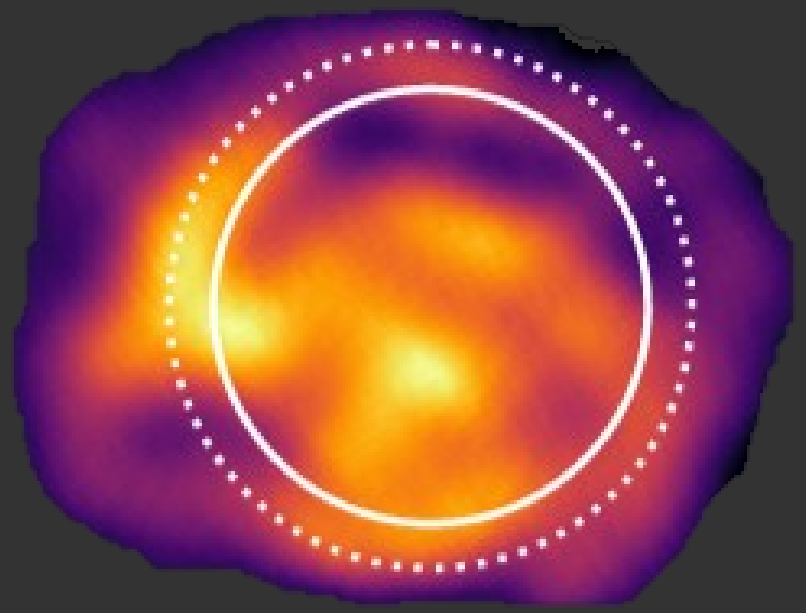
the **Low Frequency Array**

Imaging of the Quiet Sun in the Frequency Range of 20-80 MHz

LOFAR Solar and Space Weather KSP

STELLAR



BAS-BG

ИНСТИТУТ ПО АСТРОНОМИЯ С НАЦИОНАЛНА АСТРОНОМИЧЕСКА ОБСЕРВАТОРИЯ

ASTRON-NL

ASTRON

DIAS-IE

DIAS

