

For future planning of
ALMA Band-6 observations of
solar limb

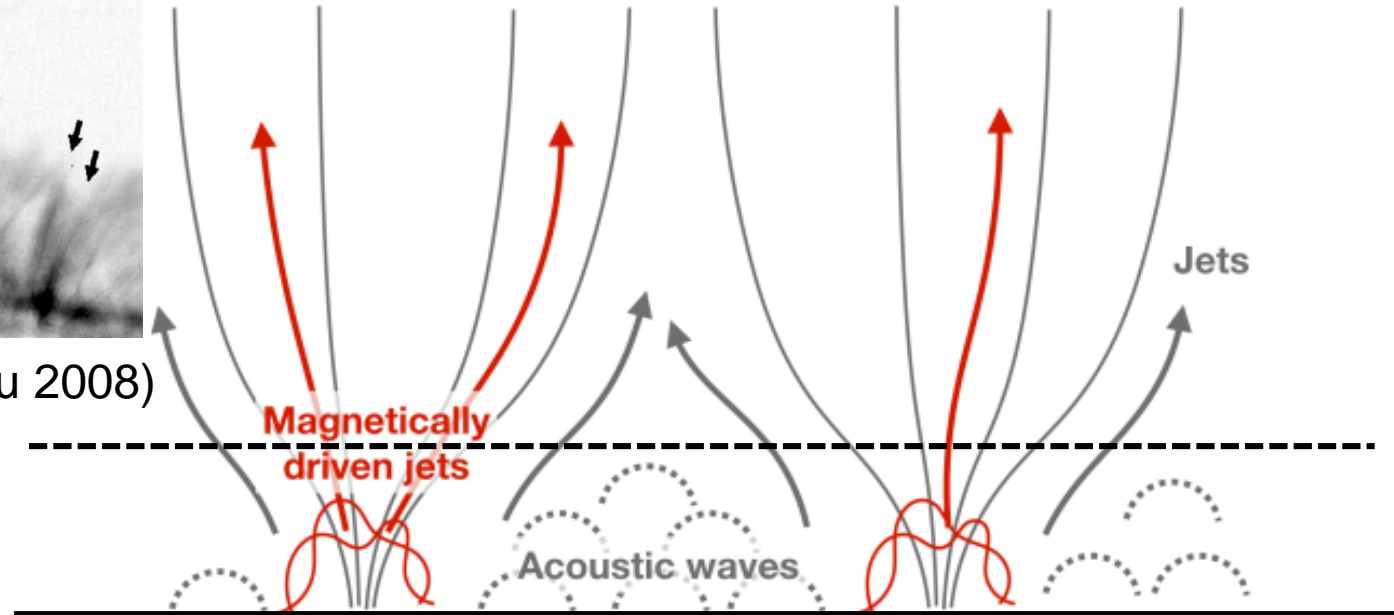
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The University of Tokyo

Chromospheric jets: model



(figure from Suematsu 2008)

