

# Aeronomy of Extra-Solar Planets at Small Orbital Distances

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The aeronomy of the upper atmosphere of Jupiter-like planets at small orbital distances is investigated with a self-consistent model for the composition and thermal structure. The composition calculations include photo-ionization and dissociation, molecular diffusion, and reactions among,  $H_2$ , He, H,  $H^+$ ,  $H_2^+$ ,  $H_3^+$ , HeH<sup>+</sup>, and electrons. The thermal structure calculations include solar heating, thermal conduction, radiative cooling from  $H_3^+$  and  $H^+$  recombination and adiabatic cooling associated with rapid atmospheric escape. The intense stellar radiation field, coupled with large atmospheric scale heights results in thermospheric temperatures of order 10,000 K. thermal decomposition of  $H_2$  at these high temperatures quickly converts  $H_2$  to H, which is then ionized, creating  $H^+$ , causing H and  $H^+$  to be the primary constituents in the thermosphere. The low mean molecular weight and high temperature create a very extended atmosphere with significant density out to distances of several planetary radii. Although the escape rate is large, it does not appear to threaten the stability of the planet.