# CALIBRATION AND CHARACTERISATION OF MICROWAVE SOUNDERS WITH THE MOON

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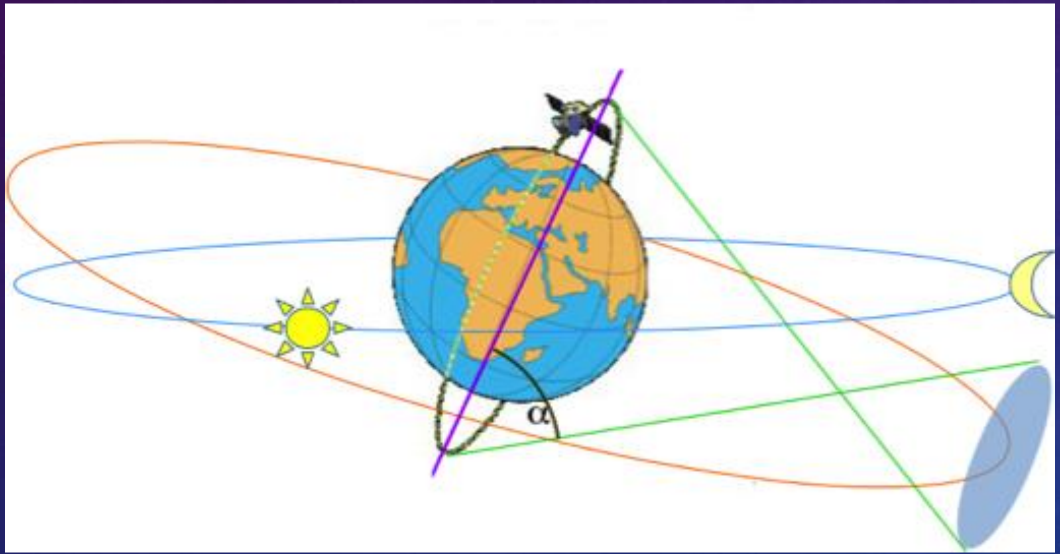
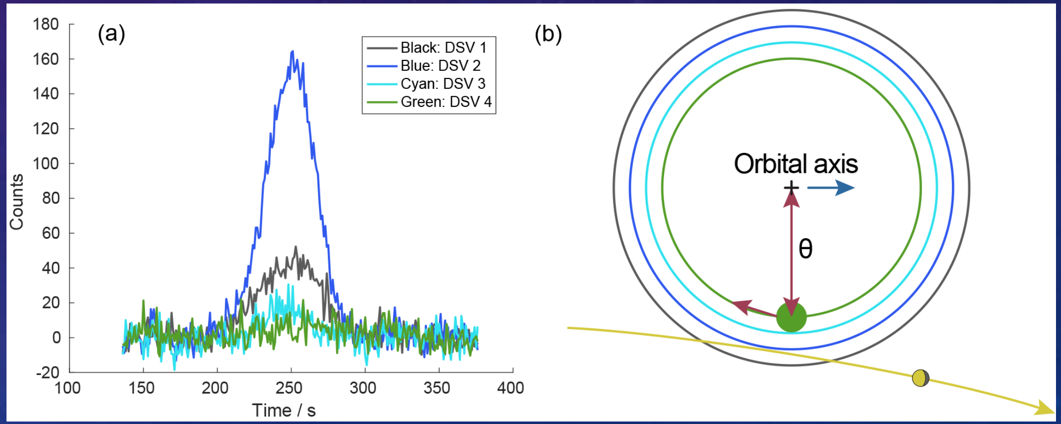
# OBSERVING THE MOON WITH AMSU-B AND MHS