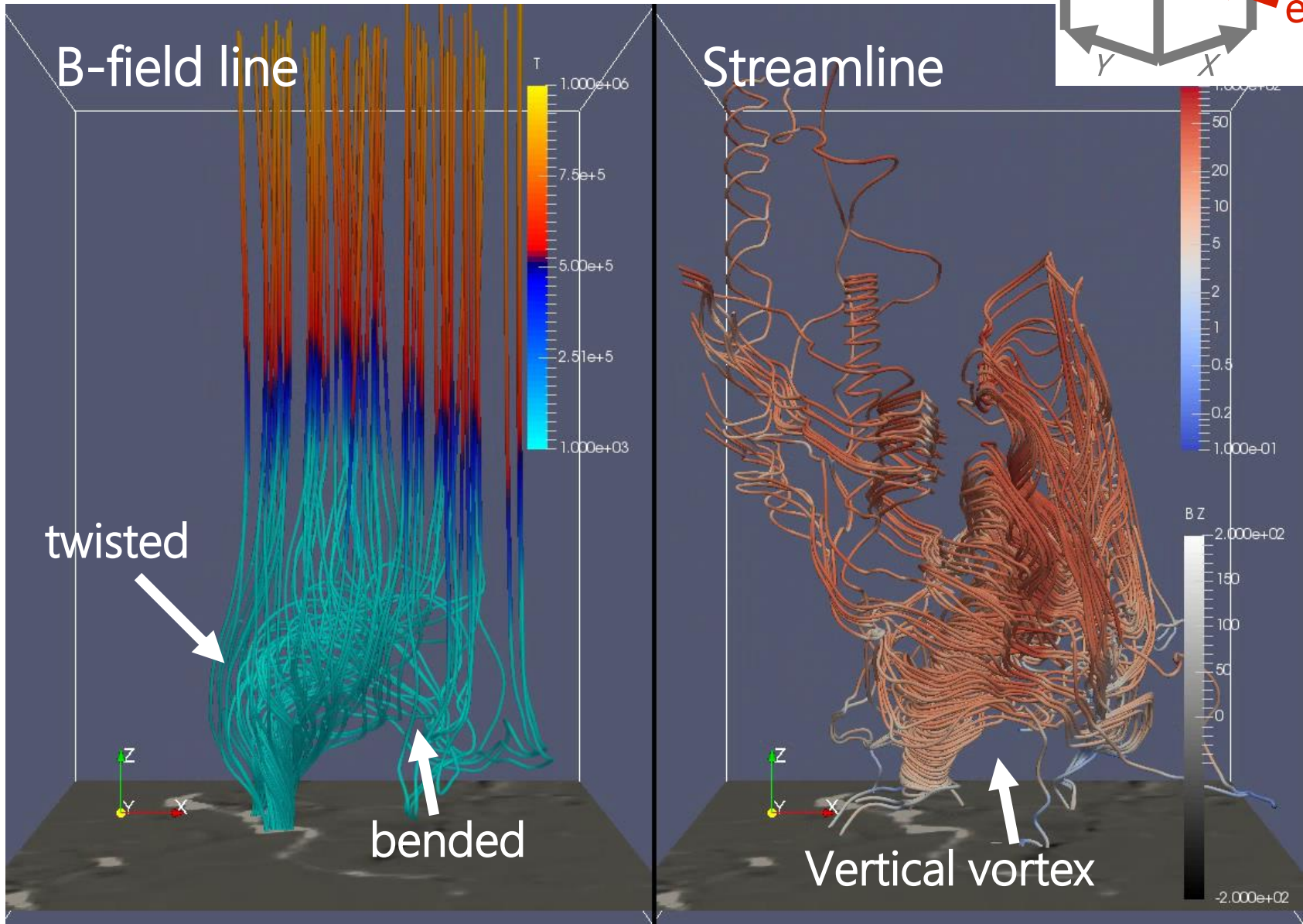
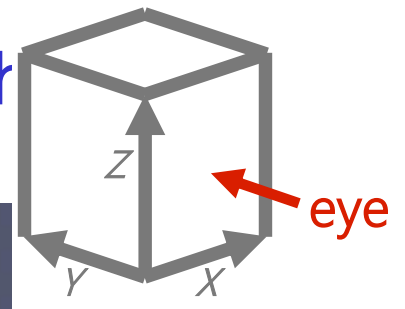


(figure from Iijima 2016, PhD UTokyo)

The **dense cool chromospheric plasma** is lifted by an interaction of shock waves with transition-region contact discontinuities (Hollweg 1982, Suematsu+ 1982). But as for the generation of shock waves, it is still under debate.

