From Interstellar Ices to Polycyclic Aromatic Hydrocarbons
A symposium to honor Lou Allamandola's Contributions to the Molecular Universe
Annapolis, MD, USA - September 13^{th} to September 17^{th}, 2015

Infrared spectroscopy of embedded high-mass YSOs in the Large Magellanic Cloud: Methanol and the 3.47 μm band

Takashi Shimonishi[1], Emmanuel Dartois[2], Takashi Onaka[3], and François Boulanger[2]

[1] Frontier Research Institute for Interdisciplinary Sciences, Tohoku University, Aramakiazaaoba 6-3, Aoba-ku, Sendai, Miyagi, 980-8578, Japan

[2] Institut d'Astrophysique Spatiale, UMR 8617, Université Paris-Sud, bâtiment 121, 91405 Orsay, France

[3] Department of Astronomy, Graduate School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0033, Japan

e-mail: shimonishi@astr.tohoku.ac.jp

Interstellar chemistry in low metallicity environments is crucial to understand chemical processes in the past metal-poor universe. The Large Magellanic Cloud (LMC) is one of the nearest metal-poor galaxies and an excellent target to study low metallicity interstellar chemistry. We here report the results of 3–4 μm spectroscopic observations towards eleven embedded high-mass young stellar objects (YSOs) in the LMC with the ISAAC at the Very Large Telescope [1]. Absorption bands due to solid H_2O and CH_3OH as well as the 3.47 μm band are detected, and the properties of these bands are investigated based on comparisons with Galactic embedded sources. We found that the 3.53 μm CH_3OH ice absorption band for the LMC high-mass YSOs is absent or very weak compared to those seen toward Galactic counterparts. We hypothesize that grain surface reactions at relatively high dust temperature (warm ice chemistry) are responsible for the low abundance of solid CH_3OH in the LMC. The warm ice chemistry hypothesis is also consistent with the high abundance of solid CO_2 in the LMC suggested in previous studies (e.g., [2]). The 3.47 μm absorption band, which is generally seen in Galactic embedded sources (e.g., [3]), is detected toward six out of eleven LMC YSOs. In contrast to the CH_3OH ice band, strength ratios of the 3.47 μm band and water ice band are found to be similar between the LMC and Galactic samples. Although the carrier of the band is still under debate, our result suggests that the lower metallicity and different interstellar environment of the LMC have little effect on the abundance ratio of the 3.47 μm band carrier and water ice. In this presentation, we discuss the characteristics of ice chemistry in low metallicity environments based on the infrared C–H stretching region spectra of embedded high-mass YSOs in the LMC.

REFERENCES

[1] Shimonishi, T., Dartois, E., Onaka, T., and Boulanger, F. (2015) submitted
[2] Shimonishi, T., Onaka, T., Kato, D., Sakon, I., Ita, Y., Kawamura, A., and Kaneda, H. (2010) A&A, 514, A12
[3] Allamandola, L. J., Sandford, S. A., Tielens, A. G. G. M., and Herbst, T. M. (1992) ApJ, 399, 134