Institiúid Ard-Léinn Bhaile Átha Cliath | Dublin Institute for Advanced Studies

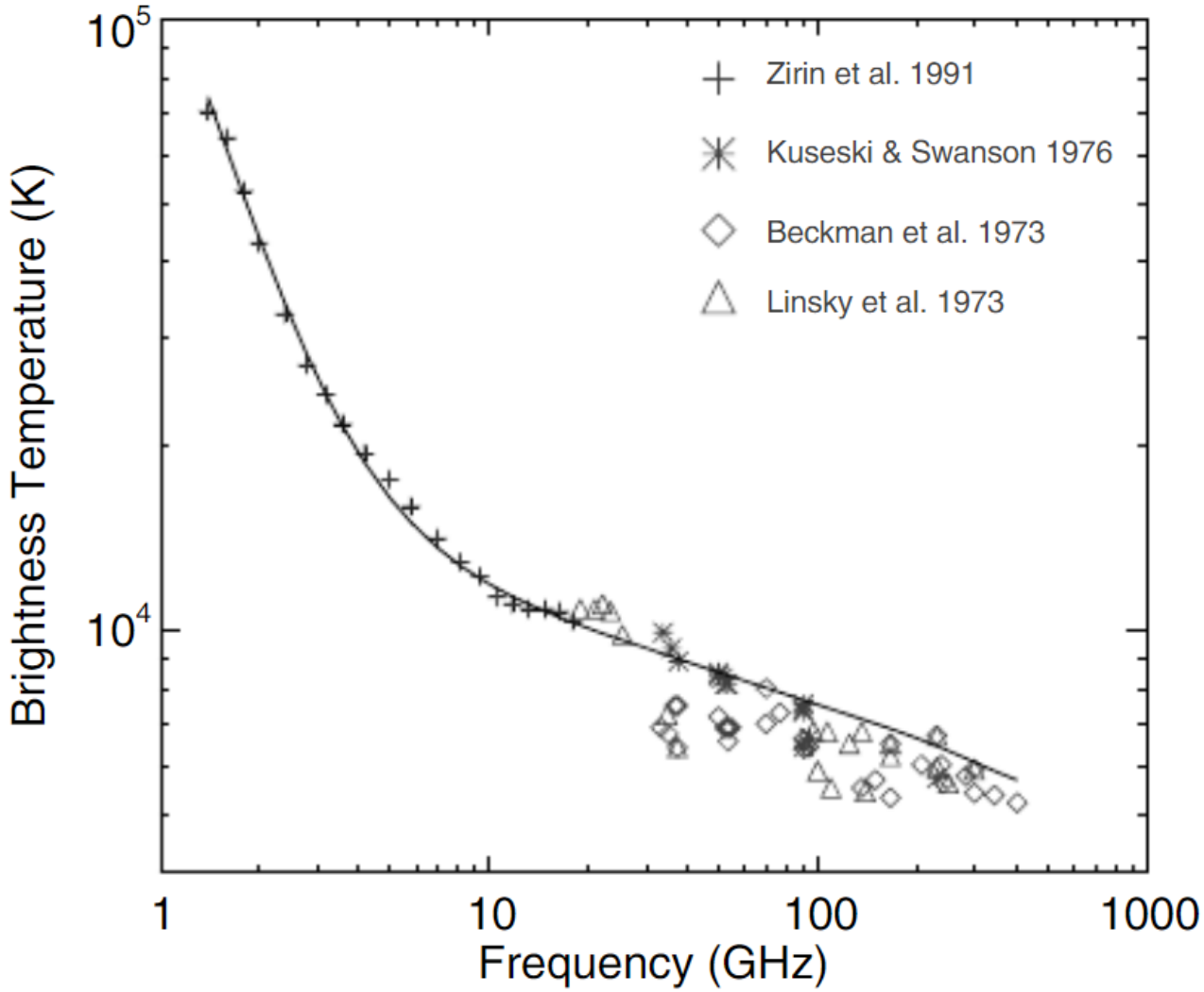
TUS-BG

EGU General Assembly

Quiet sun study

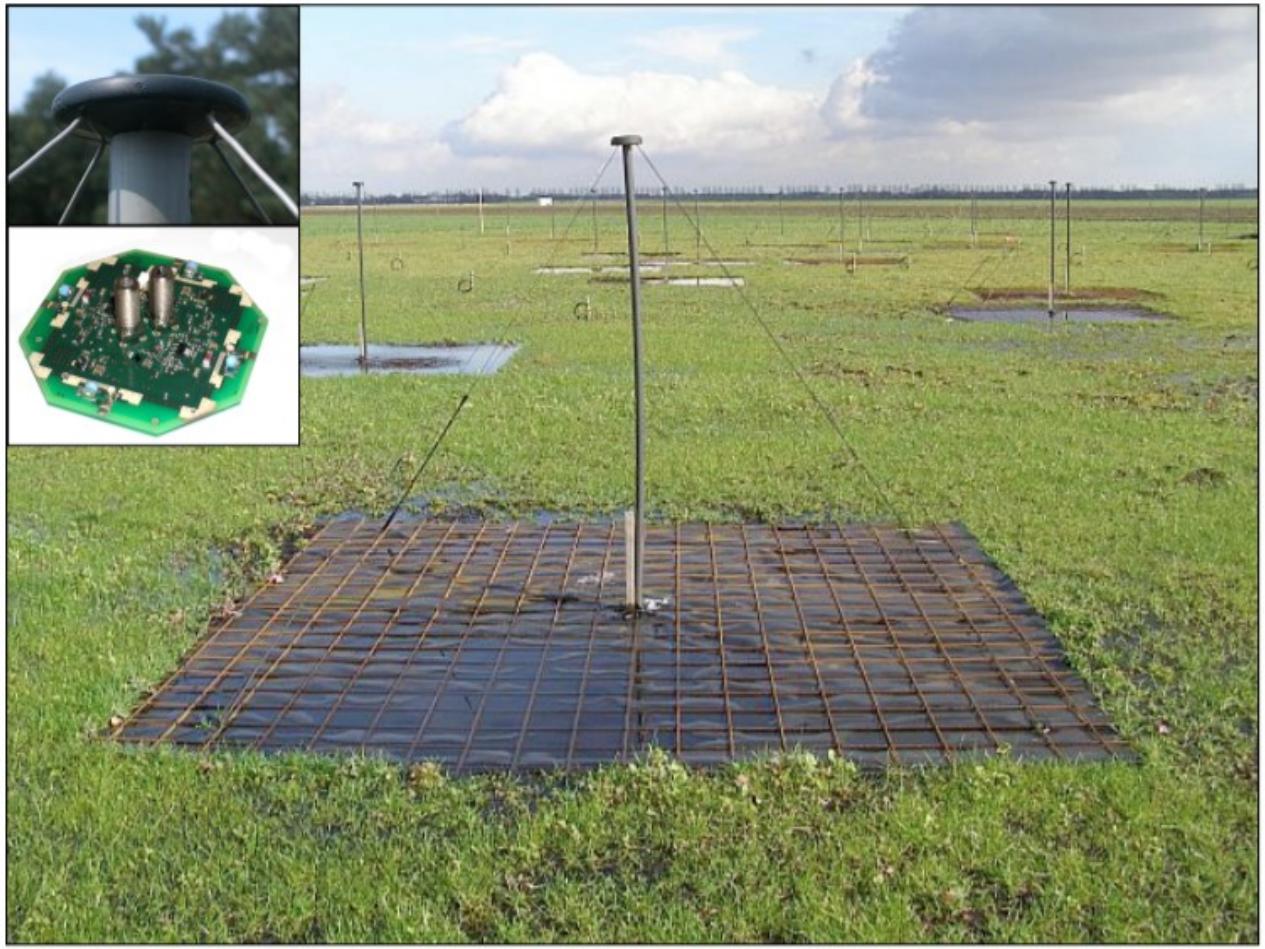
- Majorly in microwave band
- Quiet sun in > 1GHz well described by thermal bremsstrahlung

