The observational studies of circumstellar matter with ASTRO-F

Issei Yamamura[1]

[1] ISAS

http://www.ir.isas.ac.jp/~yamamura/

Stars with a mass below about 8 times of the solar mass evolve up to red-giants at the final stage of their evolution. The atmosphere of these stars are extended due to their pulsation. At the outermost region of this extended atmosphere dust grains form. The radiation pressure from the central star blows out the dust with the surrounding gas. This mass-loss phenomenon is one of the major source of the interstellar dust grains. The behavior of mass loss relates on the dust formation processes, and the processes and the formed grains are different depending on the chemical composition, the luminosity, and the pulsation of the star.

To understand the mass-loss mechanism and the relation between mass loss and the evolution of the central star has been an ultimate goal of the studies of evolved stars. Infrared observations are an excellent tool to approach this problem. Especially observations from the space have always provided the greatest results since the very first satellite IRAS. The Infrared Space Observatory (ISO) that was launched in 1995 had two spectrometers, the SWS and the LWS, and obtained continuous spectra in the very broad wavelength range of 2.4--200 micron.

One of the most brilliant results of the ISO is the discovery of the crystalline silicates in the space. Waters et al. (1996, Astronomy and Astrophysics, 315, L361) and Wealkens et al. (same volume, L245) reported the first detection of the crystalline silicates in the evolved stars and the young stars, respectively. Since then a new field of astronomy, ``space mineralogy'', has been established and the extensive studies such as analysis of the ISO spectra, laboratory measurements, and theoretical works have been done. However, we still have a lot of unsolved problems. For example, why there are only Mg-rich crystalline dusts?, what is the crystallization mechanism, and how are the crystalline silicates processed in the interstellar space.

ASTRO-F is the Japanese astronomical infrared satellite which will be launched in early 2004. ASTRO-F, together with the U.S. mission SIRTF, is expected to progress the infrared astronomy in the post-ISO era. ASTRO-F has two scientific facilities; the Far-Infrared Surveyor (FIS) and the Infrared Camera (IRC). The satellite is operated such like IRAS: the main purpose of the mission is to carry out the whole sky survey with much higher spatial resolution and the sensitivity than IRAS and construct the infrared source catalogue. ASTRO-F spends some amount of mission time for the pointing observations of certain areas of the sky. This observing mode provides higher sensitivity than the survey. Also spectroscopic observations with the FIS and the IRC are performed. Scientific observation programs optimized for the ASTRO-F capabilities are being considered.

In this presentation, I review the recent progress of the studies of the circumstellar dust around the evolved stars and some young stars, and discuss about future direction of this field, especially observations with ASTRO-F.