Title:
Modelling the Microwave Radiation of the Moon

Authors:
T.G. Müller (1), M. Burgdorf(2)
(1) Max-Planck-Institut für extraterrestrische Physik (MPE), Garching, Germany, tmueller@mpe.mpg.de
(2) Meteorologisches Institut, Centrum für Erdsystem- und Nachhaltigkeitsforschung (CEN), Universität Hamburg, Germany

Abstract:
Based on a high-quality and well-tested model for the Moon at mid-infrared wavelengths (Müller et al. 2021), we looked into the microwave radiation of the Moon (e.g., Yang & Burgdorf 2020). We find an excellent agreement (better than 5% on absolute scale) between our model predictions and 89 GHz Microwave Sounder disk-integrated measurements of the Moon. The high model accuracy holds over a wide phase angle range between -90° to +90°, and over the given variations in distances and viewing geometries.
The model includes the known physical and thermal properties of the Moon, as well as the true illumination and observing geometry at a given measurement epoch. It was combined with a newly established frequency and phase angle dependent hemispherical emissivity model. This new "global emissivity model" deviates considerably from basic (constant) spectral emissivity assumptions in the GHz regime, but is required to explain the disk-integrated lunar microwave radiation. We will present our lunar microwave thermophysical model and the comparison with data taken at different frequencies and coming from different satellites. Our lunar model allows to predict (disk-integrated) radiance or brightness temperatures for the absolute calibration of instruments. Via the Moon, it is also possible to look into instrument ageing effects, to cross calibrate instruments onboard different satellites and over long time scales.

References:
- Müller, T. G., Burgdorf, M., Ali-Lagoa, V. et al., "The Moon at thermal infrared wavelengths: a benchmark for asteroid thermal models", Astronomy & Astrophysics, 650, A38 (2021)
- Yang, H., Burgdorf, M., "A Study of Lunar Microwave Radiation Based on Satellite Observations", Remote Sens., 12, 1129 (2020)