

**YORK UNIVERSITY  
DEPARTMENT OF EARTH AND SPACE SCIENCE AND  
ENGINEERING  
and  
CENTRE FOR RESEARCH IN EARTH AND SPACE SCIENCE  
S E M I N A R**

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**New insights into Martian ice caps  
and glaciers from radar sounding:  
Is the present the key to the Past?**

ABSTRACT

Ice on Mars takes many forms, but the polar ice caps are the most apparent and voluminous, containing enough water ice to form a global water layer 20 meters thick. Enigmatic features within the polar ice have eluded our understanding for decades. Increasingly higher-resolution imagery has allowed us to study the surface in great detail and observe seasonal processes; however, these appeared to be disconnected from the major landforms. In the middle latitudes of Mars, many features exhibit morphologies consistent with glacial flow, yet they exist where ice is not currently stable at the surface, and no ice is exposed. This could imply a drastic change of climate, essentially requiring atmospheric precipitation and accumulation of ice at the surface. With the advent of radar sounding from orbit, we have been able to peer into the subsurface and evaluate the composition and internal structure of these deposits, enabling us to test longstanding hypotheses regarding their origin. The SHARAD radar on Mars Reconnaissance Orbiter has yielded critical stratigraphic clues pointing to aeolian origins for the spiral troughs and Chasma Boreale. In the middle latitudes, we have confirmed a glacial origin of the viscous flow features. In nearly every case, realizing the full potential of the radar data requires the addition of high-resolution observations of currently active surface processes and atmospheric modeling driven by variations in Mars' orbital parameters. By doing so, we are able to provide new constraints on the mechanisms and rates of processes governing these volatile rich deposits, and hence a better understanding of paleoclimate on Mars.

BIOGRAPHY

Dr. Jack Holt employs geophysical techniques to study ice-covered regions of Earth and Mars. He has led or co-led seven field expeditions to Antarctica since 1998 to map the ice and features buried beneath the ice. Holt is also a Co-Investigator on the [SHARAD](#) instrument team of NASA's Mars Reconnaissance Orbiter. In this role [he and his students](#) have been selecting new data acquisition targets and developing new techniques to analyze the data, leading to many new discoveries regarding ice on Mars. In Antarctica, Holt is using [a modernized, turbine-powered DC-3 aircraft](#) outfitted with ice-penetrating radars, laser altimeters, airborne gravimeter and magnetometers to study internal properties of the ice sheet, characterize sub-ice geology and to develop radar analysis techniques for studying Mars. This work contributes to the effort to map and understand water (in all forms) on Mars, the highest priority for NASA and ESA missions.



Refreshments will be served at 3:15 p.m. in the P. Delaney Gallery, Bethune College.

**DATE: Wednesday, February 18, 2015**  
**TIME: 3:30 p.m.**  
**LOCATION: P. Delaney Gallery, Bethune College**