



HAO Colloquium Series

(Refreshments served)

Speaker: Steve Bougher, Andrew F. Nagy Collegiate Research Professor,
University of Michigan

Time: 1:30 pm

Date: Wednesday, April 6, 2011

Location: CG-1, South Auditorium

Title: Solar Cycle & Seasonal Variability of the Mars Thermosphere-Ionosphere and Potential Impacts of Gravity Wave Momentum Deposition

Abstract: The Mars thermosphere-ionosphere (~100-300 km) is an intermediate atmospheric region strongly impacted by coupling below with the lower atmosphere (i.e. seasonal inflation/contraction, gravity waves, planetary waves and tides, dust storms) and coupling above with the Sun (solar soft X-ray, EUV, UV and near IR fluxes, and the solar wind interaction) (Bougher et al., 2008 review). Recent spacecraft measurements since 1997 provide a rudimentary characterization of the Mars thermosphere-ionosphere structure, and its variations over the solar cycle and Mars seasons. However, these datasets are entirely inadequate to fully characterize this reservoir of neutrals and ions that is available to participate in atmospheric escape, and also inadequate to determine the rates of volatile loss (i.e. water loss) to space. Instead, an assortment of modeling studies have been conducted in recent years to predict the response of the upper atmosphere to external forcing (e.g. solar variability, dust storms, tides and planetary waves, gravity waves, solar wind interaction). These studies are being used to prepare for the upcoming MAVEN mission to Mars (2013-2016) that is slated to conduct the needed measurements to determine modern atmospheric escape rates.

One such modeling investigation involves the NCAR Mars Thermospheric General Circulation Model (MTGCM), which is presently being used to plan for MAVEN mission operations and to prepare for later data analysis activities. This talk will briefly review the currently available Mars thermosphere-ionosphere datasets and the noted variations over the solar cycle and Mars seasons. In addition, this talk will describe the development, framework, and implementation of the MTGCM code and its capabilities and present limitations for characterizing the responsible processes that drive the Mars upper atmosphere structure and winds. In particular, recently discovered winter warming features will be discussed along with the MTGCM predicted processes responsible for the seasonal variations observed. Finally, the role of gravity waves in modifying the Mars upper atmosphere structure and dynamics is still unknown. Initial MTGCM calculations addressing gravity wave momentum deposition will be presented, with a view to new collaborations with scientists here at HAO.