

Observation project of the Martian atmosphere by THz-band heterodyne spectroscopic remote sensing with Mars micro-satellite/landers

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Recently the possible source of Methane on Mars discovered with the NASA's infrared telescope and Curiosity rover is hot issue for discussion. In 2010 the heterodyne instrument for the far infrared band on board Herschel space observatory revealed that molecular oxygen may increase at the lower atmosphere of Mars. For understanding of the behaviors of biomarkers on exoplanets, it is crucial to reveal the related chemical reaction networks of the Martian atmosphere as well as the presence or absence of life as sources of these species.

Currently the team in department of aeronautics and astronautics, the University of Tokyo is planning to launch Mars micro-satellites and landers. We have plans to install 0.4 and 0.7 THz band heterodyne spectroscopic systems on the micro-satellites and landers for the simultaneous remote sensing of the minor constituents such as O₂, H₂O, O₃, and their isotopes related to oxidation reaction networks of the Martian atmosphere. Ground-based telescopes on the earth cannot observe these species on Mars because of the strong absorption of the earth's atmosphere

For the frontend and backend Schottky barrier diode mixer detectors implemented with frequency multiplying local oscillators (Virginia diode Inc.) and high-resolution chirp transform spectrometers (1 GHz bandwidth) developed in Max Planck Institutes will be equipped, respectively. The equivalent system noise temperature is about 4000 K, which enables us to observe the spectral lines of above species with high signal-to-noise ratio according to the radiative transfer model. In case of a Mars landing mission with look-up observations so-called standard chopper wheel method is not applicable for spectral calibration. Therefore we will prepare the frequency tunable local oscillators for frequency switching mode and two blackbody calibrators with different temperatures. Planetary protection of the system is also an important task. In this conference the current status of this mission will be reported.

Keywords: Terahertz, Micro-satellite/lander, Planetary Atmosphere, Heterodyne Remote Sensing, Biomarker, Mars