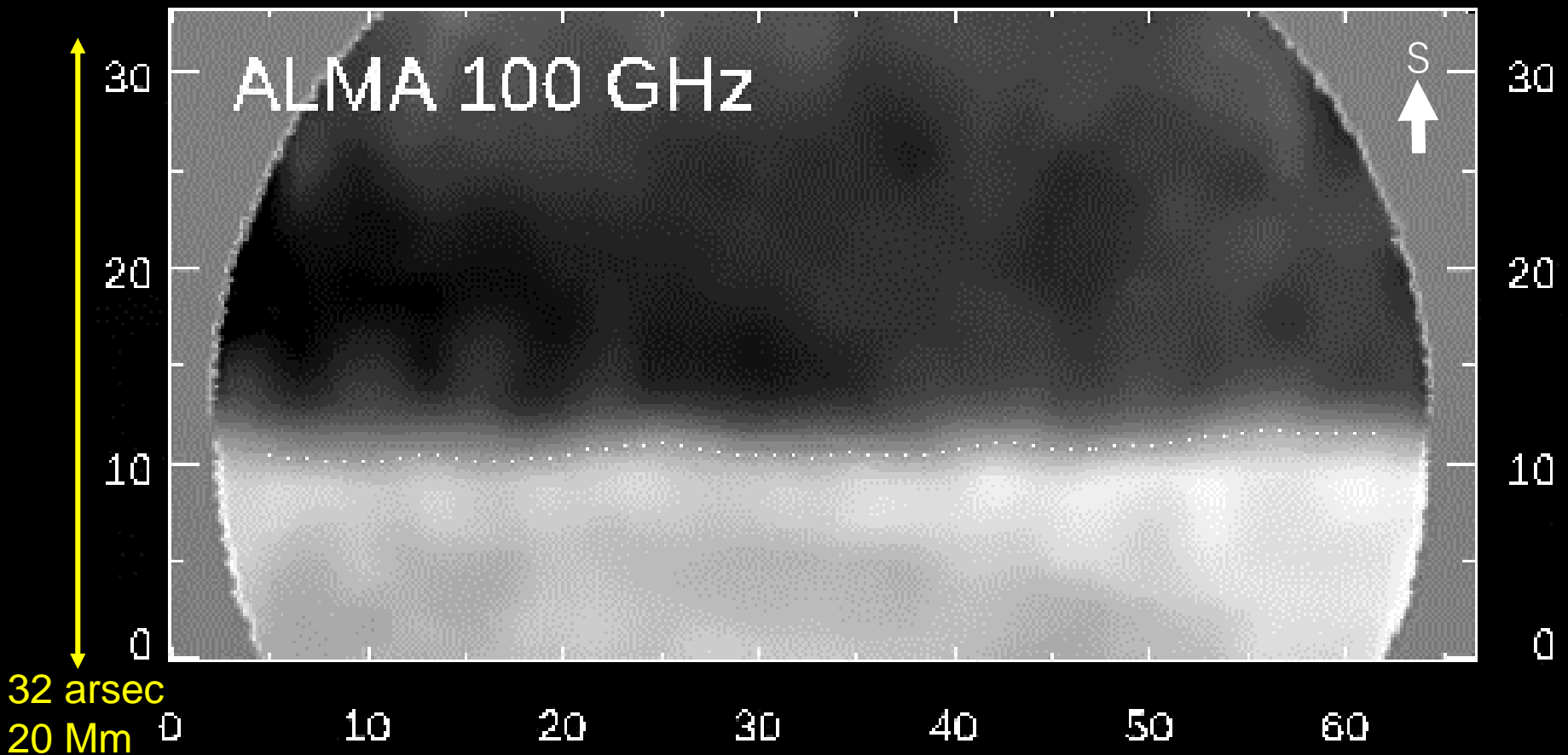
3D radiative MHD simulations of chromospheric structures

Iijima (2016, PhD thesis UTokyo), Iijima &TY (2017)



Observation results

45 min. around 14:30 UT on 2017-4-29 on the coronal hole at the solar southern pole only in Band-3 (100GHz). Spatial resolution ~ 2 arcsec.



Owing to the insufficient signal-to-noise ratio in the data beyond the limb particularly in the area more than $10''$ beyond the limb, the analysis is limited in $y < (y_{\text{limb}} + 10'')$.

Aim and data

For preparation of future ALMA observations of the solar limb, the existing data set was investigated, especially for Band-6 (239GHz) observations.

