Ice chemistry in the Magellanic Clouds

T. Shimonishi,[1] T. Onaka,[2] Y. Aikawa[1], I.Sakon[2], Y. Ita[3], A. Kawamura[4], and H. Kaneda[5]

1Department of Earth and Planetary Sciences, Graduate School of Science, Kobe University

2Department of Astronomy, Graduate School of Science, The University of Tokyo

3Astronomical Institute, Graduate School of Science, Tohoku University

4National Astronomical Observatory of Japan

5Graduate School of Science, Nagoya University

Recent advances in infrared observational instruments enable us to detect spectral information of young stellar objects (YSOs) in extragalaxies. Star-/planet-formation activities can occur in various types of galaxies which differ in various points such as size, shape, and environment. In order to understand the diversity of materials in the universe, it is very important to investigate how galactic characteristics affect the properties of materials around YSOs.

The Large and Small Magellanic Clouds are the nearest galaxies to our Galaxy (~50 kpc for LMC, and ~60 kpc for SMC). Metallicities of the LMC and the SMC are known to be approximately 1/2 and 1/5 compared to the solar neighborhood. Thus, YSOs in the Magellanic Clouds enable us to investigate how the different metallicity environments affect the properties of circumstellar materials. Chemical evolution of the universe is, as a first-order approximation, the evolution of metallicity. In this respect, it is especially important to investigate YSOs in low-metallicity environments.

For the last few years, it has been pioneer days for spectroscopic studies of YSOs in the Magellanic Clouds. A number of embedded YSOs are spectroscopically identified in the LMC and SMC, and their infrared ice features are investigated in detail (e.g., [1], [2], [3]).

In this presentation, I'm going to discuss the properties of circumstellar ices around high-mass YSOs in the LMC and SMC based on infrared spectroscopic data obtained with the *AKARI* satellite. It is shown that ices around YSOs in the Magellanic Clouds possess different properties in terms of molecular abundances and column densities for such major species as water, carbon dioxide, and carbon monoxide. In addition to the observational discussions, I'm going to present the preliminary results of numerical simulations on dust surface reactions under the unique environment of the Magellanic Clouds. The effect of galactic environment on the ice chemistry will be discussed from the point of view of observations and chemical calculations.

References

[1] T. Shimonishi, et al., 2008, ApJ, 686, L99

[2] T. Shimonishi et al., 2010, A&A, 514, A12

[3] T. Shimonishi, 2012, Ph.D thesis