Direct Observation of CO to H_2 Conversion Factor in the Orion B Molecular Cloud: an Analysis of CO Absorption Line in the FUV Region

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We analyze the CO absorption line transition at 1076-1077Å from the spectrum of HD 37903, which is observed by Berkeley Extreme and Far-Ultraviolet Spectrometer (BEFS) on the ORFEUS telescope. HD 37903 is a bright UV source star behind the southern part of the Orion B molecular cloud and generating the reflection nebula NGC 2023. Concealed by the strong wings of H_2 absorption lines, it is hard to observe CO absorption lines in the FUV region as far. The great abundance of CO molecules in the Orion B molecular cloud makes it possible to obtain the column density of CO toward HD 37903 in this study (N[CO] = 3.0×10^{17} cm^{-2}. Based on the pre-derived H_2 column densities, we verify that the obtained CO column density is reliable according to the χ^2- and F-test. In consequence of the direct measurement of CO column density, we obtain the CO to H_2 conversion factor [CO]/[H_2] in the southern part of the Orion B molecular cloud, which is [CO]/[H_2] = 4×10^{-4}. We obtain the three other H_2 tracers, which are the integrated CO and ^{13}CO emission intensities, W(CO) and W(^{13}CO), and the ^{13}CO LTE column density, N^*(^{13}CO), to investigate the physical conditions of the Orion B molecular cloud. The 14 m telescope in the Taeduk Radio Astronomy Observatory (TRAO) is used to observe the radio emission of CO(1-0) at 115.271 GHz and ^{13}CO(1-0) at 110.201 GHz toward HD 37903.