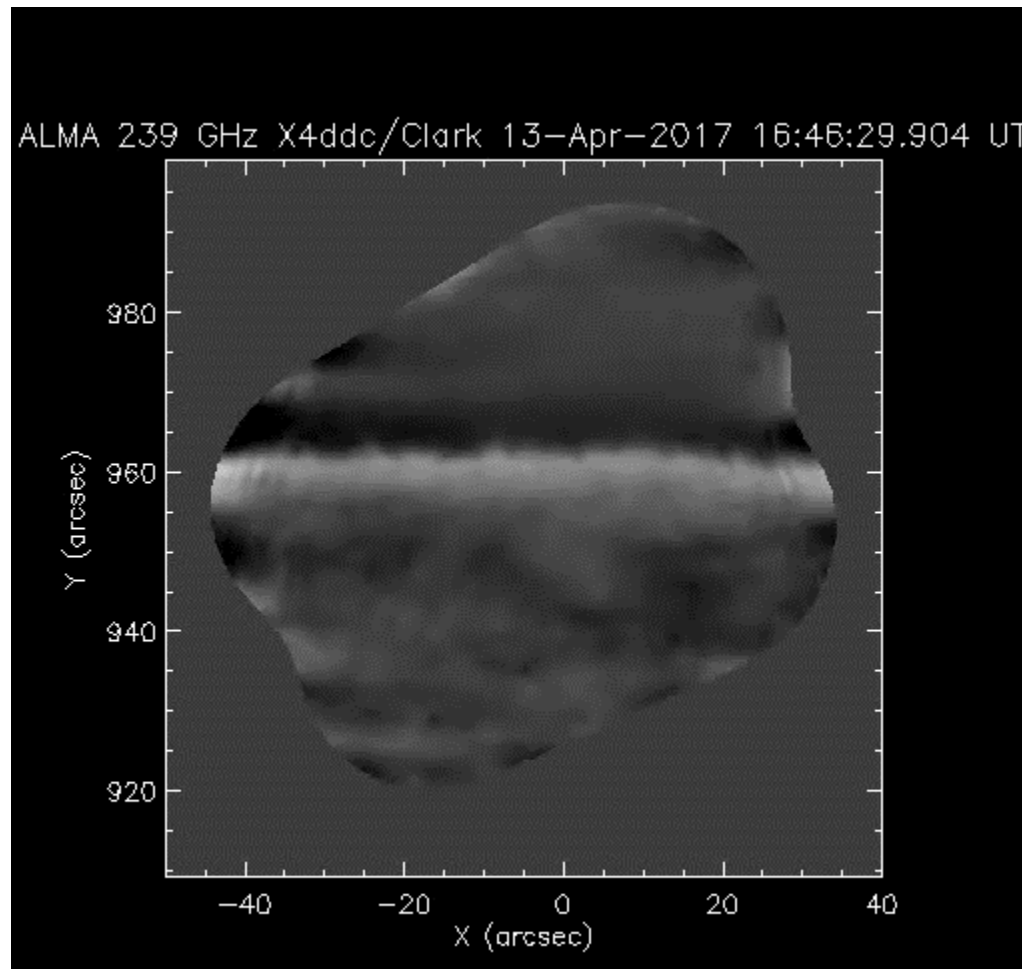
Studied items

- Feasibility of science item
 - Is the science target, i.e., footpoint dynamics of spicules, feasible ?
 - Comparison with IRIS UV data.
- Choice of pointing location
 - How many arc-seconds from the limb ?
 - Single pointing or mosaic ?

Data

2016.1.00182.S: PI,T. Bastian, "A Study of Solar Spicules at Millimeter, Optical, UV and EUV Wavelengths"