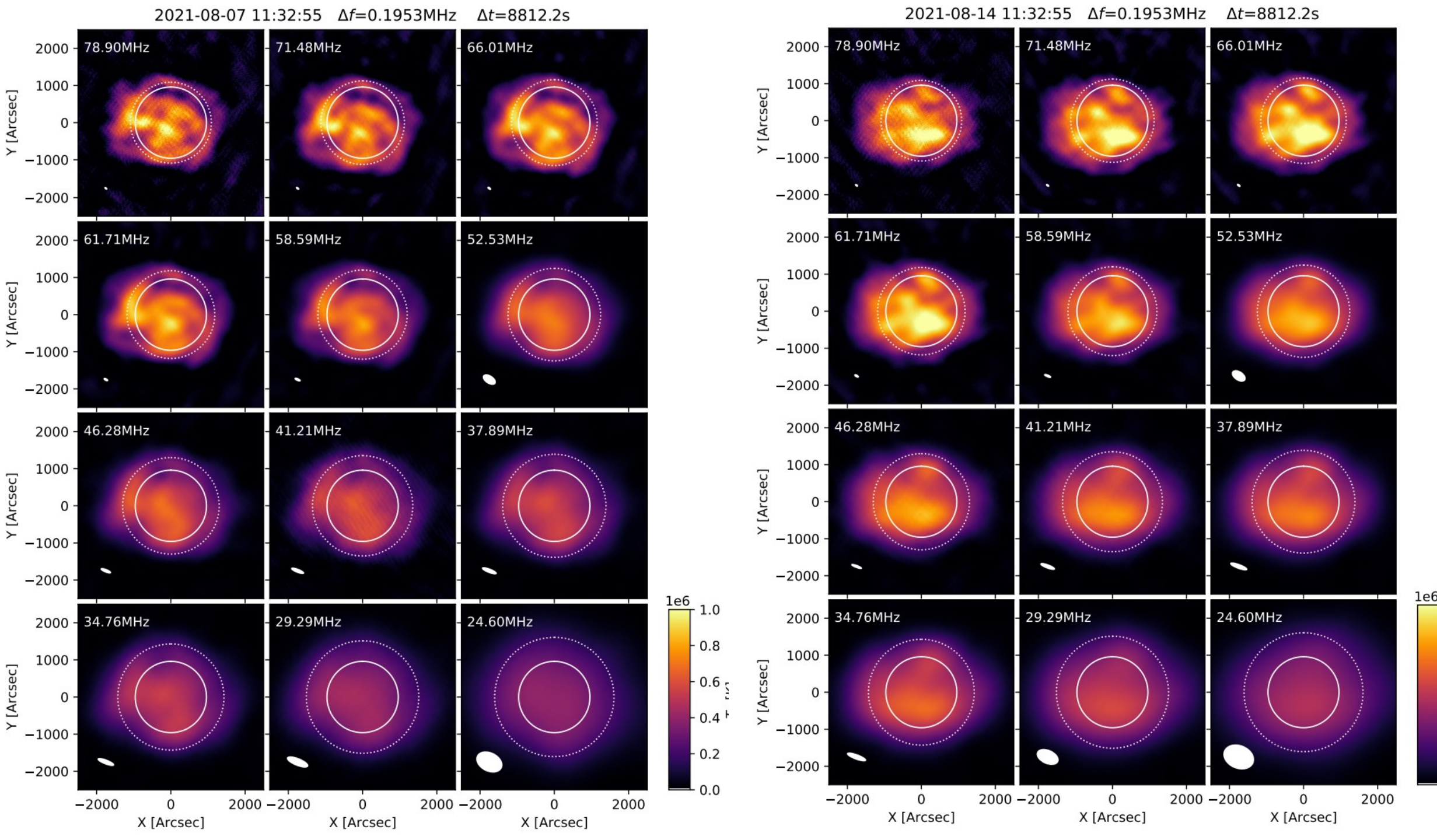
- Based on model of density and temperature of lower solar atmosphere



