Astrobiology Study with ALMA Observations: The first active interstellar comet 2I/Borisov

Yu-An Chien 簡妤安 (NTUT)
Supervisor：管一政 教授

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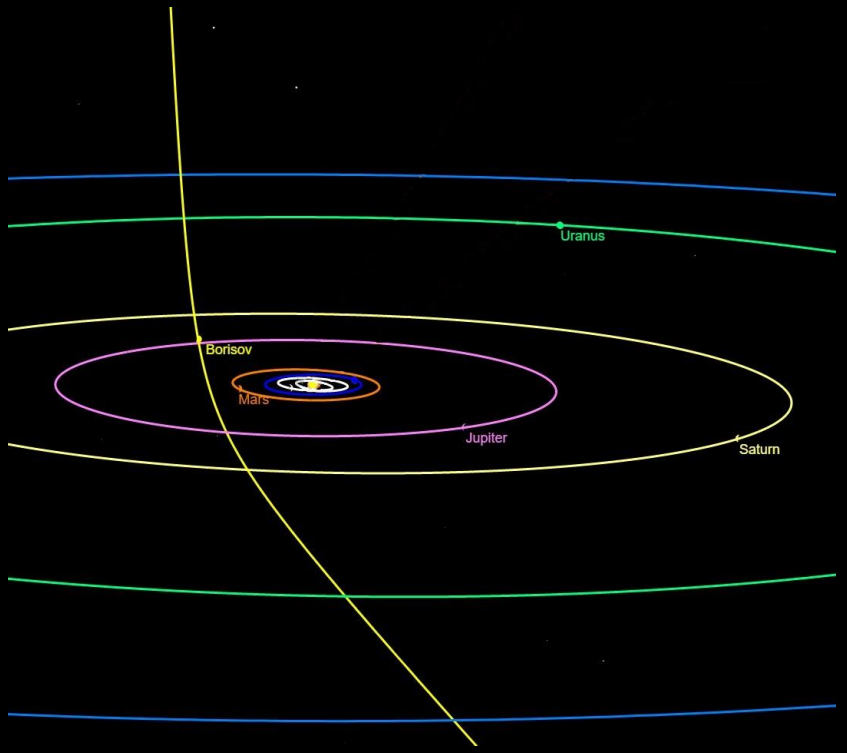
Outline

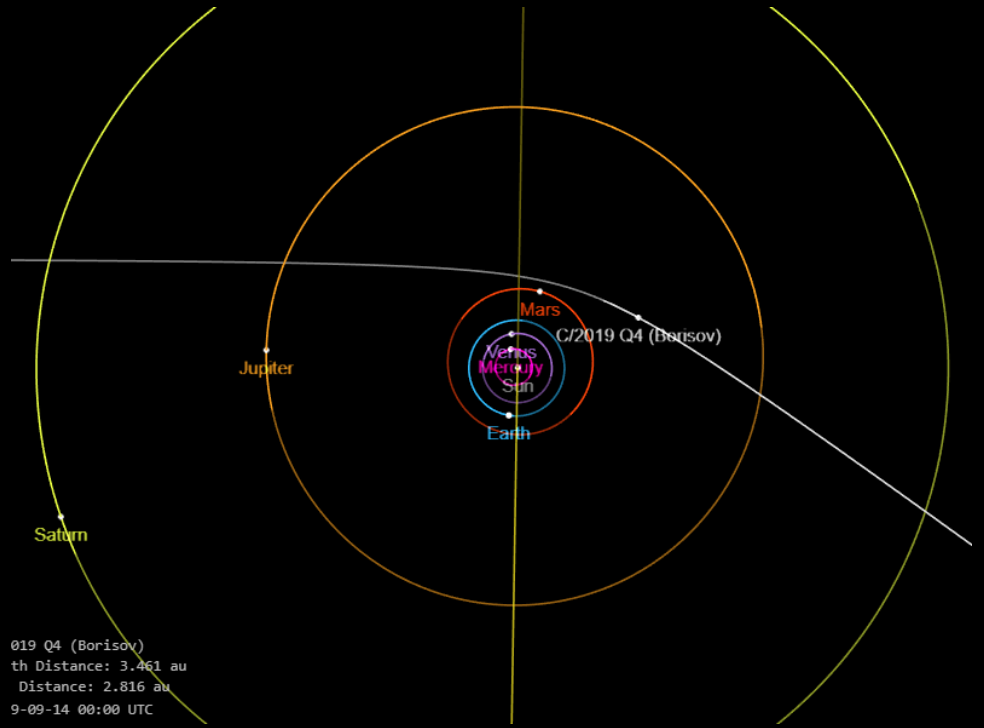
- Introduction of 2I/Borisov
- Motivation
- Observations
- Results
- Summary

