P122a VLA observations of ammonia lines towards a Class 0 protostar NGC1333 IRAS4A

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Exploring the chemical composition in the vicinity of a protostar promotes our understanding of the molecular evolution from the interstellar medium to the planetary medium. In the warm region ($\gtrsim 100\,\mathrm{K}$) around the protostar, ices sublimate from dust grain surfaces, which enables us to constrain the abundance of icy molecules using the radio molecular line observation. We observed five NH_3 and two NH_2D transitions with high-spatial resolution ($\sim 1''.0$) towards a Class 0 protobinary system NGC1333 IRAS4A using Very Large Array (VLA) to estimate the relative abundance of NH_3 to water. Combining the previous ALMA observations of $H_2{}^{18}O$ line, we revealed that the NH_3 abundance in one of the binary is smaller than the typical interstellar value ($\sim 5\%$; Öberg et al. 2011) and similar to the value in the comets in Solar system (0.2–1.4%; Mumma & Charnley 2011); the chemical evolution of nitrogen may already have started. We also detect the NH_2D lines at the central region ($\lesssim 300\,\mathrm{au}$) in one of the binary for the first time, which results in a remarkably high NH_2D/NH_3 ratio. Theoretical model by Furuya and Persson (2018) predicts that NH_3/H_2O and NH_2D/NH_3 ratios depend on the main nitorogen resorvior in the early evolutional stage. The abundance ratios obtained by our study put a constraint on the model prediction.