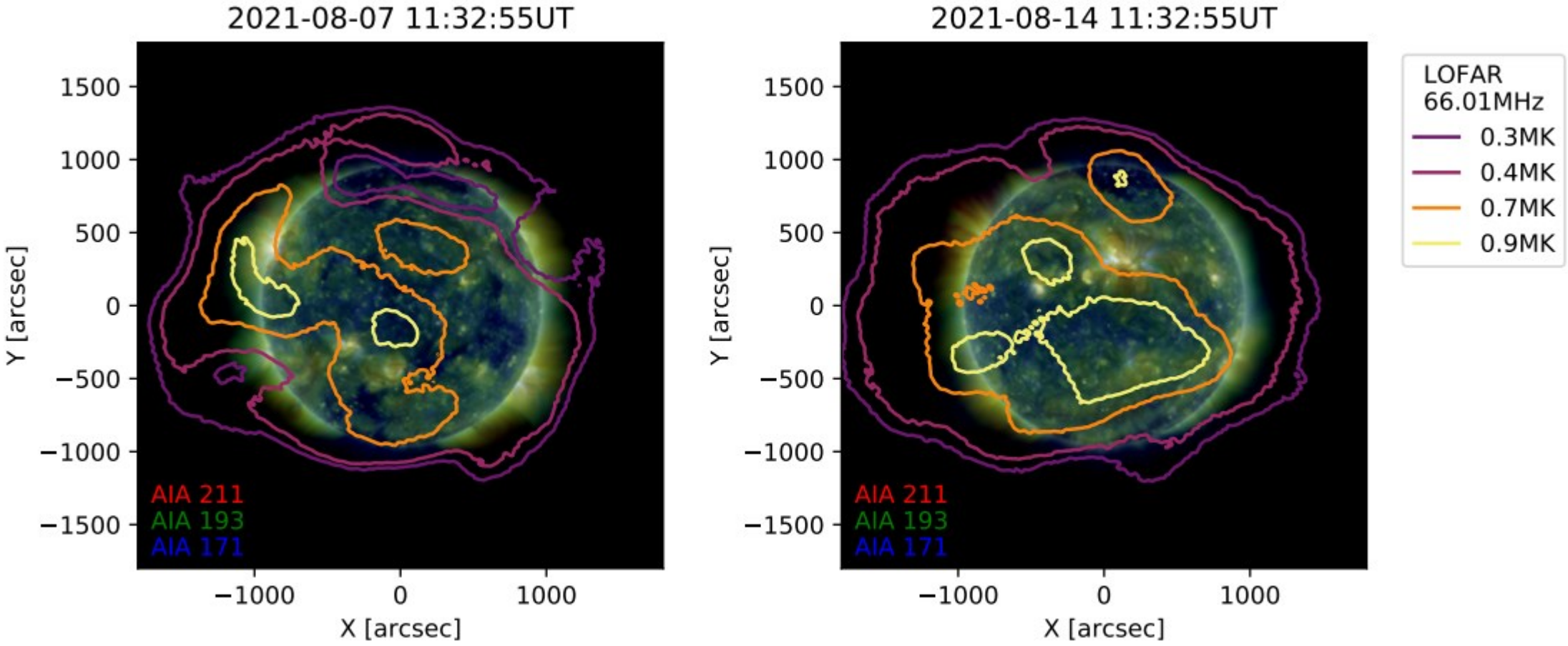
Imaging of Quiet sun with LOFAR LBA: Configuration

- Antenna set: LBA (10MHz-80MHz)
- Frequency resolution: ≈1MHz
- Time integral: 2.45 hrs (Quiet sun)
- 24 core stations and 9 remote stations (528 station baselines)
- Longest baseline : 48km
- Calibrator: Cas-A