ALMA (ESO/NAOJ/NRAO)

Introduction of 2I/Borisov

- Discovered: Gennadiy Borisov/2019
- the first interstellar comet
- Orbital eccentricity ≈ 3

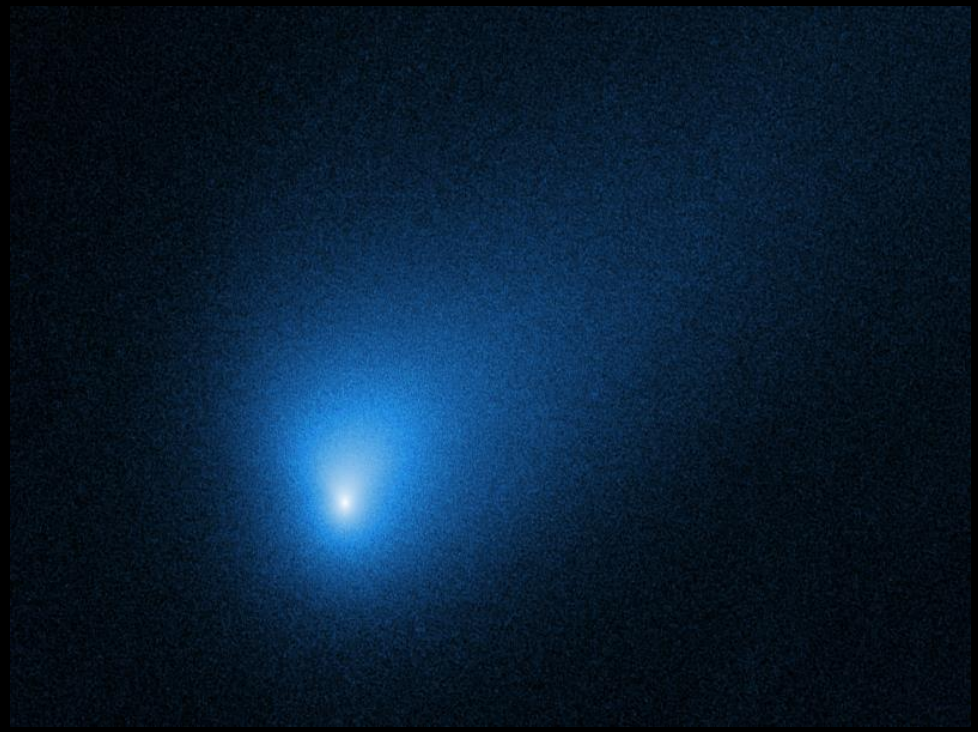




