HAO Colloquium Series

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Speaker: **Roger Varney, HAO**

Time: **1:30–2:30 pm**

Date: **Wednesday, November 28, 2012**

Location: **CG1-2126**

Title: **Dynamics of Photoelectrons in the Daylit Polar Cap Ionosphere and Their Relationship to Ion Upflow and Outflow**

Abstract:

The ionosphere is known to be an important source of plasma for the magnetosphere, but the mechanisms which allow heavy O+ ions to escape into the magnetosphere remain an active area of research. Photoelectrons produced in the daylit polar cap ionosphere can potentially affect ion upflow and outflow both by heating the ambient plasma and by augmenting the self consistent ambipolar electric field. In order to maintain zero field aligned current on a daylit polar cap flux tube the net photoelectron escape flux must be balanced either by thermal electron inflow or increased ion outflow. Recent observations from the FAST satellite [Kitamura et al. 2012] suggest that low energy (<~20 eV) photoelectrons are reflected back into the ionosphere by a potential structure much further out in the magnetosphere. Generalized semi-kinetic simulations of the polar wind [e.g. Wilson et al. 1997] can create such potential drops by forming double layers at very high altitudes. If these potential drops exist they will reduce the net photoelectron escape flux and thus the required thermal electron inflow or ion outflow to maintain zero current. However, the reflected photoelectrons will also heat the ionosphere further leading to increased ion upflow and possibly outflow. Measurements of ionospheric temperature profiles in the polar cap are now possible after the 2009 deployment of the Resolute Bay Incoherent Scatter Radar (RISR) in northern Canada. Using a single field line model of the polar cap ionosphere which includes photoelectrons we show that a heat flux down from the magnetosphere is required to explain RISR electron temperature measurements, although what proportion of this heat flux is carried by reflected photoelectrons versus ordinary thermal conduction is difficult to estimate.