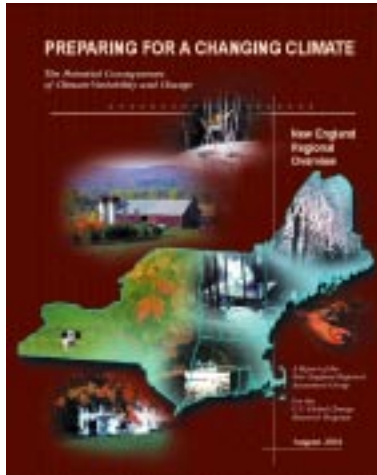
Winter 2002

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In August 2001, the New England Governors and Eastern Canadian Premiers adopted a Climate Action Plan. This plan sets a short-term goal of reducing regional greenhouse gas emissions to 1990 levels by 2010, along with ambitious longer-term goals. The NERA report is acknowledged to be one of the main bases for action for developing the Climate Action Plan.

## Focus on the Region

### Turning Up the Heat on Climate Science in New England



If nothing is done to reduce the amount of carbon dioxide released into the atmosphere, the average temperature in New England and upstate New York is likely to increase by 6° to 10° F over the next century. In addition to temperature change, the region may experience increases in precipitation from 10 to 30 percent. These changes, if they occur, would profoundly affect the New England region, with major impacts expected on weather, air quality, human health, the natural environment and the regional economy.

This is the conclusion of a new report released by the Institute. The New England Regional Assessment (NERA) report is one of 16 such regional reports conducted as part of a national assessment of potential climate change impacts and is the product of a four-year effort to characterize the impacts of a changing climate to the region. It examines the current understanding of factors known to influence our regional climate, and the projections of possible future regional climates.

The report presents records of regional average temperatures that show warming of 0.7° F since 1895. Within the region there has been considerable variation in the trend. Rhode Island and New Hampshire have warmed by two to three times the regional average, while Maine has cooled somewhat, most likely the result of re-growing forests which absorb sunlight and cool the land surface. The recent milder winters, earlier maple sap flows, earlier dates for ice melting on lakes and reduced snowfall experienced across the New England region are likely responses to this increase in temperature during the past century.

"Human activities are affecting climate," says Barrett Rock, Professor of Forest Resources and the report's lead author. "There is now strong evidence that much of the global warming experienced in the last half of the 20th century is attributable to human factors, the major culprit being the burning of fossil fuels."

To derive future projections, scientists used data for the region from two established global climate models used in the U.S. National Assessment of Climate Change Impacts on the United States -- the UK Hadley Model and the Canadian Climate Model. Both models were run into the future, assuming that atmospheric CO<sub>2</sub> concentrations increase at 1 percent of 1990 levels per year throughout the century.

Predicted temperature increases would be greater than any climatic variation experienced by the region in the past 10,000 years, says Rock,

*continued on page 2*



## Weather Forecasting on Earth gets a Lift from Space Science

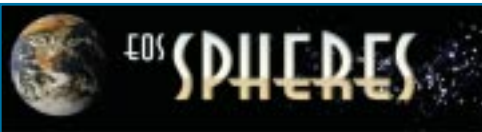
For the first time, scientists are now demonstrating the capacity for measuring wind speeds around the globe using sophisticated laser technology in an effort to improve weather forecasting. This project, called "GroundWinds," has been made possible through a unique partnership between Earth and space scientists. Berrien Moore III, Director of EOS and a global carbon cycle scientist, and James Ryan, Professor of Physics and Space Science, are co-principle investigators on the project, which has been awarded more than \$8 million from NOAA.

"The Space Science Center has built instruments for Earth science projects, but this is the first serious collaboration between Earth and space scientists at the Institute," says Ryan. "It opens up all new possibilities for space scientists, some of which will catch the interest of Earth scientists and vice versa."

Although originally conceived as a project focusing on atmospheric dynamics, Ryan was a natural fit with the project. GroundWinds promised to be a major technological project, and space science is all about high technology. Also, while the instruments are currently based on the ground in a technology demonstration, the eventual goal is to measure wind from low Earth orbit.

Moore explains, "The next step will be a high altitude balloon mission and then, hopefully, space." — Amy Seif

<http://groundwinds.sr.unh.edu>



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Spheres Newsletter  
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## Turning Up the Heat

*continued from page 1*



describing what such a warming trend might mean. "If the average temperature for Boston were to increase by 6° F,

as one of the scenarios suggests, then Boston's new average temperature would roughly equal the current 30-year average temperature of Richmond, Virginia. If it were to increase by 10° F, as the second model suggests, then Boston's new average temperature would equal Atlanta's current average."

George Hurtt, an assistant professor in EOS and lead author of the report's chapter on future climates, cautions that the report is not making predictions, but is rather projecting the future based on current trends and the best global computer models available today.