By Tony873004 – wiki

Motivation

Searching for chemical composition of 2I/Borisov

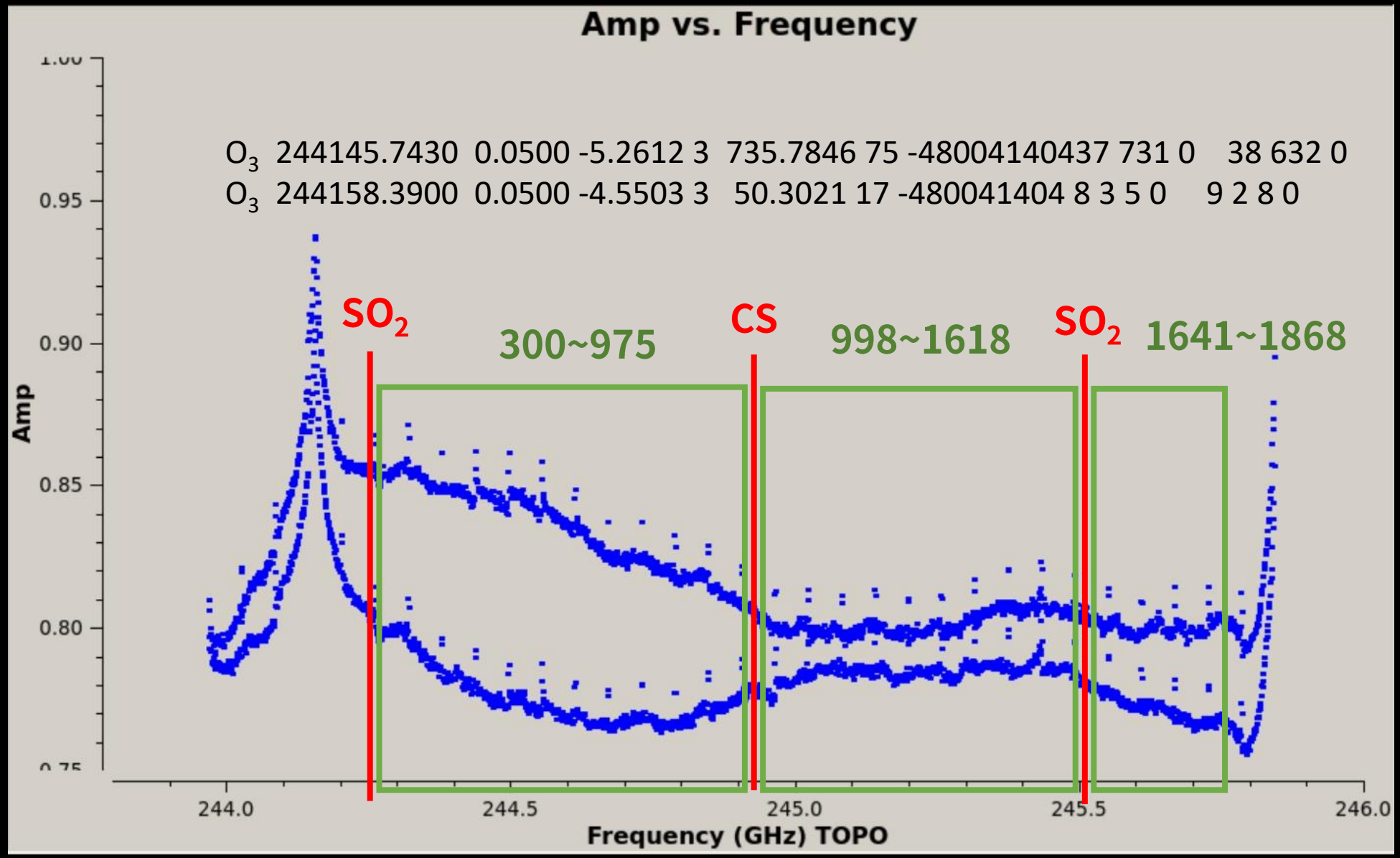


NASA, ESA, and D. Jewitt (UCLA)

