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Sub-millimeter sounder onboard MELOS: Recent status of the development

YASUKO KASAI[1], Hideo Sagawa[1*], Paul Hartogh[2], Takeshi Manabe[3], Takeshi Kuroda[4], Satoshi Ochiai[1], Toshiyuki Nishibori[5], Yukina Aoyama[6], Masataku Kinoshita[3], Donal Murtagh[7], Fredrik von Scheele[8]

[1]NICT, [2]MPS, [3]Osaka Pref. Univ., [4]ISAS/JAXA, [5]JAXA, [6]Ibaraki Univ., [7]Chalmers Univ. Tech., [8]SSC

The Sub-millimeter wave (SMM) sounder is proposed for the Japanese Mars orbiter (MELOS-1) which launch is planned in 2018. With the SMM sounder, a substantial progress on the meteorological understanding of Mars is expected: For instance, horizontal mapping of the temperature profile, direct measurements of wind speed, sensitive measurements of the water vapor and minor molecules, and observations of the thermal properties of the (sub-)surface. MELOS-1 orbiter is planned to be placed on a high elliptic orbit, with an inclination angle of 63.4 degree, having the peri- and apocenter altitudes of around 300 km and 6.36 Martian radii, respectively. During the near-apocenter orbit, the SMM sounder will observe the nadir (and near-nadir) direction to detect local time variations of the temperature and minor molecules abundances. And when the orbiter comes close to Mars, the SMM sounder will perform the limb sounding, i.e. point several tangential heights of the Martian atmosphere by using the spacecraft maneuver. In this limb observation mode, the vertical profile of wind velocity becomes primal target. In addition, we examine the possible sensitivity to the minor molecules using Solar occultation geometry which achieves, in general, much higher signal-to-noise ratio observations compared to the conventional atmospheric sounding.
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 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. The polarization receiver system will be equipped in order to observe the thermal property of the surface.
In this work, we present the latest status of the instrumental development, and discuss the possible scientific performance of the MELOS SMM sounder by performing the observational simulations.

Keywords: Martian atmosphere, Sub-millimeter sounder, Instrument, Radiative transfer, Water vapor, Remote sensing