Infrared spectroscopy in the C--H stretching region towards embedded high-mass young stellar objects in the Large Magellanic Cloud

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Since cosmic metallicity is believed to be increasing in time with the evolution of our universe, interstellar chemistry in low metallicity environments is crucial to understand chemical processes in the past universe. The Large Magellanic Cloud (LMC) is an excellent target to study such low metallicity interstellar chemistry thanks to its metal-poor environment and proximity.

Here we report the results of infrared spectroscopic observations of embedded high-mass young stellar objects (YSOs) in the LMC with the Very Large Telescope. We obtained medium resolution spectra in the 3--4 micron range for eleven LMC YSOs and detected absorption bands due to solid H_2O and CH_3OH as well as the 3.47 micron absorption band. The properties of these bands are investigated based on comparisons with Galactic embedded sources. We found that the 3.53 micron CH_3OH ice absorption band for the LMC high-mass YSOs is absent or very weak compared to that seen toward Galactic counterparts. We estimate the column densities and abundance of the CH_3OH ice using the obtained spectra, which suggests that solid CH_3OH is less abundant in the LMC than in our Galaxy. We propose that grain surface reactions at relatively high dust temperature (warm ice chemistry) are responsible for the observed characteristics of ice chemical compositions in the LMC; i.e., the low abundance of solid CH_3OH presented in this work as well as the high abundance of solid CO_2 reported in previous observations. The 3.47 micron absorption band, which is generally seen in embedded sources, is detected toward six out of eleven LMC YSOs. In contrast to the CH_3OH ice band, strength ratios of the 3.47 micron band and water ice band are found to be similar between LMC and Galactic samples. Although the carrier of the 3.47 micron band is still under debate, our result suggests that the low metallicity and different interstellar environment of the LMC have little effect on the formation of the band carrier.

In this presentation, we are going to discuss the characteristics of the C--H stretching region spectrum in low metallicity environments based on these observational results.