Position of

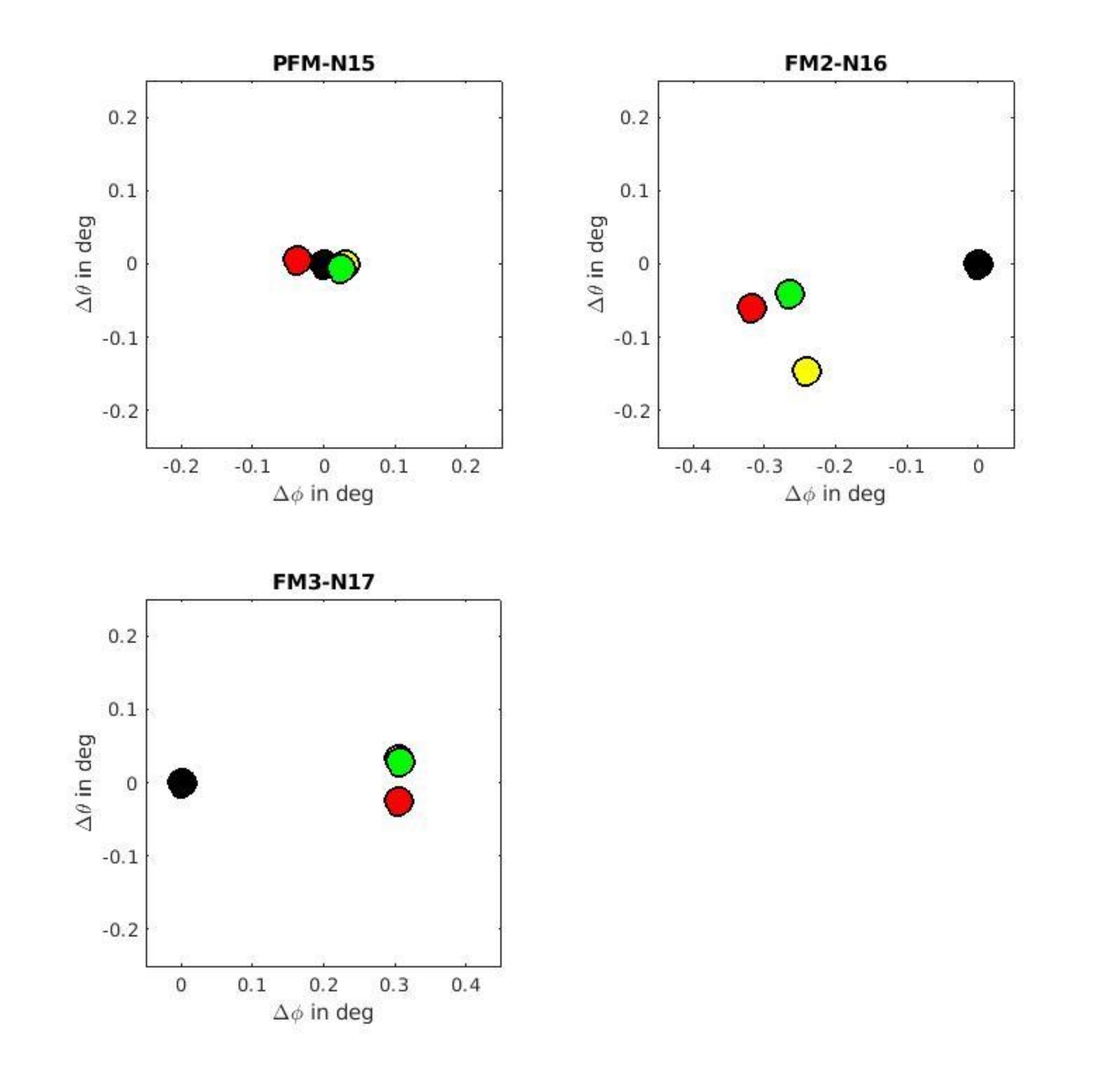



Light Curves



# POINTING ERROR OF AMSU-B

It is possible to determine the pointing direction in both the along-track and the scan direction with high accuracy from the amplitude and the position of the peak in each pixel of the deep space view.
Channel 1: red, channel 2: yellow, other channels: green, nominal position: black

