Model for ultraviolet dayglow emissions on Mars

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Airglow measurements on Mars have been carried out extensively earlier by Mariner series of spacecraft and recently by SPICAM instrument onboard Mars Express. Intense emissions have been observed from CO, O, and CO_2^+ in the Martian atmosphere at different solar activity conditions. Cameron bands of CO ($a^3\Pi - X^1\Sigma^+$, 180 - 260 nm) are the brightest emissions observed in the Martian dayglow. Other important emissions are fourth positive system ($A^1\Pi - X^1\Sigma^+$, 140 -180 nm) of CO, ultraviolet doublet ($B^2\Sigma^+_u - X^2\Pi_g$, emission near 289 nm) and Fox-Duffendack-Barker bands ($A^2\Pi_u - X^2\Pi_g$) of CO_2^+, and the ^3P-^1S (297.2 nm) multiplet of O. There are some weak line emissions observed at 110-180 nm regions, from atomic carbon and oxygen. Recent observations have also identified the features of Vegard-Keplan band system of N_2. Strong emissions in the wavelength region 190-430 nm shows the direct interaction of solar UV radiation and photoelectrons with the CO_2 - the major constituent of Martian atmosphere.

We have developed a Monte Carlo model[1] for the electron energy (≤1000 eV) degradation in an atmosphere of CO_2, which has been employed to calculate photoelectron flux and volume excitation rates of emissions in the Mars. Calculations are also made for excitation rates due to photon impact. Intensities of various emissions due to photon and photoelectrons impact are calculated under different solar activity conditions and found to be in accord with the latest dayglow measurements from SPICAM onboard Mars Express. The results will be discussed.

References

[1] Bhardwaj A. and S. K. Jain, (2009), *J. Geophys. Res.,* 114, A11309, doi: 10.1029/2009JA014298.