"These models were developed for addressing global issues, and are more error-prone on a regional level," says Hurtt. "Still, the evidence that current trends may have dramatic consequences for the region is suggestive enough to warrant further research, assessment and action to reduce uncertainties and help mitigate the problem."

The New England Regional Assessment of the potential consequences of climate variability and change is a collaborative effort of scientists and stakeholders across the New England region.

— Sharon Keeler, UNH News Bureau 

<http://www.necci.sr.unh.edu>

## From the Director Introducing SPHERES

The Institute for the Study of Earth, Oceans, and Space (EOS) at the University of New Hampshire has created an extraordinary record of scientific achievement over its 17 years of existence. It seems appropriate in our inaugural newsletter to reflect on our cumulative achievements. However, we must recognize that this record of scientific excellence stems from strong roots set down before the Institute came into being.

Before the age of satellites, Professor Jack Lockwood built one of the world's first cosmic ray detectors at the Mount Washington Observatory. When the nation was ready to go to space, the Space Science Center, then within the Department of Physics, was ready and contributed significantly to wonderful path-finding explorations in space. Jack Lockwood was also one of the driving forces behind one of the four great astrophysical observatories: the Gamma Ray Observatory (GRO). GRO, launched in April 1991, was the heaviest scientific payload lifted into orbit.

Complementing these contributions, our colleagues in the Space Science Center, now within EOS, were also breaking new ground in the investigation of one very important star—the Sun. EOS, in collaboration with major universities and laboratories, contributed significantly to most of the space physics missions focused on the study of the Sun-Earth System that were launched during the past decade, including Wind, Fast, Polar, ACE, Equator-S, Cluster II and a host of successful sounding rocket experiments—led by Roger Arnoldy, the first Director of EOS.

The future of EOS in space looks equally exciting. Our colleague, Professor Antoinette Galvin, is Principal Investigator for the PLASTIC Instrument, which is to be flown on a new solar mission in 2004. We expect great things to continue emerging from our Solar-Terrestrial Theory Group, one of only a few groups nationwide to have received continuous funding from NASA's Sun-Earth Connections Theory Program since its inception.

We also have been honored by the generosity of Mr. Peter Paul and the UNH Foundation enabling the Peter T. Paul Chair in Space Science. This remarkable gift is leading us on another global search: this time for someone to fill the Peter Paul Chair.

Paralleling this record of success in space physics and astrophysics, the Earth scientists within EOS have been making extraordinary strides in understanding our planet's changing environment. This understanding comes, partly,

through intensive field investigations spanning the globe; our colleagues and students have been literally everywhere.



Earth scientists in EOS are also beginning to envision our planet as one world undivided by national boundaries, encircled by one grand ocean and wrapped in one envelope of air. By looking at the whole planet, through instruments orbiting high above and mathematical models on computers, we are exploring the systems that shape the global environment.

We recognize that environmental change is occurring at a rapidly increasing rate. Greenhouse gases from the burning of fossil fuels are accumulating in the atmosphere, large areas of forest are being cleared, significant stocks of pollutants are being introduced into the biosphere, the global water cycle is being altered, and significant reductions in fish stocks are occurring.

Research that crosses boundaries is essential if adequate understanding of the causes, the impacts of these changes, and the possibilities of successful mitigation strategies are to be achieved. By promoting that understanding, the Institute contributes to the formation of reasoned and effective public policies to ensure intelligent use of the Earth's resources and protection for our environment. Importantly, EOS has demonstrated that we excel at this type of multi-disciplinary scientific strategy.

Our research is beginning to yield solutions. EOS is probing the issue of the economic feasibility of open-ocean aquaculture, and developing new instruments to improve weather forecasting and revolutionary new methods to share information over the Internet. We are involving younger students in grammar and high schools in programs that teach them how to understand their environment, using tools that range from the macroscopic (i.e., satellite imagery) to the microscopic.

This leads to my final point in this reflection about our past and now about the future. EOS is now a leading international center in research on global environmental change, and hence it is our responsibility to develop a new generation of scientists and citizens empowered to meet the challenges posed by such changes in the Earth's environment.

The achievements of the past have been literally remarkable and provide a strong foundation for us to meet the challenges of the future.

— Berrien Moore III 



## Northeast Consortium Moves In

Ann Bucklin, the UNH Representative for the Northeast Consortium, calls the project "a creative response to a difficult problem." The problem is the depletion of New England fisheries and its impact on the fishing industry. The response is a project that encourages and funds commercial fishermen to become active participants in fisheries and oceanography research. The Northeast Consortium brings a new source of income to fishermen; seventy-five percent of the funding goes directly to the industry.