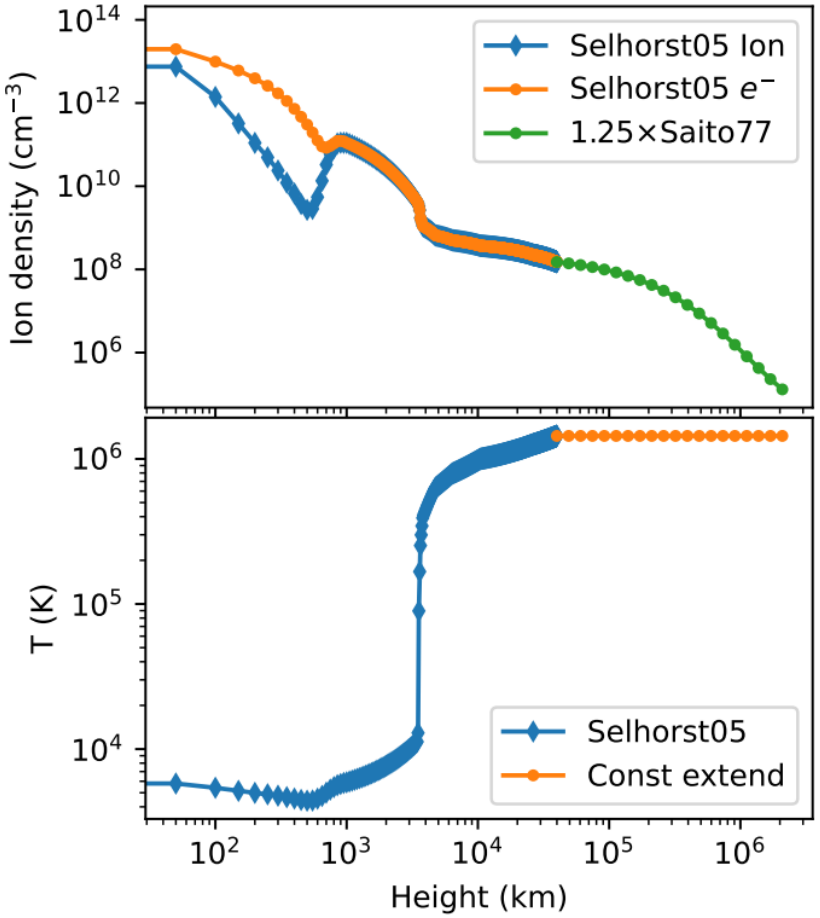

2021-08-07 11:32:55 Δf=0.1953MHz Δt=8812.2s
2021-08-14 11:32:55 Δf=0.1953MHz Δt=8812.2s
78.90MHz
71.48MHz
66.01MHz
61.71MHz
58.59MHz
52.53MHz
46.28MHz
41.21MHz
37.89MHz
34.76MHz
29.29MHz
24.60MHz
Y [Arcsec]
X [Arcsec]
2000
1000
0
−1000
−2000
1e6
1.0
0.8
0.6
0.4
0.2
0.0

