Millimeter-Wave Radiometry for studying Venus Atmospheric Constituents

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Millimeter (mm) and sub-millimeter (sub-mm) wave radiometers can be used for the quantification of various atmospheric constituents in the Venus mesosphere as several minor species in the upper atmosphere have resonance emission/absorption bands in these frequencies owing to the rotational transitions. A Radiative Transfer simulation based study for Venus Atmospheric emission has been performed to determine the mm/sub-mm wave frequencies for the estimation of atmospheric constituents such as water vapour, CO, CO_2, SO_2, HDO and HCl present in mesosphere of Venus for a LIMB viewing geometry. The simulations help for identifying mm/sub-mm wave measurement frequencies for both day and night time condition. It has been determined that 183, 380, 448, and 556 GHz are most sensitive to water vapour constituents and hence suitable for water vapor measurements in the mesosphere. The frequencies such as 115, 230, and 345 GHz are optimum for CO measurements which shows day/night variability in thermal emission and hence can also be used to derive temperature profiles at 90-110 km. SO_2 can be detected using 346 GHz and HDO shows sensitivity at 226 and 335 GHz and can be used to derive profiles of HDO. A peak thermal emission at 625 GHz is obtained due to absorption of HCl species and hence can be used to study its variability at 70-100 km. We will be presenting brightness temperature variability at different altitude levels and the corresponding sensitivity at the mm/sub-mm wave frequencies for a limb sounding radiometer. These simulations have great importance in designing payload/instrument and retrieval of the atmospheric parameters for the available sensor capabilities.