Investigation of the UV radiation process in NGC 2023

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NGC 2023, a conspicuous reflection nebula in the southern part of the Orion B molecular cloud (L1630), is one of the most famous targets for studying PDRs. The central star, HD 37903, provides the principal illumination for NGC 2023, which forms an H II region and creates a PDR between the H II region and the rest of the neutral cloud. Many observations have been conducted in the various wavelength bands. H2 absorption lines are observed in the far-UV band toward HD 37903 (Leé et al. 2002, Meyer et al. 2001), while H2 emissions of NGC 2023 are studied by near-IR observation (Burton et al. 1998, McCartney et al. 1999). Other species are also observed by far-IR (Harvey, Thronson, & Gatley 1980), radio (Gatley et al. 1987, Jaffe et al. 1990), and far-UV (Knauth et al. 2001) bands. These observational results provide the clues how the UV radiation emitted from HD 37903 interacts with the surrounding gas and changes the physical conditions of NGC 2023.

In this study, we run the radiative-collisional equilibrium program CLOUDY (Ferland 1997) to simulate the UV radiation process of NGC 2023. The input parameters are chose to generate the same ionization and excitation distribution of atoms and molecules as observed. Finally, we concrete the model for NGC 2023, which makes it possible not only to derive all the physical conditions of NGC 2023 but also to predict new lines which are not observed yet.