Coronal Holes .vs. Radio image

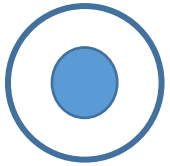


Brightness temperature spectrum

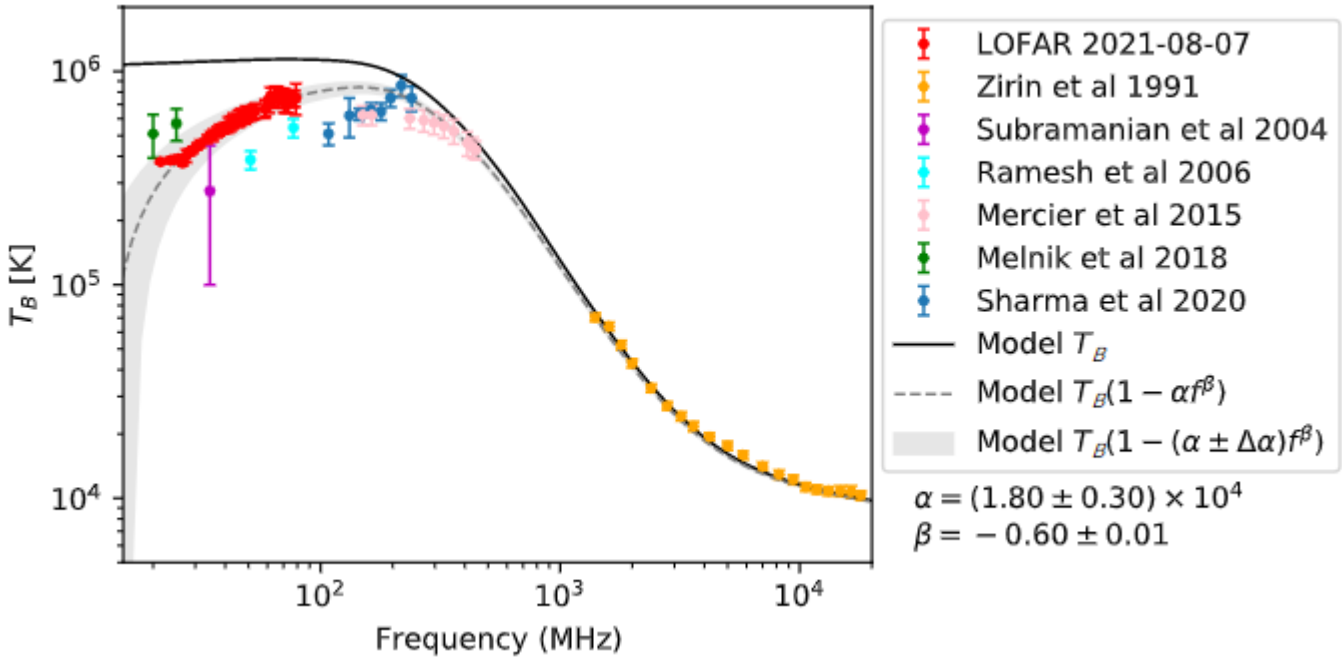