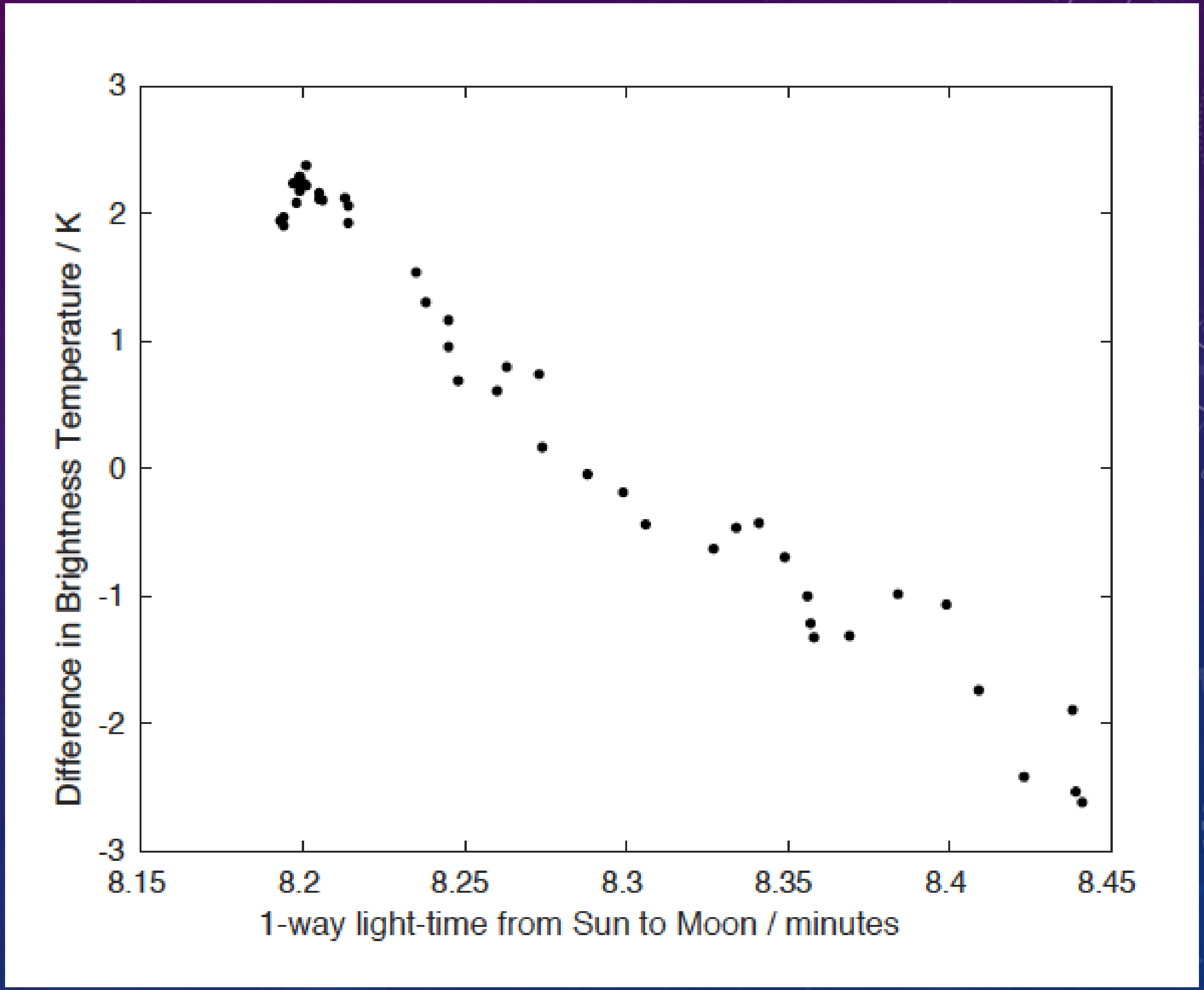


# MEAN HALF POWER BEAMWIDTH

- Duration of Moon intrusion → beam size
- Check with measured radiance
- Results from ground tests could not always be reproduced in flight
- Mean half power beamwidth ⚡ requirements in some cases
- MHS on Metop-C: issues with both beam size and pointing error
- Beam diameter for sounding channels ≥ 1.21° (except for N16 and Metop-B)

