Séminaire Lundi 18 Juin 2012 11h00 / Seminar Monday June 18th 2012 11h00

Conférencier/Lecturer : Marie-Eve Gagne, Stella M. L. Melo, Kimberly Strong (Canadian Space Agency, University of Toronto)

Sujet/Subject: Using airglow to understand the energetic balance in CO2-dominated atmospheres

Présentation/Presentation: Anglais / English

Lieu/Room: Salle des vents (Dorval)

iweb: http://web-mrb.cmc.ec.gc.ca/mrb/rpn/SEM/

web: http://collaboration.cmc.ec.gc.ca/science/rpn/SEM/index.php

Résumé / Abstract :

Forecast of temperature at the aerobreaking altitudes in the Martian atmosphere remains a major challenge as models and measurements dier signicantly. In this altitude range, the oxygen photochemistry controls the energetic. Indeed, atomic oxygen is a major player in the CO_2 15-m cooling mechanism in the neutral atmosphere. Accurate density proles of atomic oxygen are required to constrain the behavior of Global Circulation Models (GCMs) above 50 km but direct measurements have not been made up to this day. Without proper validation of Mars GCMs, an underestimation of the atomic oxygen content would yield an overestimation of the temperatures because of the role of CO_2 15-m cooling in the thermal balance.

We are investigating the possibility of deriving temperature measurements from airglow detection in the middle atmosphere of Mars. Airglow arises from the emission of energy due to photochemical reactions that occur in the atmosphere, usually at high altitudes where the atmospheric density is relatively low. Airglow measurements provide a highly promising approach for the determination of temperature over the middle atmosphere given the strong heritage of this technique for Earth observations. Airglow has been observed on Mars during the Mariner 6, 7 & 9 missions in the early 1970's; the presence of atmospheric airglow features in dierent spectral regions has since been conrmed by the measurements of instruments on board Mars Express and Mars Reconnaissance Orbiter.

We will describe the work regarding the simulations of airglow emissions in the Mars atmosphere and how this study can enable us to better understand: (1) the photochemical reactions that involve atomic oxygen, (2) the mechanisms that control the atomic oxygen density, and (3) the

implication of the atomic oxygen concentration for the thermal structure and the energetic budget. This work has led us to the development of an airglow model to make predictions about the emission rate and distribution of the nighttime emissions of O_2 and NO in CO_2-dominated atmospheres. This model has been run using both Martian and Venusian atmospheric conditions from 3-D GCMs to provide consistency in the oxygen photochemical scheme by comparing our results with observations of these airglow emissions in both atmospheres.