ELECTRON DENSITY AND ION PRODUCTION RATE CALCULATIONS OVER THE MARTIAN ATMOSPHERE.

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Introduction: With the advent of the year 2013, the planetary science community is eagerly looking forward to the launch of two Mars missions: '*Mangalyaan*' from India in this October and '*MAVEN*' the US Mars Mission. Both the missions are essentially aimed to eye the Mars with the scientific goals to understand the upper atmospheric and ionospheric processes thereat.

With this perspective in our mind we have planned to study the martian upper atmosphere-ionosphere theoretically, using our quantum mechanical approach. Electron-atom-molecule interactions are one of the most fundamental phenomena in the atmosphere of any planet. Quantitative rendering of fundamental electron collision processes through the relevant cross sections, is necessary to comprehend and model the planetary atmospheres.

The production and loss of electrons are the key processes that decide the formation, stability and decay of the different atomic-molecular species and the resulting ion/neutral chemistry. The role of electron impact elastic scattering and inelastic processes viz. excitation, ionization cannot be ignored in the planetary atmospheres. Cross sections for these processes are vital inputs in the modeling of these environments. It is essential to apply latest and reliable cross section data [1] in place of old compilation using old data [2].

Theory: A semi-empirical quantum mechanical approach has been developed by us [3-5] in order to calculate the various total elastic, inelastic, ionization as well as summed-electronic excitation cross sections. In recent years our publishing efforts [3-5] have benchmarked this theoretical methodology for various cross section calculations. Further with the aim of the application of these microscopic quantities, a micro-to-macro approach has been employed for the derivation of bulk parameters such as Collision frequencies, Ion production rates (IPR) and Electron densities.

Aim: With the above mentioned theoretical background we aim to carry out the following studies in the Martian upper atmosphere.

  i)   To calculate the microscopic ionization cross sections for CO_2, N_2, O_2, CO and O
  ii) To employ these microscopic quantities to calculate ion production rates (IPR),
  iii) To show the variation in the IPR with respect to the change in solar zenith angle (SZA),

  iv) Further to use these IPR to calculate the electron densities.

Appendix: We also plan to discuss, how various elastic and excitation processes can affect the planetary atmospheres.

The detailed results and discussions will be presented during the Conference.

References:

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