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## Northern Lights Research Enters Final Frontier

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### NORTHERN LIGHTS RESEARCH ENTERS FINAL FRONTIER

An international team of scientists -- including physicists from the University of Calgary -- will begin gathering the most detailed information yet about the ever-changing northern lights, as a multi-year research project enters its ultimate phase with the launch of five NASA satellites from Cape Canaveral next month.

Researchers in the U of C's Institute for Space Research will play a critical role in a five-satellite NASA mission called THEMIS (Time History of Events and Macroscale Interactions during Substorms) which is scheduled for launch at 6:07 pm (Eastern Time) on February 15, just over a month from today. For their part in the program, the U of C's THEMIS team is operating a network of Ground-Based Observatories (GBOs) across Northern Canada. The THEMIS satellites will probe dynamic processes of astrophysical interest in near-Earth space, while the GBOs will create mosaics of the night sky, capturing changes in the northern lights that are an essential part of the information needed to answer the questions that THEMIS is targeting. The ground and space-based THEMIS observations will enable scientists to pinpoint the cause of brilliant explosions of shimmering light known as "auroral substorms."

"This is a very exciting moment for us because we are expecting to greatly enhance our understanding of these space disturbances that are both beautiful and powerful," said U of C physics professor Dr. Eric Donovan, leader of the Canadian component of THEMIS.

"The next few years are going to be very busy for us and our THEMIS colleagues at NASA and the University of California at Berkeley," Donovan said.

The U of C operates 16 GBOs located in communities across northern Canada (four more in Alaska are operated by Berkeley), which consist of automated all-sky cameras that use time lapse digital imaging and special optics to record auroras in the northern skies. The five satellites are on orbits designed so that they come together in conjunctions over central Canada every four days. During these conjunctions, the cameras will be used to determine the onset of auroral substorms, while instruments on the five satellites will provide measurements of changes in energetic particle populations and the magnetic field in space. The mission will last at least two years, during which time the GBOs will record more than 200 million photographs.

Auroras are caused by the interaction of charged particles from the sun, also known as the solar wind, with the Earth's magnetic field. Auroral substorms are the unpredictable bursts in auroral activity that take place when energy stored in the tail of the magnetic field is released and travel along magnetic lines to the polar regions where they cause spectacular displays of iridescent light. These storms are not fully understood and previous studies have not been able to determine where in the magnetosphere the energy of the solar wind transforms into explosive auroras. Auroral substorms have also been linked to disturbances of telecommunications systems on Earth and damage to satellites.

The NASA-funded THEMIS mission is led by the Space Science Laboratory at the University of California at Berkeley, while the Canadian component of the project is funded by the Canadian Space Agency.

In Canada, THEMIS will ultimately involve scientists with from the Universities of Alberta, Saskatchewan, New Brunswick, and Calgary, Athabasca University, the Canadian Space Agency, and Natural Resources Canada.

Most of the GBOs operate in small communities in the north including Whitehorse, Inuvik, Sanikiluaq, and Gillam. The GBOs are run with the generous assistance of community volunteers who help monitor and maintain the equipment.

"Our custodians do a great job of looking after the cameras and playing host to our project in their communities," said THEMIS Canada deployment and site manager Mike Greffen. "They are a critical link in a large and important NASA-CSA mission."

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