A year ago, the Consortium administration office was moved to EOS. The original concept began in 1998 in Senator Gregg's congressional office, when a Sea Grant/Knauss Marine Policy Fellow in the Senator's office, Brian McLachlan, helped create and fund the Consortium. The Consortium has always been regional in nature, including the states bordering the Gulf of Maine, and is led by representatives from MIT, University of Maine, Woods Hole Oceanographic Institute, and UNH. The Consortium received nearly \$8 million in 2001 and currently funds more than 40 projects.

Says Bucklin, "Moving the consortium to EOS was a big challenge for the Institute, which doesn't typically administer outreach to these communities; we end up dealing directly with fishermen or with their wives who run the business while they are at sea. This was also a huge grants administration challenge, which the Institute shoulders for altruistic reasons." — AS

<http://www.northeastconsortium.org/>



*Pictured here is the fishing vessel "FV Ellen Diane," owned by David Goethel, on its way to tag codfish as part of a cooperative research project funded by the Northeast Consortium. Photo by Ethel Goethel.*

## New Graduate Program in Natural Resources and Earth Systems Science

UNH has evolved into a premier research institution in the environmental sciences, as evidenced by its ranking among the top five research universities in citations in both ecology/environmental science and the geosciences by the Institute for Scientific Information. EOS faculty and others have been interested for some time in developing a graduate program that captures the intellectual breadth and depth of ongoing research activities. We are pleased to announce, along with our colleagues in the Earth Sciences, Natural Resources and other departments, the genesis of a new combined graduate program in Natural Resources and Earth Systems Science. This new program will be by far the largest Ph.D. program on campus and will offer two degrees: the Ph.D. in Natural Resources and Environmental Studies and the Ph.D. in Earth and Environmental Sciences.

The new program represents a name change for two existing programs, replacing the present Natural Resources Ph.D. program and the Ph.D. in Earth Sciences, and a reorganization of the administration for these programs. Changing the

names of the degree programs offers better visibility, coherence, and focus. Combining the two degrees under a single graduate program recognizes their similarities, fosters interdisciplinary research, and provides numerous administrative efficiencies.

Governance and administration of each of these degree programs will rest with the faculty of the Graduate Program in Natural Resources and Earth Systems and will be similar to the existing structure of the Natural Resources Ph.D. program. The program lies outside of existing colleges and institutes and reports directly to the Graduate School. Faculty for the umbrella program will include those already affiliated with the Natural Resources Ph.D. program and graduate faculty in the Department of Earth Sciences.

Students enrolled in the current programs can choose to remain in their program until graduation or can transfer to the new program. For more information on the new Graduate Programs in Natural Resources and Earth Systems Science, contact John Aber at [john.aber@unh.edu](mailto:john.aber@unh.edu). — AS

<http://www.nr-phd.sr.unh.edu>

*Bookmark this*

## EOS web site gets a face-lift

What's the buzz at EOS? What you are hearing is the hum of computers, as excited faculty and students check out the new EOS web site. The real face of the Institute shines through this more comprehensive, reader-friendly and exciting site. Now visitors can view our table of courses and course syllabi, learn about our graduate programs, and find out about upcoming events.

See for yourself:

<http://www.eos.unh.edu>



## Funding Reaches an All-Time High

Research awards at UNH and in EOS reached an all-time high during Fiscal Year 2001. EOS awards during the year were \$24.5 million, approximately 30% of UNH's total external funding of \$81.9 million.

## Faculty/Staff News

### Earth System Science

**John Aber** co-authored two recent articles in *Bioscience* and wrote the lead editorial for a special edition of the journal. As the co-chair of the Forest Sector portion of the First National Assessment of the Potential Impacts of Climate Variability and Change, he contributed to the report on Climate Change Impacts on the U.S. He was the invited plenary speaker at the International Plant Nutrition Symposium and chaired a session on the impacts of nitrogen deposition on forests at the 2nd International Nitrogen Conference.

**Janet Campbell**, as a member of NASA's science team for the Moderate Resolution Imaging Spectroradiometer (MODIS), is responsible for the continuity between MODIS chlorophyll measurements and those of the Sea-viewing Wide Field-of-View Sensor (SeaWiFS). The ultimate goal is to monitor changes in marine ecosystems in response to climate change.

**George Hurtt** was co-author of a major new paper, published in *Ecological Monographs*, presenting the theoretical basis and first application of a new ecosystem model for use in large scale ecological, biogeochemical and land surface studies.

**Berrien Moore III, Rob Braswell**, and **Kathy Hibbard**, along with other leading carbon scientists from around the world, co-authored a paper entitled "Recent patterns and mechanisms of carbon exchange by terrestrial ecosystems" in *Nature* this past November.

