CONTROL ID: 2246753

TITLE: The Monte Carlo simulation of nonthermal emissions excited in the H2O dissociation

ABSTRACT BODY:

Abstract Body: In addition to the direct observations of water, we can obtain a lot of information by analyzing the emissions of products of the H2O dissociation under the action of stellar radiation and wind. As a rule, the products occur not only in the states of internal excitation but also with the excess of kinetic energy. To correctly consider these non-thermal particles, whose energy usually substantially exceeds the thermal energy of the ambient atmospheric gas, one should use a kinetic Monte Carlo method. In this paper we present an elaborated Monte Carlo model allowing us to calculate both the energy distribution functions and the excitation rates of the corresponding emissions. We also present the results of the application of this model to the photochemistry of a cometary coma. We compute the energy distribution functions of the metastable O(1D) and O(1S) species and obtain the shapes of the red (630 nm) and green (557.7 nm) spectral lines originating all over the coma. We show that both species have a severely non-Maxwellian EDF, which results in broad spectral lines. We explain that the shape of spectral lines depends not only on the exothermicity of photochemical production mechanisms but also on the thermalization due to elastic collisions. In the paper, we also discuss if it is possible to observe the UV emission produced by the products of dissociation of H2O molecules with the WSO-UV space mission.

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PRESENTATION TYPE: Oral