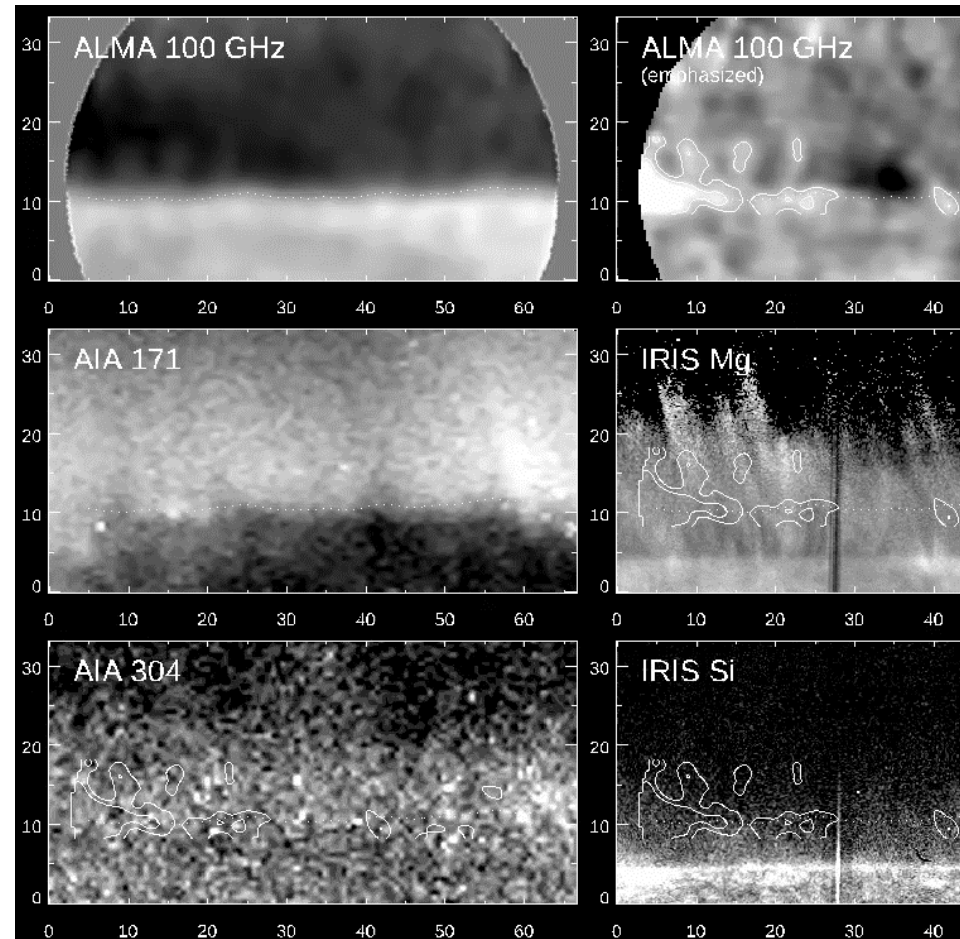
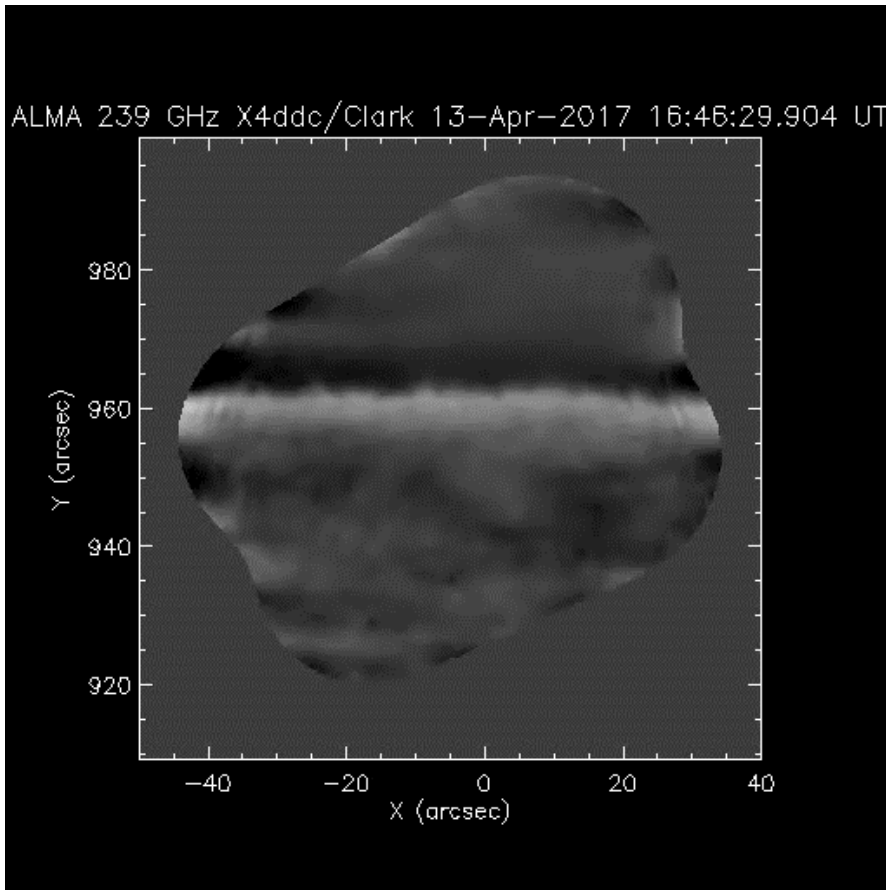
Only Band-6 data used, north polar limb, mosaic pointing