**Scott Ollinger** and **Mary Martin** received an award of \$884,818 from the NASA Earth System Science Program to test the applicability of a new approach for studying rates of growth and carbon uptake across a wide range of ecosystems and locations, including the eastern US, Brazil, Australia, and California. They also co-authored a paper on regional variation in foliar chemistry and soil nitrogen status, published in *Ecology*.

**Michael Prentice** led a small international expedition to Papua New Guinea in November to reconstruct the history of the El Niño Southern Oscillation in the far tropical western Pacific using high elevation lake records. The expedition was

conducted in collaboration with the American Museum of Natural History and a biodiversity zoo in Papua New Guinea.

**Barrett Rock** is on sabbatical this year teaching at Charles University in Prague and at Mendel University in Brno, sponsored by a Fulbright Faculty Scholar award. While in Central Europe, he is also acting as the GLOBE Science Ambassador to that region and is attending GLOBE training workshops in several countries. Continuing his on-going research, he is also monitoring forest damage caused by air pollution in the mountains of the Czech Republic.

**Dork Sahagian** gave the keynote address at the conference "Image Analysis, Sediments and Paleoenvironments." He has been nominated to run for Secretary of the new Biogeosciences section of AGU. His recent publications have appeared in the journals *AAPG Bulletin*, *Computers in Geosciences*, the *Bulletin of Volcanology*, and in *Global and Planetary Change*.

**Robert Talbot** reports that there was an AIRMAP science planning meeting at the New England Center in October. He is looking forward to mid-July, when the RV Ron Brown, NOAA's largest research vessel, will be based out of Portsmouth for a month. The ship will be involved in a "scoping study" to provide preliminary information for planning the large-scale New England Air Quality Study in summer 2004.

### Space Science

**Roger Arnoldy**, in collaboration with Cornell University, was involved in the launch of a Black Brant 12 rocket from the University of Alaska rocket range this January. UNH provided charged particle detectors to measure the aurora and a new experiment attempting to measure the temperature of the current-carrying thermal electron population at altitudes in the ionosphere and higher. **Mark Widholm** is the project engineer.

**Antoinette Galvin** was appointed to the Christa McAuliffe Planetarium Commission in September for a three-year term. This appointment is made by the Governor of New Hampshire.

**Joseph Hollweg** and the Solar Terrestrial Theory group have received another three years funding from NASA's Sun-Earth Connections Theory Program to study solar wind, coronal mass ejections, and other solar phenomena. The Solar Terrestrial Theory group is one of the few research

groups nationwide to receive continuous funding from this competitive NASA program since 1980.

**Vania Jordanova** has been awarded a three-year research grant from the National Science Foundation Geospace Environment Modeling Program for support of the project entitled "GEM: Magnetic Storm Modeling". A broad-based study will be undertaken of the dynamical coupling between solar wind and the Earth's magnetosphere during several geomagnetic storms.



**Mark Granoff** and **Phillip Demaine** were awarded a U.S. patent for the development of the Surface Trace Electrical Feedthru, an integral part of the SEPICA instrument on the ACE satellite.

**Mark McConnell** was recently awarded observation time on the International Gamma-Ray Astrophysics Laboratory (INTEGRAL), a European satellite that is scheduled for launch in October, 2002. He will use the observing time to follow up on observations made by the Compton Gamma-Ray Observatory. He is anxiously awaiting the winter launch of the High Energy Solar Spectroscopic Imager (HESSI) and will be using data from HESSI to study hard X-ray polarization in solar flares. In November, Mark presented a paper at the Gamma-Ray Burst and Afterglow Astronomy Workshop at Woods Hole.

**Andrzej Rucinski** has been involved in the development of a new Bachelor of Science degree program in computer engineering, offered through the UNH Department of Electrical and Computer Engineering.


**James Ryan** received two grants from NASA's High Energy Astrophysics Supporting Research and Technology Program to develop detectors for hard x-ray and gamma-ray imaging and spectroscopy. The awards exceed \$1 million over a three-year period. **Mark McConnell** and **John Macri** are co-investigators in the effort.



**Mark McConnell, Richard Miller, John Macri**, and **James Ryan** developed a newly-patented method and apparatus for imaging through 3-dimensional tracking of protons.

## Faculty Outreach

Addressing members of the U.S. House and Senate in Washington D.C., George Hurtt spoke in the halls of Congress: "It is becoming increasingly clear that significant global climate change will result if the concentrations of greenhouse gases in the atmosphere continue to rise." Hurtt, Assistant Professor in EOS and Natural Resources, participated as a panel member at an October congressional briefing on region-wide greenhouse gas reductions, sponsored by the Global Legislators Organization for a Balanced Environment. Says Hurtt, "Federal legislators are starting to see that New England is taking steps to act, even if it is without federal leadership."

