DETECTION OF INTERPLANETARY DUST AND ITS EFFECT ON PRODUCTION AND DENSITY OF ATMOSPHERIC AND METALLIC ION LAYERS: COMPARISON WITH MAVEN/ROSE OBSERVATIONS.

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Introduction: Interplanetary Dust Particles (IDPs) originate from the sources like asteroid belt, and they encounter various planets during their motion in the solar system. The impact rate of IDP was observed by LPW onboard MAVEN for the particle size of 1-5 μm or 5-25 μm. In the present paper, the observed impact rate is used to obtain IDP flux at Mars.

Results: We have calculated production rates of the atmospheric ions (CO_2^+, O_2^+, N_2^+, O^+, CO^+ and NO^+) and metals (Mg, Fe, Na, Mn, K, Ni, Mg^+, Fe^+, Na^+, Mn^+, K^+ and Ni^+) due to solar EUV and IDP impact with the Martian atmosphere, respectively (Figure 1). It is found that ablation of IDP due to the impact of micrometeoroids (mass $\leq 10^{-4}$ gm) and meteoroids (mass $> 10^{-4}$ gm) create a broad layer at 108 km and 75 km, respectively. The atmospheric ions peaked in the upper atmosphere at ~ 120 km. We have also estimated electron densities due to solar EUV and meteoroid impact in the upper and middle ionosphere, respectively. The estimated densities are compared with the two electron density profiles observed by Radio Occultation Science Experiment (ROSE) onboard Mars Atmospheric and Volatile Evolution (MAVEN) on 10 October, 2017 at SZA 78° and 75°, which featured 2 and 3 layers, respectively (Figure 2 and 3). The first and second layers are produced due to photo ionization and meteoroid impact ionizations, respectively. The third layer is created due to direct impact of solar wind with Mars' atmosphere at low altitude ~ 60 km.

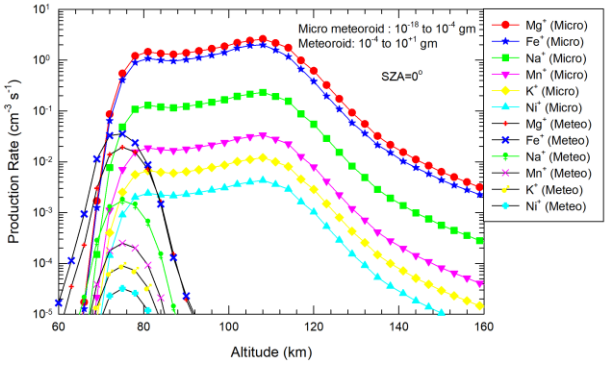

Figure 1: The production rates of metallic ions (Mg^+, Fe^+, Na^+, Mn^+, K^+ and Ni^+) due to impact of meteoroids and micrometeoroids as a function of altitude at SZA=0°.

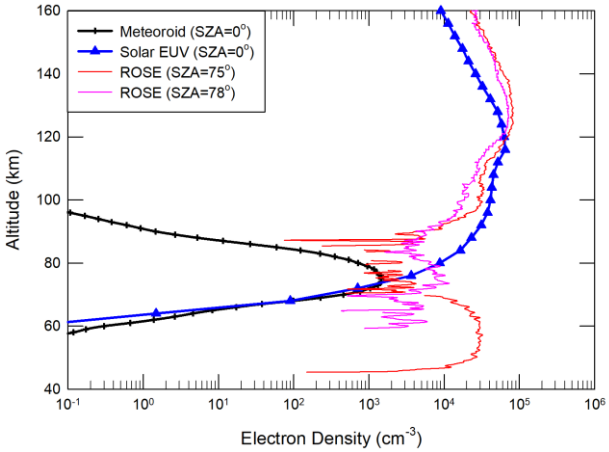

Figure 2: Comparison of estimated electron density profiles due to meteoroids and solar EUV impact with the two profiles of ROSE observations made on 10 October, 2017 during orbit # 5880 at SZA =75° and 78°, respectively.

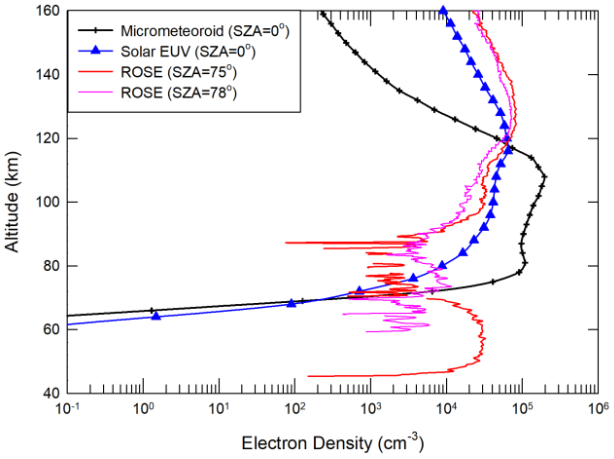

Figure 3: Comparison of electron density profiles due to micrometeoroids and solar EUV impact with the two profiles of ROSE observations made on 10 October, 2017 during orbit # 5880 at SZA=75° and 78°, respectively.

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