Simulation Study on Density Distribution of the Hot Oxygen Atoms in the Martian Exosphere

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Mars, with almost no intrinsic magnetic field, may have an atmospheric escape mechanism different from the magnetized planets such as the earth. Distribution and escape of non-thermal atmospheric constituents are important for understanding the atmospheric evolution and the interaction between non-magnetized planets and the solar wind. Hot oxygen atoms are produced by dissociative recombination of molecular oxygen ion, the major ion in the Martian ionosphere. The produced hot oxygen atoms near or above the exobase form a hot oxygen corona and escape from the planet.

For the study of the Martian oxygen corona, remote sensing of the resonance scattering of the solar UV by hot oxygen atoms is helpful. Since McElroy [1972] suggested the existence of hot oxygen corona around Mars, a number of theoretical model calculations have been reported. However, few of them gave intensity distribution of the resonance scattering. Shinozaki [1994] calculated the intensity distribution by taking a multi scattering process into account but by assuming a spherically symmetric model atmosphere in which oxygen density depends only on the altitude. It's necessary to use more realistic spherically asymmetric model for the discussion on the structure of the exosphere. In order to calculate the intensity of the resonance scattering, we are now constructing spherically asymmetric model of three-dimensional density distribution of hot oxygen atoms produced by dissociative recombination of molecular oxygen ions with the Monte-Carlo method. When velocity distribution of hot oxygen atoms are incorporated into the model, it will be able to obtain the intensity distribution of the hot oxygen corona by considering change of g-factor for each atom.

As a first step to the goal, result of the model calculation for three-dimensional density distribution of hot oxygen atoms produced by dissociative recombination of molecular oxygen ions will be presented.