Observations

- Observation date : 2019-Dec-02
- On source time : 34min 24sec
- Channel width : 976.562 kHz (1.2 km/s)
- Frequency range : 243.971~245.846 GHz
- Total channel number : 1920
- Number of antennas : 41
- Target molecular line : SO_2 ($10_{3,7}$-$10_{2,8}$@245563.410 MHz)
  CS (5-4@244935.556 MHz)
  SO_2 ($14_{0,14}$-$13_{1,13}$@244254.205 MHz)

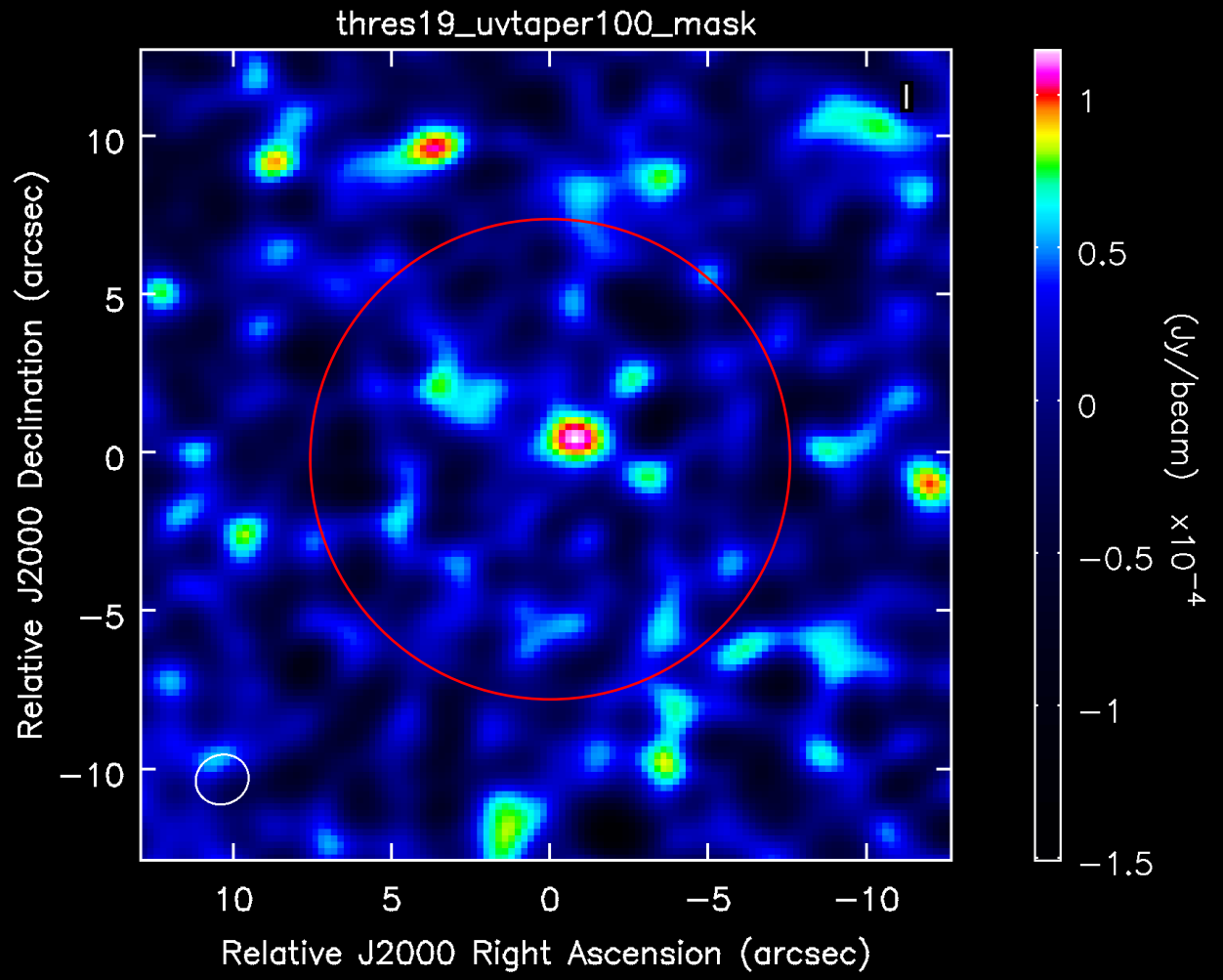
Results


Amp vs. Frequency
O3 244145.7430 0.0500 -5.2612 3 735.7846 75 -48004140437 731 0 38 632 0
O3 244158.3900 0.0500 -4.5503 3 50.3021 17 -480041404 8 3 5 0 9 2 8 0
SO2
300~975
CS
998~1618
SO2
1641~1868
Amp
0.95
0.90
0.85
0.80
244.0
244.5
245.0
245.5
246.0
Frequency (GHz) TOPO