Following in the excitement of the NERA release, EOS faculty members Cameron Wake and George Hurtt testified on Nov. 14 to the N.H. House Science, Technology, and Energy Committee on an amendment to Bill 284. The House Bill seeks to reduce the emissions of four pollutants, including carbon dioxide, by state power plants, and if successful, would provide the first legislated limit on carbon dioxide emissions in the country. — AS 



## Visiting Student Offers Taxonomic Expertise

As part of an international partnership to create a web-based genomic database, Sabine Grabbert has come to UNH from Germany as a Zoogene Fellow. Zoogene is one of eight pilot projects of the "Census of Marine Life" Initiative, funded by NSF. Grabbert is working in Ann Bucklin's laboratory in EOS, where DNA sequences are determined for zooplankton species, including copepods (small, shrimp-like organisms) and euphausiids (also known as krill).

Bucklin calls Zoogene a "Fahrenheit 451" project. "We are preserving a record in DNA sequences. People who can identify zooplankton are leaving the field, and we are losing taxonomic expertise. However, the ability to sequence DNA is becoming universal," she explains.

Grabbert met Bucklin at a taxonomy workshop in Germany last year, and Bucklin invited her to come to the Institute as a research fellow. Grabbert, a taxonomic expert, is currently working towards her Ph.D. at the

University of Oldenburg in Germany. Grabbert also works with the Alfred Wegener Institute for Polar Research (AWI) in Germany as a guest researcher. As a Zoogene fellow, she is developing a database for Antarctic copepods, which she collected during an Antarctic research cruise on the AWI research vessel "Polarstar."

Grabbert's research involves sequencing genes for a web-based molecular database called Genbank. The methods she was using in Germany are compatible with the methods used by Zoogene scientists.

"I came to Ann's lab because she is at the top of the field in molecular copepod research," says Grabbert. "Learning from Ann's expertise has progressed my research. The lab is very welcoming, and I enjoy working with fellow scientists whose interests coincide with mine. My participation in the exchange program at UNH gives me the opportunity to get involved in the American university system." — AS

<http://www.ZooGene.org>



Sabine Grabbert, Zoogene Fellow and visiting graduate student, is sequencing genes of zooplankton as part of a national project.

### Student Recruitment

## New Prospects for Graduate Study in Earth Science

A new program is slated to begin this summer at the Institute, which will expose undergraduate students from small colleges to the breadth and depth of NASA and EOS scientific research. This new initiative will encourage students who may not normally be familiar with the research options available at larger graduate research institutions to explore Earth, the atmosphere or ocean science for their graduate work.

The program will provide funding for summer internships and the first two years of graduate study, if the students enroll at UNH/EOS. The summer internship at EOS would begin after their junior year. The students will then participate in a second internship after their senior year at NASA Goddard Space Flight Center (GSFC). This program differs from other science internship programs for undergraduates in that it offers continuous progression from an internship to funding for graduate school at UNH in Earth science.

This is a new approach for EOS for recruiting new students into a career in Earth sciences. We expect to welcome strong students from the best colleges and universities. The undergraduates sought are those exceptional science or mathematics students who want to experience, possibly for the first time, advanced university research in Earth, ocean, and atmospheric sciences. An announcement will soon go out to top liberal arts colleges and selected other institutions throughout the Northeast, including UNH. At first, the program will allow for the enrollment of four undergraduate students each year.

This educational initiative was developed under the UNH-GSFC Joint Center for Earth Sciences and is funded by NASA and matching funds from EOS. — AS

### Student News

**Manoel Cardoso**, a Ph.D. student, recently returned from a week in Brazil, where he collected information for better interpretation of satellite fire data. He observed 90 rainforest fires in three days. He presented a paper on future fire patterns in Amazonia at the AGU fall meeting. His poster on modeling large-scale fire dynamics in Amazonia was exhibited at the Global Change Open Science Conference in Amsterdam. His participation in these events was partially supported by a UNH Graduate School Travel Grant.

**Seung-Hyun Son**, a Ph.D. candidate, was awarded funding from the EOS-Earth Sciences Student Research Fund. Seung-Hyun gave a presentation this February at the ASLO 2001 Meeting on primary production modeling in case II waters. He participated in a Yellow Sea cruise this past August.

**Elizabeth MacDonald**, a Ph.D. candidate, is going to Alaska in January to launch SIERRA, an auroral sounding rocket, with Professor Arnoldy. In October, she attended the integration of this rocket at the NASA/Wallops Flight Facility in Virginia.

**John Slater**, a Ph.D. candidate, reports on his new publications, which include an article on the relationships between transport and ions in Greenland snow in the *Journal of Geophysical Research* and an article on light extinction by aerosols in *The Science of the Total Environment*. NASA has renewed his Earth System Science Fellowship for another year.

