Future Submillimeter Remote Sensing of the Martian Atmosphere

Hideo SAGAWA [1], Yasuko KASAI [1], Paul HARTOGH [2] and Takeshi KURODA [2, 3]

[1]*National Institute of Information and Communication Technology, Japan*
[2]*Max-Planck-Institut für Sonnensystemforschung, Germany*
[3]*Institute of Space and Astronautical Science, Japan*

The submillimeter wavelength is a suitable wavelength to study the chemical composition in the Martian atmosphere. This is because most of the atmospheric molecular species have several rotational transitions in the submillimeter domain, and their line strengths are generally stronger than those at the millimeter wavelength. From the technical point of view, the heterodyne spectroscopy, which is a widely used technique in the millimeter/submillimeter region, enables one to measure the accurate spectral line shape of the molecular transition. By using the pressure dependence of the spectral line shape, the vertical profiles of the atmospheric state i.e., the temperature and the molecular abundance can be retrieved from the observed spectra.

The recent advances in the submillimeter remote sensing, such as the observations with HIFI onboard the Herschel space telescope, have opened an exciting new era in the Martian atmospheric science. With HIFI, sensitive explorations on the vertical distributions of the Martian water vapor as well as other photochemically important species are conducted. At the same time, looking at the terrestrial atmospheric observations, SMILES equipped on the International Space Station has been demonstrating the effectiveness of the limb emission sounding in detecting very low concentrated chemical species, and in improving the vertical resolution of the retrieved product. To follow such successful applications of the space-born submillimeter remote sensing, new submillimeter wave instruments are now proposed to the future Mars orbiters led by Japan (MELOS) and by ESA/NASA (ExoMars/Mars Trace Gas Mission). In this paper, we present the possible perspective of future submillimeter remote sensing of the Martian atmosphere.

Keywords: HIFI, Heterodyne Instrument for the Far Infrared; ALMA, Atacama Large Millimeter Array; SMILES, Superconduction Submillimeter-wave Limb-emission Sounder.