Mid-infrared High-resolution Spectrograph for SPICA

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We present the status of the development of mid-infrared high-resolution spectrograph for SPICA, which is a next-generation infrared astronomical mission in space with a cooled 3.0 m telescope [1]. High-resolution spectroscopy in the mid-infrared wavelength range is of strong interest. Since numerous rotational-vibration bands of molecules are located in this wavelength range, spectra of celestial objects and ISMs provide fruitful information on physical/chemical condition of them. However, in ground-based observation, systematic observations have been hampered by the strong atmospheric extinction, which limits the observational wavelength range, and also by the large amount of thermal background, which reduces the sensitivity in most cases. Therefore high-resolution spectroscopy from space has been awaited for investigating the mid-infrared wavelength region, but it has not yet been realized because the size and the weight of instruments for high-resolution spectroscopy are so large and so heavy that it is difficult to launch them. SPICA is a precious opportunity to explore this exciting field. Mid-infrared Camera and Spectrograph (MCS) is proposed for SPICA [2]. As one function of MCS, we have been developing a high-resolution spectrograph (MCS-HRS) [3].

The goal of MCS-HRS is to achieve a spectral resolution ($\lambda/\Delta\lambda$) of 20,000-30,000 in the mid-infrared wavelength. In the latest specification, the wavelength coverage is set to be 12-18 μm, where many organic molecules can be detected but it is hard to access from ground due to the strong atmospheric extinction. The main observational targets are ISMs, proto-planetary disks, and comets. The high-resolution capability of the spectrograph enables not only identifying molecular lines but also kinematic studies in the mid-infrared wavelengths. Observing the compositional distribution in proto-planetary disks provides crucial information to understand the formation process of planets. MCS-HRS can shed light on the material evolution among ISMs - proto-planetary disks - comets (planetesimals), and it also has possibility to find molecules some of which could be bio-maker.

References

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