Model



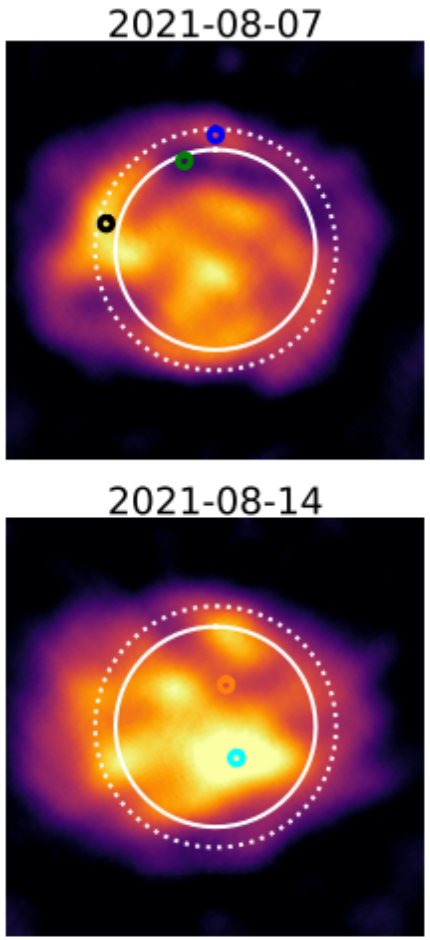
Model and observation

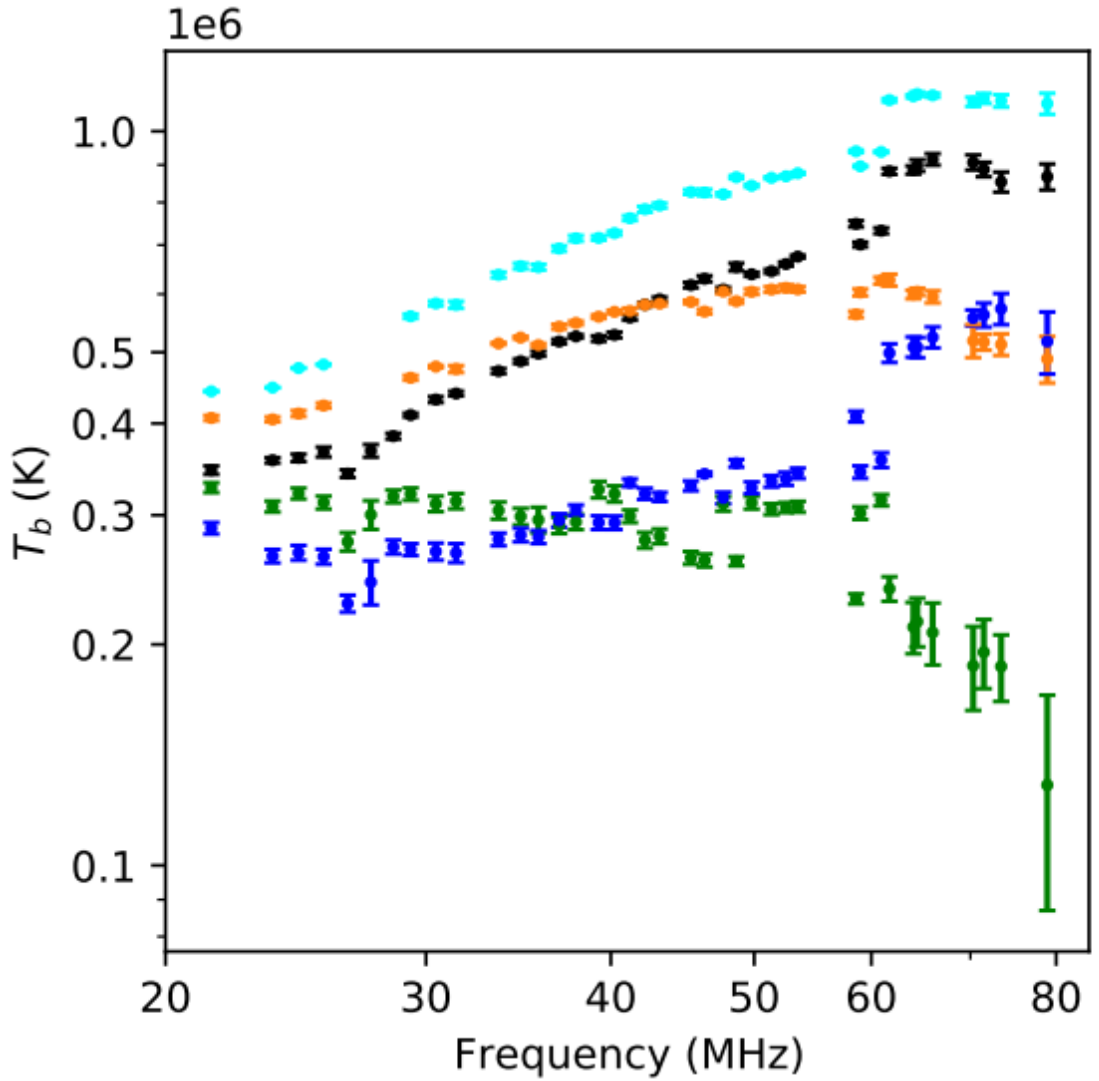


Center averaged (<0.5 Rs)