Comparison of Band-3 & Band-6 scenarios

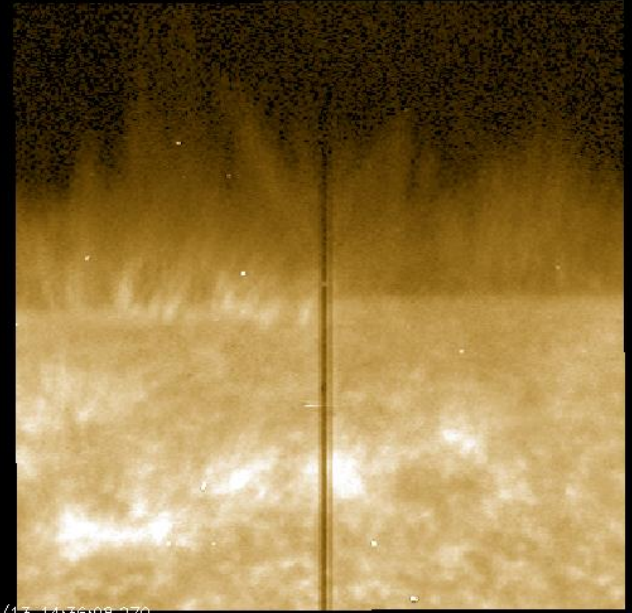
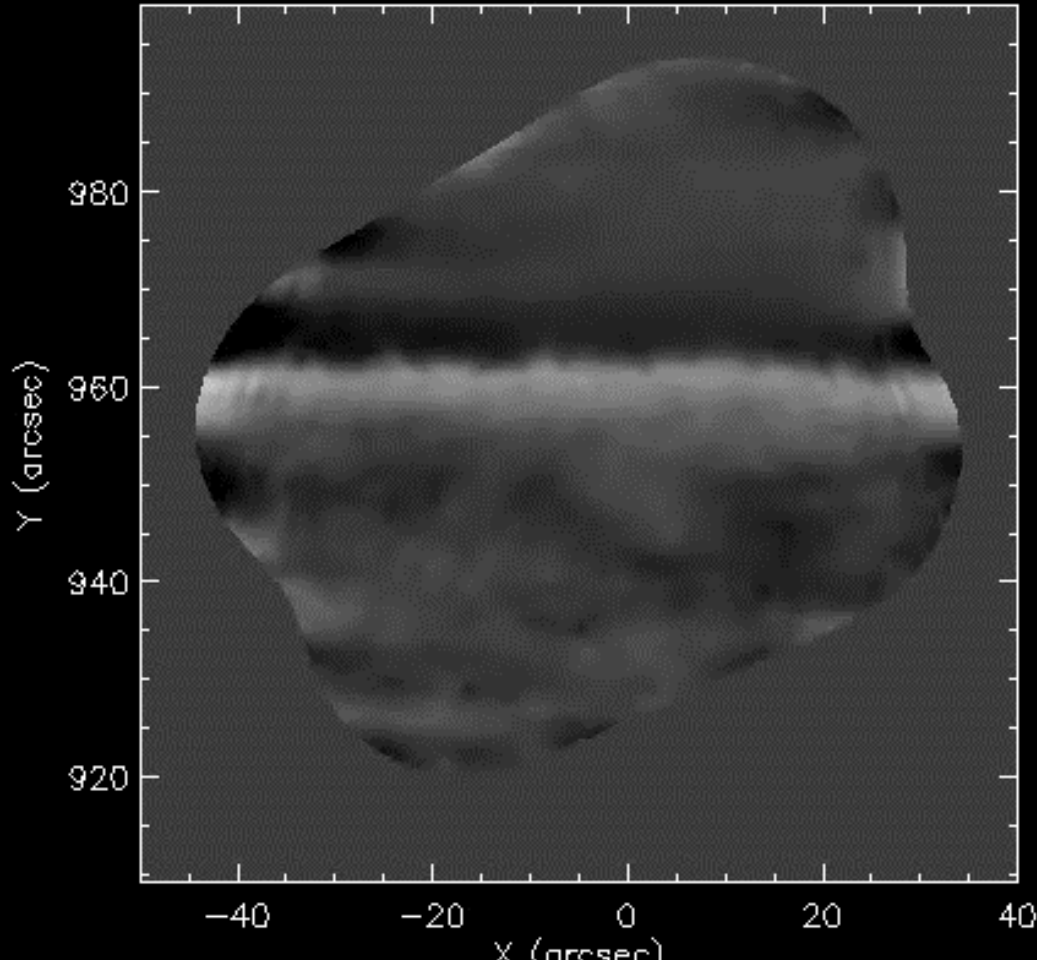
Due to the high resolution capabilities in Band-6 (239GHz), sharp spicular structures are relatively well recognized.

The footpoint regions show some "cloudy" structure.



