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Estimation of Europa's exosphere loss rates

Alice Lucchetti (1,2), Christina Plainaki (3), Gabriele Cremonese (2), Anna Milillo (3), Valery Shematovich (4), Xianzhe Jia (5), and Timothy Cassidy (6)

(1) CISAS, University of Padova, Via Venezia 15, 35131 Padova, Italy (alice.lucchetti@oapd.inaf.it); , (2) INAF-Astronomical Observatory of Padova, Vicolo dell'Osservatorio 5, 35131 Padova, Italy, (3) INAF-IAPS Roma, Istituto di Astrofisica e Planetologia Spaziali di Roma, Via del Fosso del Cavaliere, 00133 Roma, Italy, (4) Insitute of Astronomy RAS, Moscow, Russia, (5) Department of Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI, USA, (6) University of Colorado, Laboratory for Atmospheric and Space Physics, 1234 Discovery Drive Boulder, CO 80303, USA

Reactions in Europa's exosphere are dominated by plasma interactions with neutrals. The cross-sections for these processes are energy dependent and therefore the respective loss rates of the exospheric species depend on the speed distribution of the charged particles relative to the neutrals, as well as the densities of each reactant. In this work we review the average H_2O, O_2, and H2 loss rates due to plasma-neutral interactions to perform an estimation of the Europa's total exosphere loss. Since the electron density at Europa's orbit varies significantly with the magnetic latitude of the moon in Jupiter's magnetosphere, the dissociation and ionization rates for electron-impact processes are subject to spatial and temporal variations. Therefore, the resulting neutral loss rates determining the actual spatial distribution of the neutral density is not homogeneous. In addition, the ion-neutral interactions have an input to the loss of exospheric species as well as to the modification of the energy distribution of the existing species (for example, the O_2 energy distribution is modified through charge-exchange between O_2 and O_2+). In our calculations, the photoreactions were considered for conditions of quiet and active Sun.