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Suprathermal corona at Titan: contributions of photochemistry and plasma inflow

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Analysis of the neutral nitrogen and methane measurements made by INMS instrument during Cassini first flybys in the Titan's upper atmosphere showed an evidence for the presence of a significant population of suprathermal molecules (Waite et al., 2005). A strong dependence of hot corona population on the dynamical mechanisms taking place in the upper atmosphere was found. Moreover, the nonthermal processes of mass, momentum and energy transfer induced by the complex interaction between Titan's upper atmosphere and Saturn's magnetospheric plasma are especially responsible for the spatial and temporal variations in temperature and population of the suprathermal corona (De La Haye et al., 2007a). A numerical 1D Direct Simulation Monte Carlo (DSMC) model was developed to investigate the molecular collisional processes by which the forcing via both influx of the Saturnian magnetospheric plasma and absorption of the solar ultraviolet radiation on the Titan's upper atmosphere is resulted in the formation of suprathermal corona. The relative role of the following energetic processes - exothermic photochemistry (Cravens et al., 1997; Shematovich 1998, 1999), and atmospheric sputtering (Johnson 1994; Lammer and Bauer, 1993; Shematovich et al., 2003), - determining the creation, transport and loss to space of suprathermal molecules in the Titan's corona is investigated. The calculated energy distributions of nitrogen and methane molecules in the extended Titan's corona are presented and the contributions of photochemistry and magnetospheric plasma inflow are estimated. The results of calculations are compared with the INMS measurements and predictions by the other current models (Michael et al., 2005, De La Haye et al., 2007b).

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