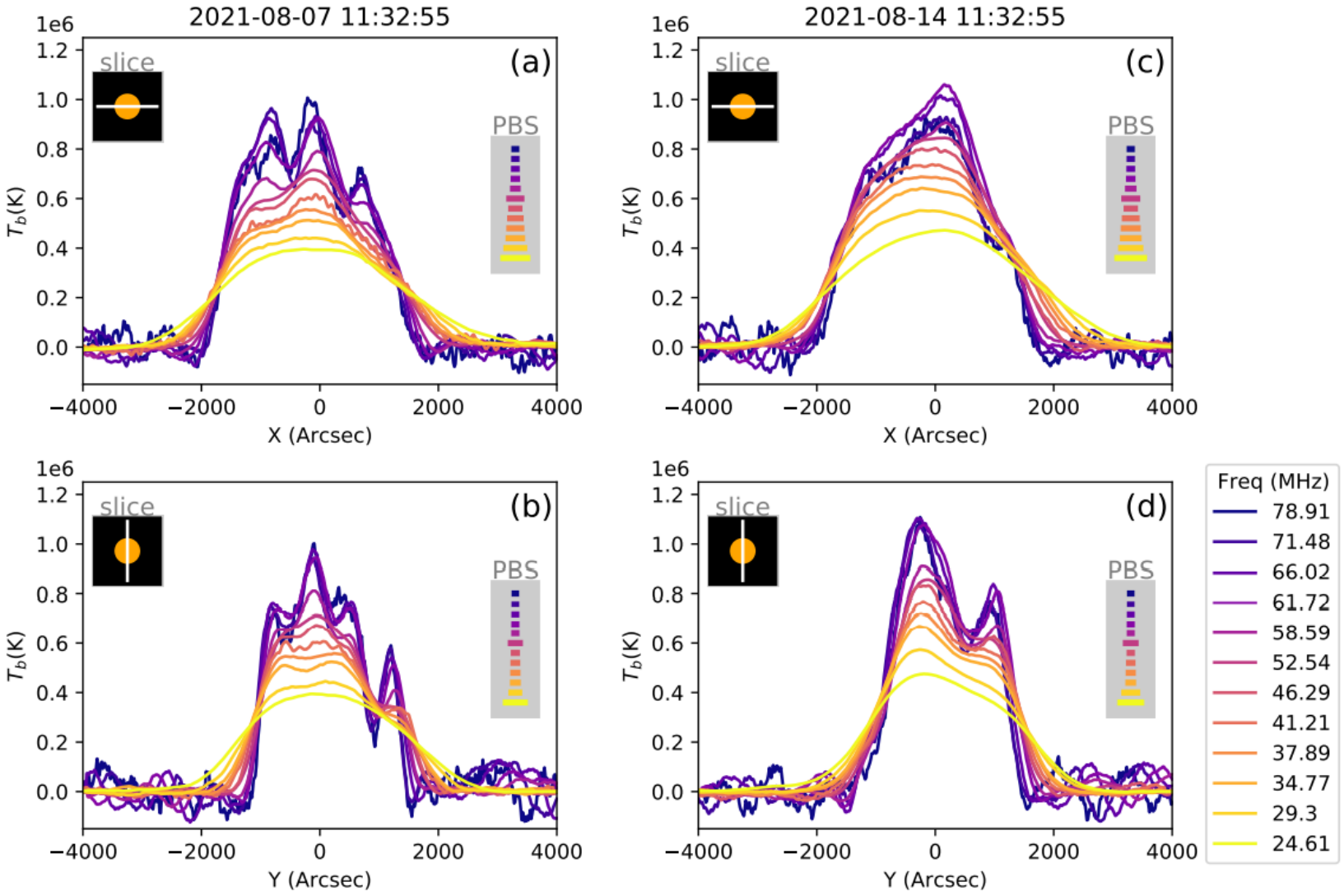


Spectrum of coronal holes and dark regions

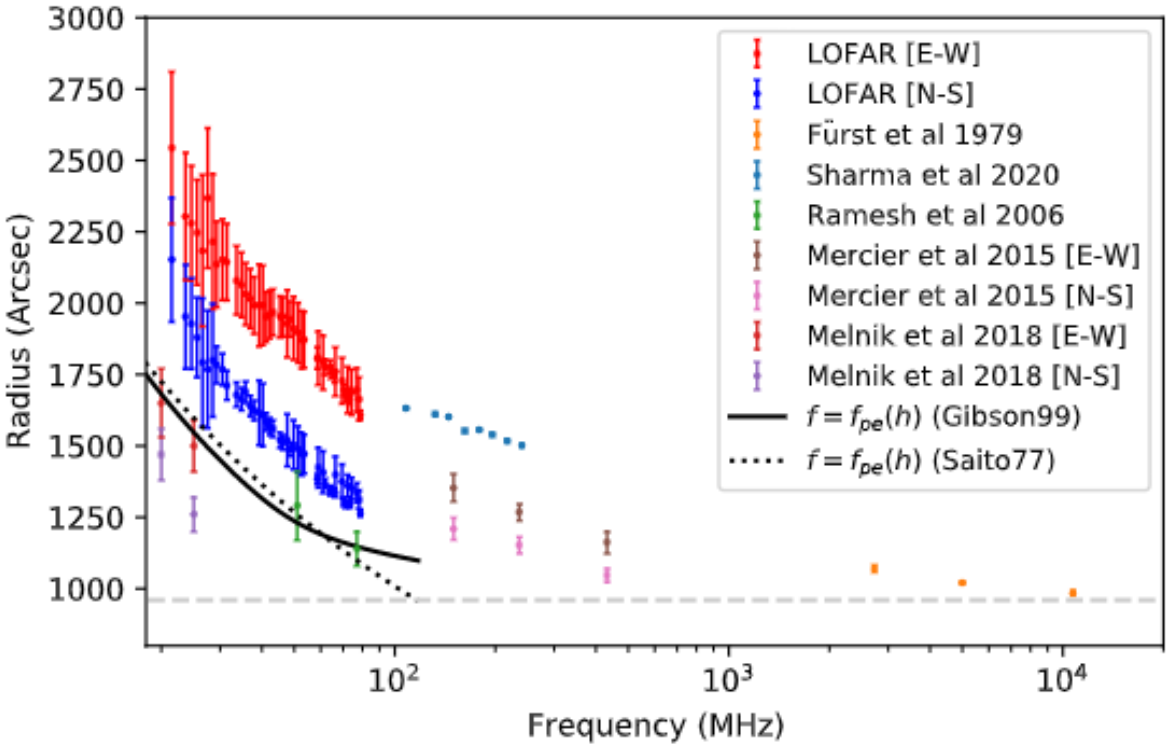


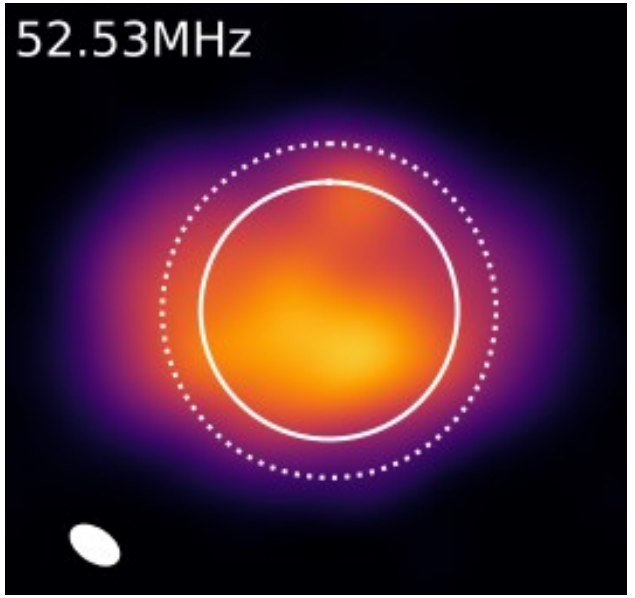


Slice in the equator and meridian



Size of the sun in radio





Conclusions

- The brightness temperature measured as the center average is lower than model predicted of thermal bremsstrahlung
- Equator coronal holes are bright in frequency range of 10-80MHz
- We find an extremely low brightness temperature region on the solar disk [why]
- The size of the sun is larger in E-W direction.
- The size shares the same trend with the local plasma radius