**Doug Vandemark**, a Ph.D. candidate in OPAL, participated in joint aircraft and shipboard ocean observations off of Cape Cod as part of the Office of Naval Research Coupled Boundary Layer and Air-Sea Transfer (CBLAST) experiment. He was co-author of three papers appearing in *Geoscience and Remote Sensing Transactions*, *Geophysical Research Letters*, and *Proceedings of the Royal Society*. Doug, a new graduate student at EOS, is also a researcher with NASA Goddard Space Flight Center.

**Adam Wilson**, an MS candidate, received an assistantship to work with the New England Integrated Sciences and Assessment of climate and human connections in New England. Adam has been reviewing historical climate data to look for trends and finds that the New England climate is changing.

## Much More than Just a Hunk of PLASTIC

What involves more than twelve staff, five faculty, three students, four institutions, and \$7 million? The answer, the same one offered as society's future in the movie "The Graduate," is PLASTIC. PLASTIC, which stands for "Plasma and SupraThermal Ion Composition Instrument," is currently under development at the Institute. A PLASTIC instrument will be launched into outer space on each of NASA's two Solar Terrestrial Relations Observatories (STEREO) spacecraft in November 2005.

PLASTIC's purpose is to measure particles from the sun and particles energized in space in order to study coronal mass ejections. These energy outputs from the sun can disrupt magnetic fields, causing auroras, space craft damage, power grid surges, gasoline leakage, and they can even confuse birds who use the Earth's magnetic polarity for migration patterns.


The development of this instrument, according to EOS's Toni Galvin, Professor of Physics and the project's Principle Investigator, will be a "major engineering feat." This engineering challenge will draw upon the expertise of four institutions, including the University of Berne in Switzerland, the Max Planck Institute for Extraterrestrial Physics in Germany, the NASA Goddard Space Flight Center in Maryland, and UNH as the lead institution.

One of the greatest challenges in building the instrument will be constraints imposed by the amount of energy available in space to power

PLASTIC. The engineers must develop an instrument that uses as little mass and power as possible, but yet it must be able to collect a large amount of useful data. Less than 10 watts of power, which is provided by the sun via solar panels, will be available to this 25,000 volt device.

Explains Galvin, "One of the difficulties will be to get a high voltage instrument to work properly in space without having discharges that are catastrophic."

The instrument will also have to meet challenges of structural integrity, as it will need to survive the extreme vibrations experienced during a launch and the extreme temperatures of space, known as "shake and bake." EOS's Steven Turco, the Instrument Manager, is working with the project engineers, including EOS's Mark Granoff for mechanical and Ken Crocker for electrical, to ensure that the instrument meets these and other design requirements.

STEREO is one of NASA's Solar Terrestrial Probes Missions and part of the Sun-Earth Connection Roadmap. UNH's design faced tough competition against NASA Goddard, MIT, Los Alamos National Laboratory, and the University of Michigan, and was accepted in a peer-reviewed process. — AS 

<http://stereo.sr.unh.edu>




*Space Grant contributed to Living with a Star, shown here at the Christa McAuliffe Planetarium in Concord, N.H. Photo by Bob LaPre, The Union Leader*

## Space Grant News

Since the inception of its National Space Grant College and Fellowship Program in 1991, EOS has been the New Hampshire hub of kindergarten through post-graduate outreach education on NASA-related science. NASA began Space Grant, which was modeled after the previously existing Sea Grant program, in 1989 in an effort to use the excitement and opportunities of space science to inspire the nation's future technological workforce.