Comparison of Band-6 with IRIS 2796 SJI

ALMA 239 GHz X4ddc/Clark 13-Apr-2017 16:46:29.904 UT



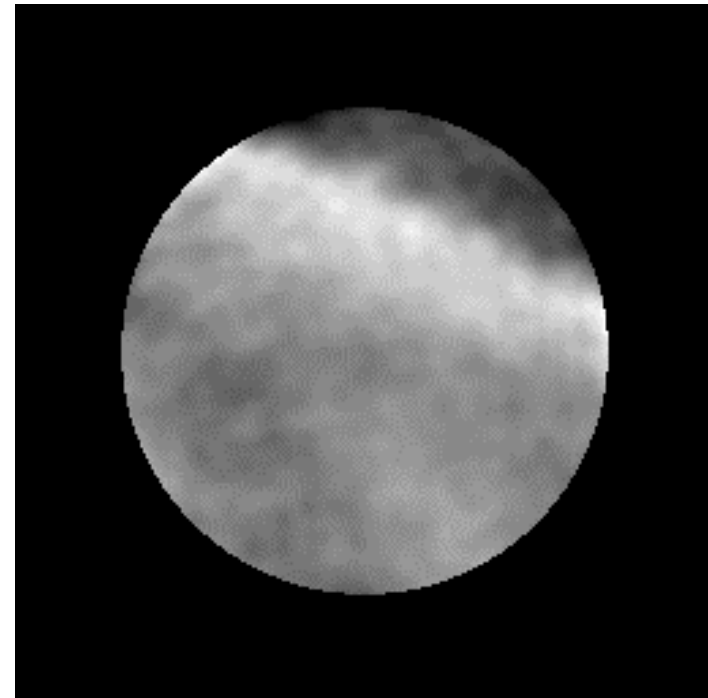
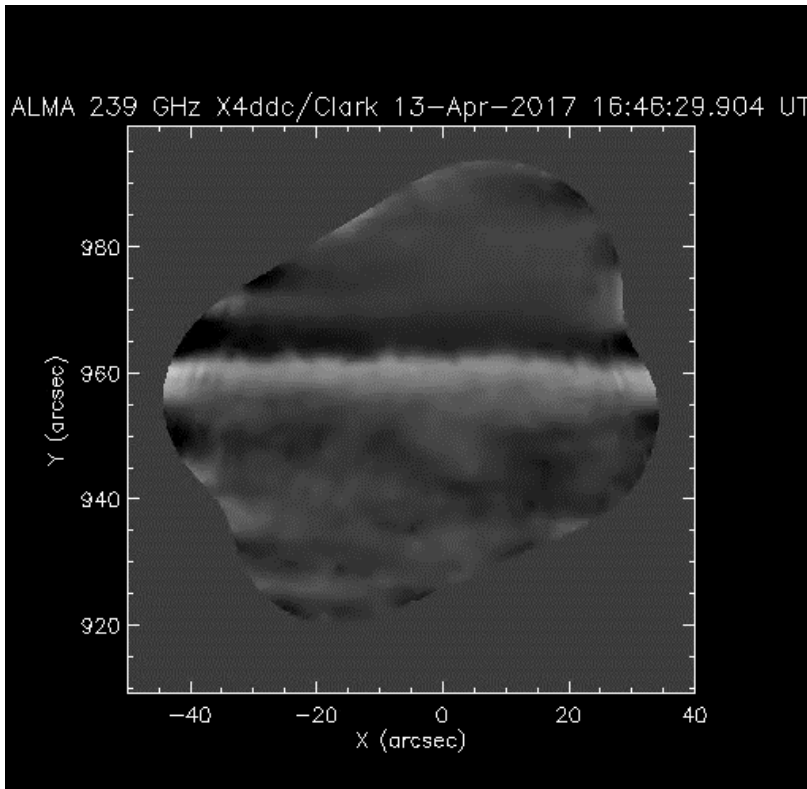
2017/04/13 14:56:08.270

There found similar structures in UV 2796 (Mg IIh&k $\log_{10} T[\text{K}]=4$) image. So the ALMA cloudy structure could be real.

Pointing 1/2

Although fine structures are resolved, the sequence of images is not stable probably due to the variable seeing condition and distortion among separated pointing sets.

