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## School's Out, Students In At UNH Research Institute

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Institute for the Study of Earth, Oceans, and Space

June 25, 2008

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DURHAM, N.H. -- All's quiet on the campus sidewalks and in the building hallways of the University of New Hampshire in Durham. Gone are the hordes of undergraduates hauling backpacks and talking on cell phones as they make their way between classes.

But at Morse Hall, home to the UNH Institute for the Study of Earth, Oceans, and Space (EOS), there are scores of undergraduates whose work is in full swing for the summer.

EOS, the university's largest research enterprise, sees a large influx of undergraduate researchers every summer, and this year is no exception.

The institute's four interdisciplinary research centers collectively have more than 60 undergraduates currently working on a diversity of projects that probe phenomena from deep in space to down in the dirt.

Senior physics major Brian Lynch is working in the Space Science Center analyzing how clusters of galaxies are affected by supermassive black holes that dwell in their centers. Closer to home, a diverse group of students majoring in chemistry, environmental conservation, political science, and biology are working in the Complex Systems Research Center investigating carbon cycling in forest ecosystems - from leaf to soil to atmosphere.

Among the summertime student researchers are physics majors George Clark and Morgan O'Neill, both of whom will be seniors next fall semester. The two are continuing work they've been doing since their freshman years on an instrument for NASA's upcoming Interstellar Boundary Explorer or IBEX satellite mission, which is scheduled to launch in September.

IBEX will carry UNH-built instruments on board, among them a "star sensor" that Clark and O'Neill helped design and build. By charting the heavens the sensor will help precisely pinpoint the source region of the atomic particles hurtling through deep space that are IBEX's quarry. This, in turn, will allow scientists to create the first "full-sky" map of the boundary that separates our solar system from interstellar space.

The flight model of the star sensor is already integrated on the satellite, which is being readied for launch. But testing an exact replica in a state-of-the-art laboratory/darkroom in Morse Hall, Clark and O'Neill continue to calibrate the instrument. This will increase the sensor's ability to take accurate star readings through the "noise" of other light sources, such as the Zodiacal light (sunlight reflected off dust particles in the solar system) and the fuzz of the Milky Way. The students are also working on adding the Moon as another precise target for the sensor's directional reading.

Professor Eberhard Möbius is UNH's principal investigator for the IBEX project and has guided

Clark and O'Neill from the beginning of their work on the star sensor. "Without their dedication over the past three years we would not have a calibrated star sensor for IBEX. They are doing a marvelous job that the IBEX team is recognizing, and for them this task is worth several times as much as taking another class each year," Möbius says.

More down-to-earth research is being conducted by senior biology major Rachel Torman, who is spending her summer in the woods of Bartlett Experimental Forest in the White Mountains and Harvard Forest in central Massachusetts gathering field data to analyze back at the Forest Ecosystem Lab at UNH.

Along with fellow undergraduates Jordan Jessup, TerKhor Met, and Morgan Stanton, Torman collects forest "litter" (fallen leaves and branches) on forest plots. The litter is dried, weighed, sorted by species, and ground up for chemical analysis. The data derived will help researchers understand how carbon and nitrogen are cycled in forests. Torman and Jessup are also working on a project studying nitrogen mineralization in soil. Says Jessup, "It's interesting and exciting to be a part of this research to further understand the dynamics of nitrogen cycling, especially since humans have doubled the amount of nitrogen going into the natural environment."

In two ocean-related projects, senior Olivia DeMeo - a summer intern in the joint NASA-UNH Research & Discover program based at EOS - is working with research assistant professor Joe Salisbury of the Ocean Process Analysis Laboratory trying to better characterize the complex issue of how coastal ocean waters play a role in the global carbon cycle. (The R&D program provides undergraduates from colleges around the nation the opportunity to delve into independent, graduate-level scientific research alongside experts in the field.) And junior Kaitlyn Steele is using sediment core samples she extracted from local tidal mud flats to determine if increasing carbon dioxide concentration in the atmosphere will stimulate methane production from coastal sediment. If this proves to be the case, it will be another pathway for increasing concentrations of this potent greenhouse gas, which contributes to rising global temperatures.

Steele secured funding for her project through UNH's Summer Undergraduate Research Fellowship (SURF) program. Working with research assistant professor Ruth Varner of the Climate Change Research Center, Steele is analyzing her samples using a mass spectrometer to measure particular isotopes of methane to determine if the gas was created through increased levels of carbon dioxide.

Varner notes that such collaborative research benefits both student and teacher. The methane isotope work is something Varner has wanted to do but simply didn't have the time and, says Steele, "I'm getting an experience that is so different from normal academics and can only be learned firsthand. I hope that this project will serve as the beginning of my research career and enable me to apply for future internships and fellowships through NOAA and NASA."

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**A photograph is available to download here:**

[http://www.eos.unh.edu/newsimage/ibex\\_students\\_lg.jpg](http://www.eos.unh.edu/newsimage/ibex_students_lg.jpg)

Caption: UNH undergraduates Morgan O'Neill (left) and George Clark helped design and build the star sensor for NASA's upcoming Interstellar Boundary Explorer mission. Photo: David Sims, UNH-EOS.



