



Submillimeter wave instrument on the Japanese Mars orbiter MELOS-1

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The Submillimeter wave (SMM) instrument is proposed for the Japanese Mars orbiter (MELOS-1) which launch is planned in 2018. Characteristics of the SMM instrument are the observations of wind, temperature, CO, water vapor and its isotopes, and minor radical species such as O₃, H₂O₂ and HO₂. Many potential contributions to the Martian science are expected from these measurements: for example, the understanding of the Martian atmospheric circulation regime, the water cycle and variable hygropause, isotopic fractionation including HDO/H₂O, photochemistry in the middle atmosphere, and thermophysical properties of the surface layer.

The observing strategy is to combine both limb and nadir observations from the elliptic orbit. In the limb observing mode, several tangential heights are pointed by using the spacecraft maneuver, which improves the vertical resolution of wind and temperature observations. The nadir observing mode has an advantage of conducting horizontal mapping with temporal variation of minor molecules. Since the dust and ice cloud are almost transparent at submillimeter wavelengths, the SMM instrument can provide observational data without being affected by dust distributions.

The draft design of the instrument is having dual frequency receivers of 500 and 600 or 800 GHz in order to observe at least two water vapor lines, including the ground state 110 – 101 transition at 556.9 GHz, with different line strengths. Combination of the observations of weak and strong opacity lines enables us to measure the H₂O abundance in a wide altitude range: from the surface to higher than 100 km.

This study will optimize the instrumental design by examining its scientific performance with the observation simulations. We also discuss the scientific significances of the planned observations in collaboration with the studies using general circulation models (GCMs) for the Martian atmosphere.