Observations of Ices around Extragalactic Young Stellar Objects

Takashi Shimonishi[1], Takashi Onaka[1], Daisuke Kato[1], Itsuki Sakon[1], Yoshifusa Ita[2], Akiko Kawamura[3] and Hidehiro Kaneda[3]
[1] *Department of Astronomy, Graduate School of Science, The University of Tokyo, 7-3-1 Hongo, Bunkyo-ku, Tokyo 113-0003, Japan, e-mail: shimonishi@astron.s.u-tokyo.ac.jp*
[2]*National Astronomical Observatory of Japan*
[3]*Graduate School of Science, Nagoya University*

Question of where molecules like water or carbon dioxide on the Earth's surface came from is one of the main topics of the current “astrochemistry”. One of the possible origins of these molecules is the "ices" around young stellar objects (YSOs) [1]. Observations of ices around extragalactic YSOs are one of the challenging topics in the current ice studies. Ices are mainly observed through the infrared absorption features [2]. So far, infrared spectroscopic observations toward extragalactic embedded YSOs are very few, and their circumstellar chemistry is still poorly understood. But it is highly probable that different galactic environments (e.g., metallicity, radiation field, etc.) could affect the properties of circumstellar material.
In this study, we focused on YSOs in the Large Magellanic Cloud (LMC), which is the nearest metal-poor galaxy to our Galaxy. We investigated the chemical conditions of ices around high-mass YSOs in the LMC by near-infrared (2—5 micron) spectroscopic observations with the infrared satellite AKARI [3, 4]. As a result, we detected the absorption features of 3.05 micron H_2O ice, 4.27 micron CO_2 ice, and 4.67 micron CO ice toward these extragalactic YSOs. We derived column densities of these ices and showed that YSOs in the LMC have higher abundance of CO_2 ice (CO_2/H_2O ~0.36) than similar Galactic counterparts (CO_2/H_2O ~0.17, [5]). Since thermal or energetic processes are thought to be one of the possibilities of the CO_2 ice formation, we suggest that the strong ultraviolet radiation field and/or the generally high dust temperature in the LMC may be responsible for the high CO_2 ice abundance. This result is the important evidence which indicates that YSOs in other galaxy holds different chemical conditions in their circumstellar environments. In this presentation, we discuss the chemical properties of ices around extragalactic YSOs.

Keywords: astrochemistry; circumstellar matter; solid molecules; ISM; infrared

References

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