



The Role of Plasmas on Enhanced O_2+ Loss at Mars

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Recent results from the MAVEN Langmuir Probe and Waves instrument suggest higher than predicted electron temperatures in Mars' day side ionosphere above ~ 180 km in altitude. Correspondingly, measurements from Neutral Gas and Ion Mass Spectrometer indicate significant abundances of O_2+ up to ~ 500 km in altitude, suggesting that O_2+ may be a principal ion loss mechanism of oxygen. In this article, we investigate the effects of the higher electron temperature (which results from electron heating) and ion heating on ion outflow and loss. Numerical solutions show that plasma processes including ion heating and higher electron temperature may greatly increase O_2+ loss at Mars. In particular, enhanced T_e in Mars' ionosphere just above the exobase creates a substantial ambipolar electric field, which draws ions out of the region allowing for enhanced escape. With active solar wind, electron and ion heating, direct O_2+ loss could match or exceed loss via dissociative recombination of O_2+ . These results suggest that direct loss of O_2+ may have played a significant role in the loss of oxygen at Mars.