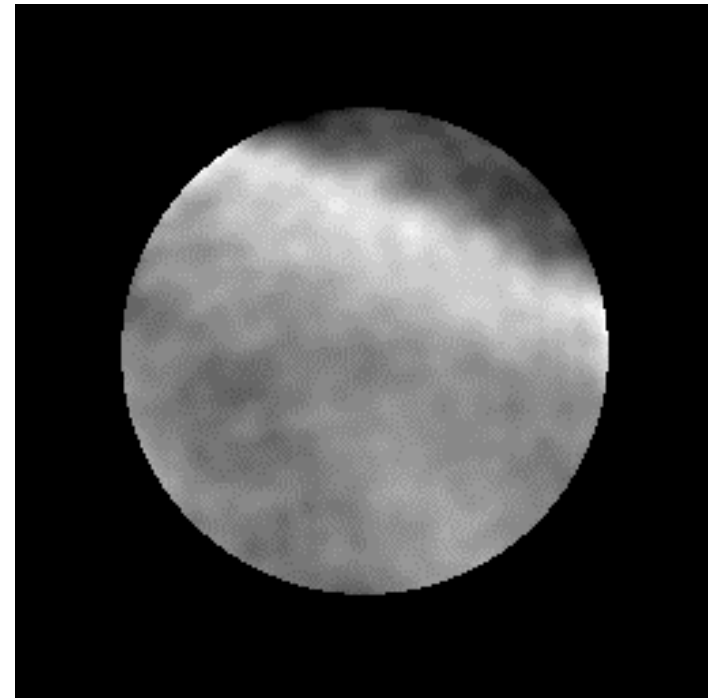
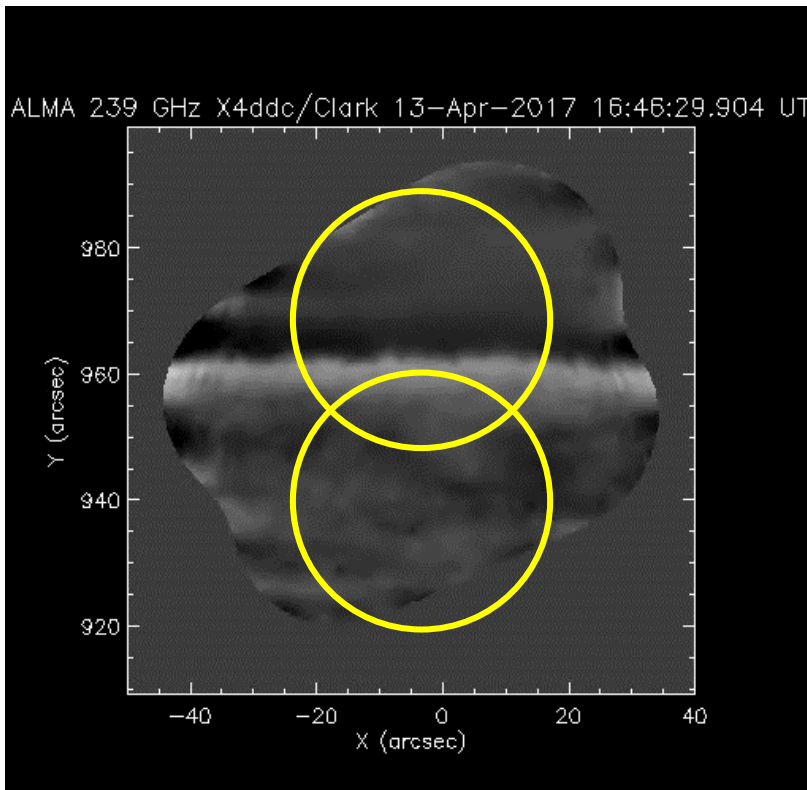
We studied the possibility of improvement of the quality in a single pointing mode, images are synthesized only by using the visibility data for one chosen pointing in this mosaic observation.



Pointing 2/2

The stableness of images seems better, but the size of FoV is too small.

Two pointing mosaic would be a better choice. One should be inside the limb, the other covers inside and outside. We can use the calibration data of the former for full data sets, while keeping good cadence.



Summary

For preparation of future ALMA observations of the solar limb, the existing data set was investigated, especially for Band-6 (239GHz) observations.

Studied items

- Feasibility of science item
 - Is the science target, i.e., footpoint dynamics of spicules, feasible ? YES
 - Comparison with IRIS UV data. **Cloudy structure at footpoints**
- Choice of pointing location
 - How many arc-seconds from the limb ?
 - Single pointing or mosaic ?

2-point mosaic observations: One in the limb, the other across the limb.