Results

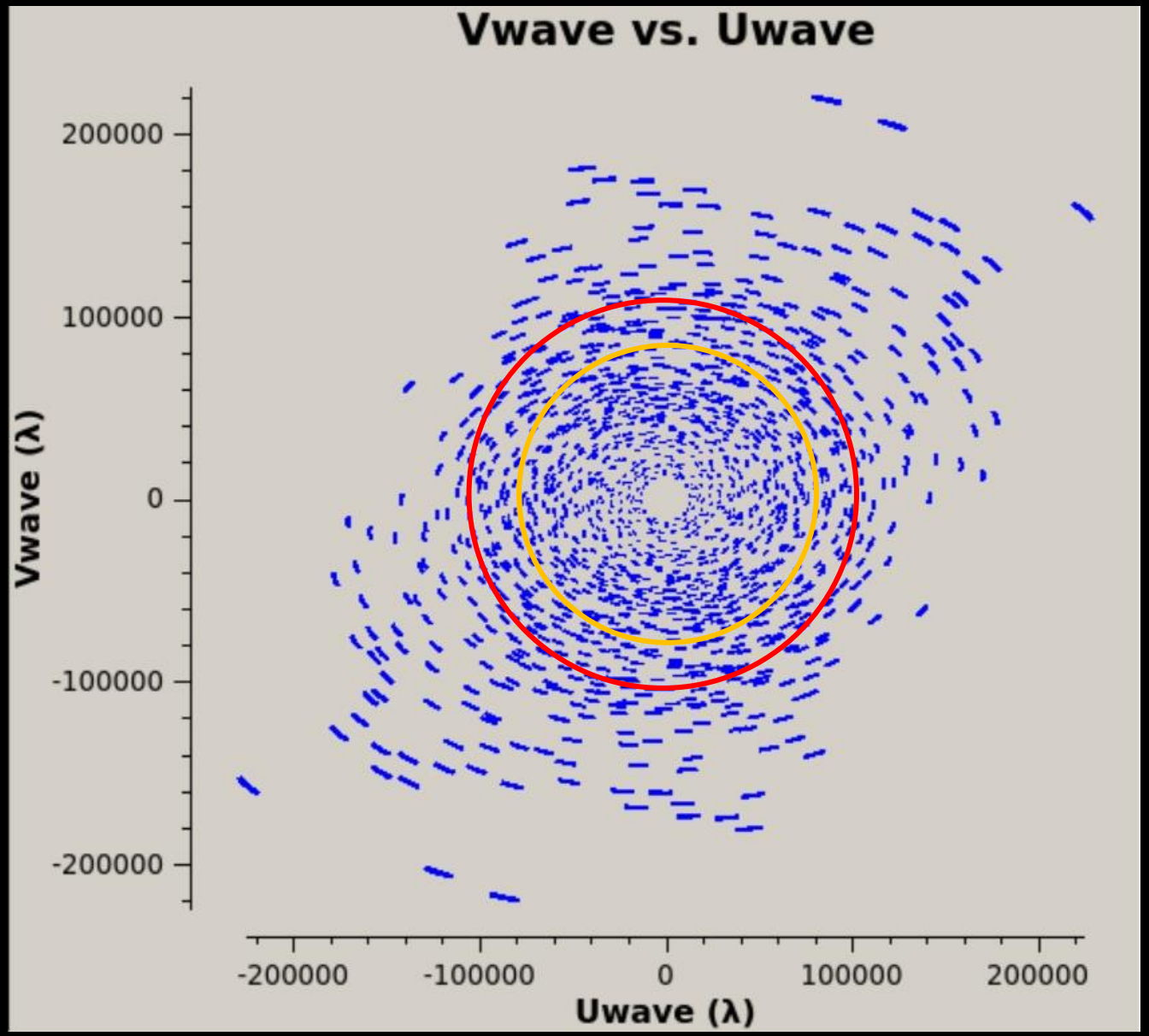
Continuum

- Rms: 32 μJy/bm
- Peak intensity: 115 μJy/bm
- S/N: 3.6