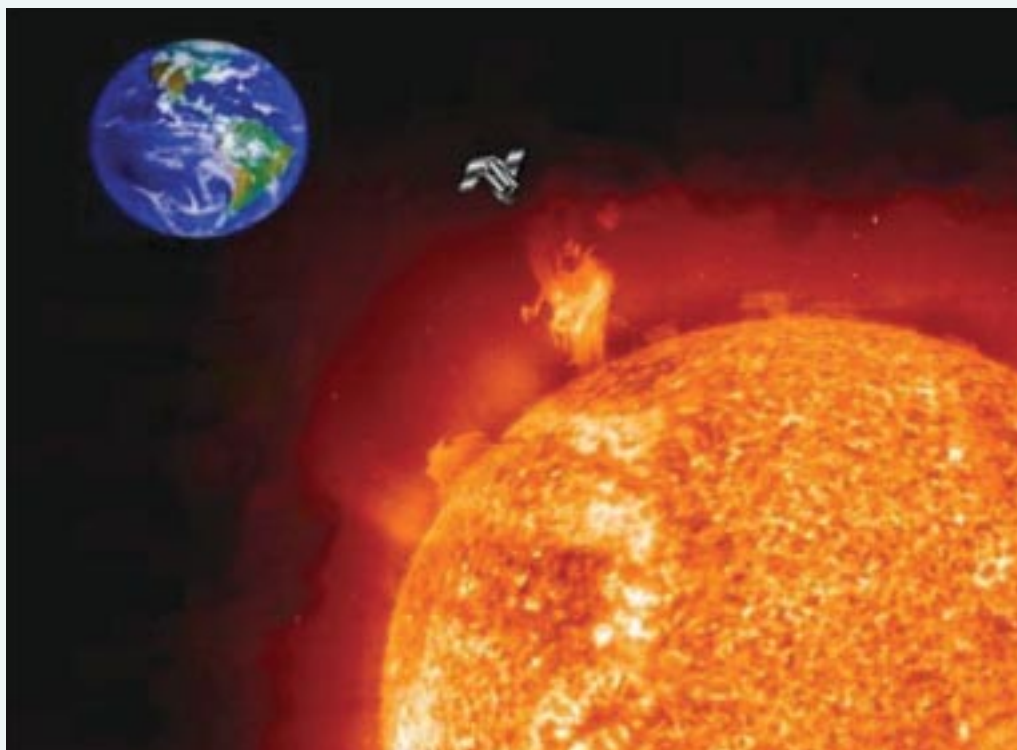
Says David Bartlett, Director of the NH Space Grant Consortium, "Through Space Grant, NASA is stimulating not just space-related studies, but all science, math and technical education in New Hampshire and throughout the U.S."

The NH Space Grant program meets the mission of the national program in a variety of ways. Support is provided to a variety of educational institutions in the state, including Plymouth State College, Dartmouth College, FIRST Place, the Christa McAuliffe Planetarium, and the Community Technical College System. Projects like Forest Watch and Project Smart use young people's excitement about space as the hook to draw K-12 students into related fields. The program also helps to fund college student research through the Undergraduate Research Opportunities Program (UROP). In addition, each year three or four one-year fellowships are awarded to graduate students.

This year, Space Grant celebrated the premier of a new show at the Christa McAuliffe Planetarium about the sun and the solar system, made possible with funding and expertise from UNH. Space Grant also helped give rise to a new course in Space Science aimed at training undergraduates to be elementary teachers. NH Space Grant looks forward to the creation of a new cooperative extension position for a GIS specialist. — AS 

<http://www.nhsgc.unh.edu>

Graduate fellowships are available through Space Grant to students wishing to conduct Earth, air or space-related research. Applications must be received by March 19, 2002.



*An artist's representation of one of the STEREO spacecrafts observing the solar atmosphere.*



## News from Sea Grant


While it has been a part of the marine picture at UNH for many years, lately there is a lot that is new about New Hampshire Sea Grant. For most of its history, it was a component of the joint Maine/New Hampshire Sea Grant College Program. The program separated in October 2000, creating two fully distinct Sea Grant programs.

The rationale for establishing a distinct Sea Grant Program at UNH included the significant increase in the size, depth, and range of marine science and engineering activity at the University. UNH now has more than 40 marine faculty and has experienced a five-fold growth in outside funding over the past 10 years. Also, an independent NH-based program would be more responsive to New Hampshire marine issues, industries, and resources, and more accessible to state programs and offices. This is consistent with the identity of Sea Grant as a federal-state partnership with local control, allowing flexible and rapid response to issues and problems in marine resource use.

As we prepare for our future as a single-state program, we are launching a comprehensive strategic planning effort as well as an intensive self-evaluation. While these activities are leading us in some new directions, our mission as Sea Grant remains unchanged: To support the wise use, conservation, and development of our marine resources through research and outreach efforts designed to involve all of the stakeholders.



*Picturesque Portsmouth (NH) Harbor is the site of a great deal of commercial and recreational marine activity, as well as the location of quite a few NH Sea Grant activities.*

In future issues of this new periodical, the Sea Grant Communications staff will report on some of our research and extension activities. — Ann Bucklin, NH Sea Grant 

<http://www.seagrant.unh.edu>

### New EOS Courses

## Looking Ahead to Academic Year 2002-03

Fall '02

### **EOS 895 Earth System Science- Understanding Our Global Environment**

This course seeks to provide a basic understanding of the Earth system on a global scale by describing how the various components (atmosphere, biosphere, lithosphere, hydrosphere) and their interactions have evolved and how they function. These topics will be explored through analysis of the physical climate system, atmospheric chemical and biogeochemical cycles, past change in the Earth System, and modeling of the Earth system. (Frolking/Braswell)

