Title:
The Moon at thermal infrared wavelengths: Comparison between NOAA/MetOp-A/MetOp-B, TIROS-N HIRS measurements and thermophysical model predictions

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Abstract:
In an earlier study (Müller et al. 2021, A&A 650, A38) it was shown that High-resolution InfraRed Sounder (HIRS) multi-channel measurements of the Moon are well explained by a Thermophysical Model (TPM) which is widely used in astronomy for the interpretation of the thermal emission of atmosphereless bodies. The TPM calculations take the known physical and thermal properties of the Moon into account, as well as the true illumination and observing geometry at the epoch of the measurement. It was combined with a newly established wavelength-dependent hemispherical emissivity model. This "global emissivity model" deviates considerably from the known lunar sample spectra, but it is required to explain the "disk-integrated" lunar radiances between 3.75 and 15 μm. Here, we demonstrate the validity of this infrared Moon model in the context of more than 120 HIRS measurement (Seibert 2022a/b/c), taken between 1979 and 2021, and covering a wide phase angle range from -85° (waxing Moon) to +83° (waning Moon). The TPM predictions match the HIRS measurements within 5% (10% at the shortest wavelengths below 5 μm) on absolute scale. The high-quality Moon model allows to benchmark the calibration of IR-based instrumentation between 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)
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- Seibert, C., “HIRS moon intrusions and model calculations”, 2022b, DOI:10.5281/zenodo.6865664.
- Seibert, C., “A collection of instrument characteristics for all satellites with HIRS/2, HIRS/3 and HIRS/4”, 2022c, DOI:10.5281/zenodo.6822188.