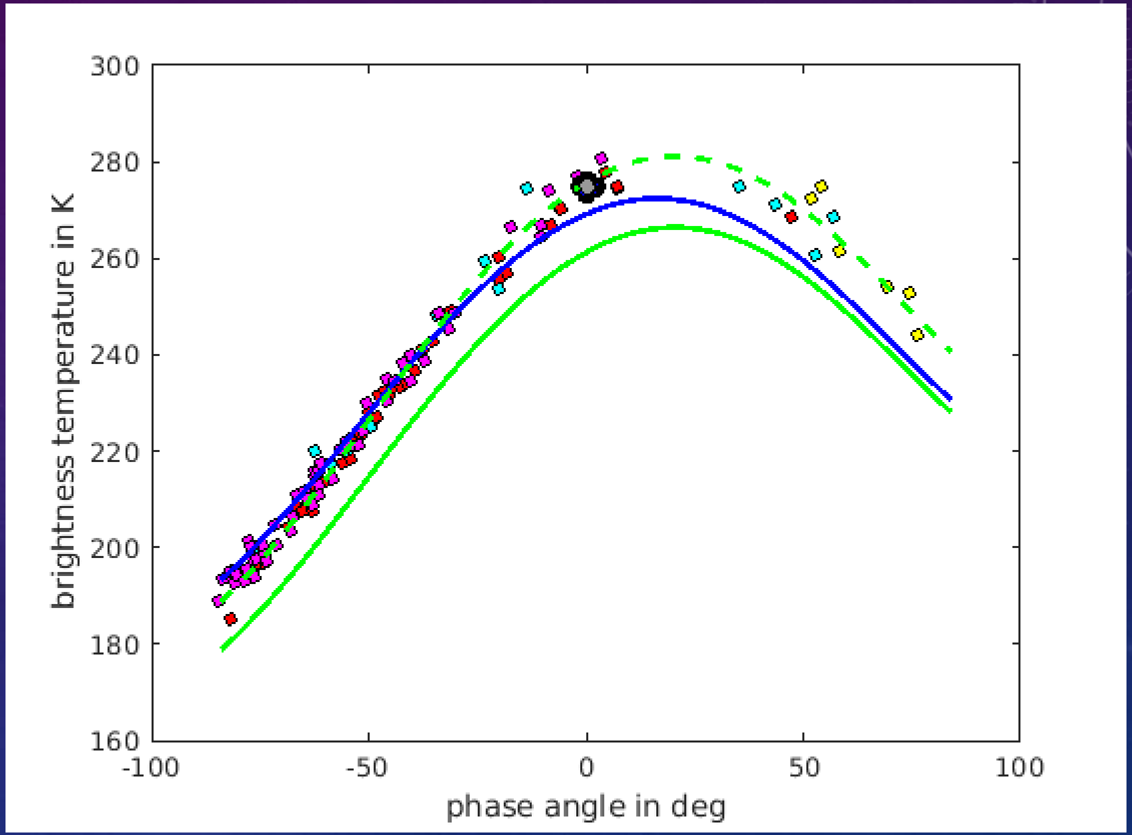
# DISTANCE SUN - MOON

The disk-integrated TB is almost 5 K higher at perihelion than at aphelion. This agrees well with the value of 4.5 K by Liu.



# OBSERVATION AND MODEL

The measured brightness temperatures of the Moon at 89 GHz from AMSU-B on NOAA-16 (cyan) and NOAA-17 (yellow) as well as from MHS on NOAA-18 (red) and NOAA-19 (magenta) are shown as a function of phase angle. The large, grey dot represents NOAA-20 ATMS. The solid lines give the predictions by Keihm (1984, blue) and Liu & Jin (2020, green). The dashed, green line represents the model by Liu & Jin, but scaled by a factor 1.055.



# SUMMARY

- Pointing accuracy at DSV
  - Requirement: ±0.1° for AMSU-B, ±0.09° for AMSU-B
  - Not compliant in 1/3 of the cases, more than ±0.3°
- Beamwidth at DSV
  - Requirement: 1.1° ± 10%
  - Not compliant in half of the sounding channels, discrepancies to ground tests ≥ ten sigma
- Photometric calibration
  - Need to take distance of Moon to Sun and Observer and phase angle into account
  - No model agrees with measurements, but Liu‘s comes very close after scaling upwards by 5.5%

# CONCLUSIONS

- Moon intrusions in the deep space view are helpful for characterising in flight
  - Pointing error of sounding channels
  - Beamwidth
  - Photometric stability
  - Agreement between satellites or channels
  - Noise and baseline variations on timescale of minutes
- Performance differs in flight significantly from ground tests