### **EOS 895 Space Instrumentation**

Modern space-based instrumentation provides extremely sophisticated and exciting measurements across a broad range of scientific disciplines. This course will explore, in detail, a selection of state-of-the-art instruments and their design challenges, for both in situ measurement (plasma, electric and magnetic fields, composition, etc.) and remote observations (gamma rays, multi-spectral photons, neutral atoms). We will probe the physical capabilities and limitations of the measurements and the creative engineering approaches required to meet the severe constraints on weight, power, and telemetry that are imposed in space missions. (Quinn)

### **EOS 895 Global Marine Ecosystems**

This course will provide an overview of marine ecosystem dynamics, with considerable emphasis on the physical forcings and biological responses. Biological and physical interactions will be highlighted at different scales from less than a kilometer to global scales, and biogeographic methods will be considered in detail to illustrate the transfer of processes across the scales considered. Considerable use will be made of satellite data from different sources as a means of observing and understanding the distribution and dynamics of specific biological-physical interactions in the ocean. (Campbell/Dowell)

Spring '03

### **EOS 895 Concepts in Earth System Science**

This course has two major, approximately equal, parts. The first covers geophysical processes and modeling common to all dynamical Earth System research. The second part consists of two separate tracks, of which students choose one, to cover dynamical concepts pertinent to sub-disciplines in meteorology and biogeochemistry. The course concludes with a short common session to share the lessons of the sub-disciplinary applications. (Prentice, Frolking, Mao)

### **EOS 895 Remote Sensing of the Terrestrial Biosphere**

This is a 4-credit course focused on learning analytical methods for using regional-to-global scale remote sensing data to study the structure and function of terrestrial ecosystems and biosphere. Students are expected to develop a physically based understanding of global remote sensing data and gain experience using these data together with models and other observations to form and test hypotheses about Earth system processes. (Xiao, Braswell)

### **EOS 895 Climate and Fisheries**

This course reviews the mechanisms by which variation in year-class strength of exploited fish and invertebrates may be connected to fluctuations in climate on interannual and interdecadal time scales. The course includes examining biological and physical processes controlling recruitment and plankton productivity, climate-mediated changes in ocean circulation and temperature, monitoring programs for long time series of biological and physical oceanographic data, examples of climate-zooplankton-fish linkage, and modeling approaches and ecosystem-based management strategies. (Runge)

For further information on EOS courses, see <http://eos.sr.unh.edu/Grads/Courses>

## EOS Events

# The EOS Concert Series



The Spring 2002 season of Spheres: The EOS Concert Series began in January with a lunch time of toe-tapping music as the New England Bluegrass Band warmed up the winter. The series continues on the third Thursday of every month in the atrium of Morse Hall. Concerts run from 12:15 - 1:15 p.m. and are followed by complimentary seasonal refreshments. Spheres is open to the public.

Berrien Moore III, the Institute's Director, with Lynda Copeland, a harpsichordist, initiated the concert series several years ago in order to

expand upon the Institute's mission of scientific inquiry by showcasing another aspect of human creativity. Music provides a common ground, and thus reflects the Institute's goal of bringing a diverse group of people together in interdisciplinary efforts.

EOS will host a variety of accomplished musicians this semester:

- 1/24 The New England Bluegrass Band performing fresh, but often forgotten music, rooted in traditional acoustic bluegrass styles
- 2/21 SARASA Chamber Orchestra, directed by Tim Merton, performing on original instruments
- 4/18 Irina Muresanu presenting music for the violin
- 5/16 Robert Thompson and Friends presenting a program of music by African-American composers — AS 🌐

<http://eos.sr.unh.edu/About/Events>

## Seeking a Leader in Space Science



*Peter T. Paul*

The University of New Hampshire seeks an outstanding individual in space science to fill the newly endowed Peter T. Paul Chair in the Space Science Center within EOS and the Physics Department. The successful candidate will enhance the prominence of the Center, Institute, and University in the space sciences, while helping to create and strengthen the interdisciplinary scientific environment that distinguishes the Institute.

We seek an individual with the ability and desire to participate in graduate and undergraduate education and to lead a major, independent research effort in any of the active fields of the Center. Candidates are expected to have a proven record of publication and research experience in areas that complement and enhance the ongoing programs in the Center. Applicants must have a Ph.D. in Physics, Space Physics, Astrophysics, or related fields, five or more years of post-doctoral research experience, and the ability to teach effectively at the undergraduate and graduate levels.

Inquiries and applications, including curriculum vitae, bibliography, a brief summary of teaching interests and future research plans, and the names and contact information of at least four references, should be directed to Prof. Roy Torbert, Director, Space Science Center, Morse Hall, University of New Hampshire, Durham, NH 03824. — AS 🌐

<http://unhinfo.unh.edu/hr/employ/fac>

### Mark Your Calendars!

**Stephen Jay Gould – renowned evolutionary biologist – is visiting EOS and speaking at UNH on April 22, 2002.**



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