- Beam size : 1.808”, 1.690”



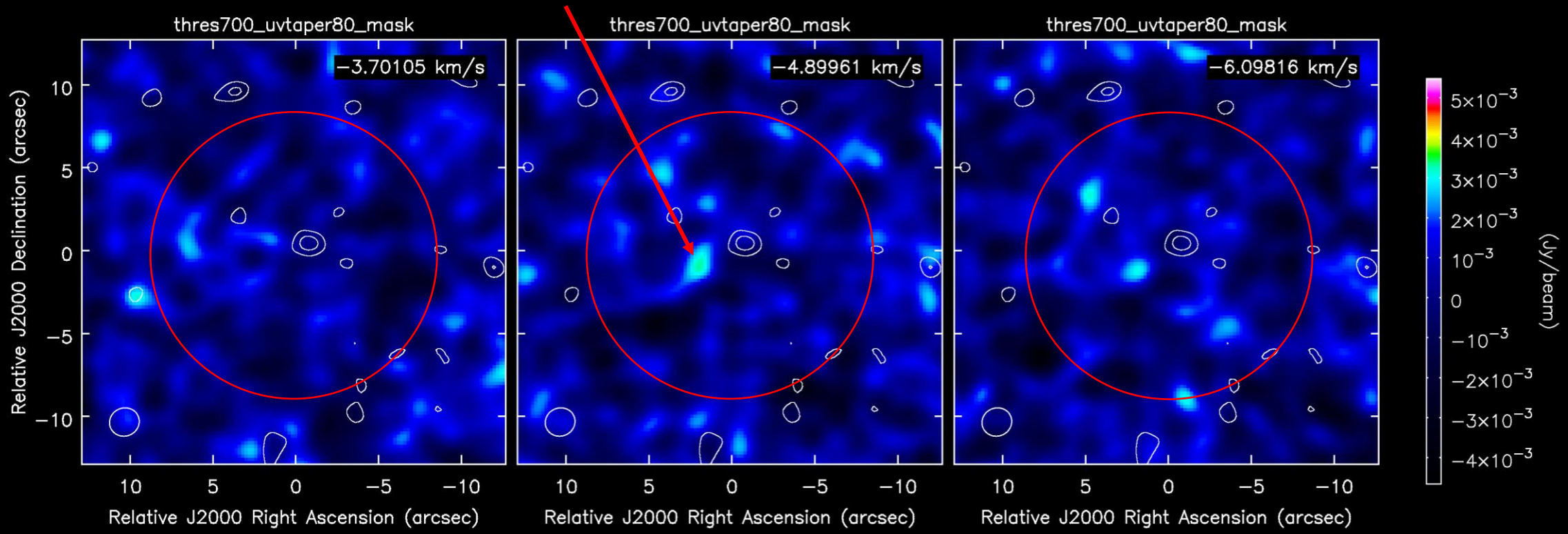
Results

80 klambda
100 klambda



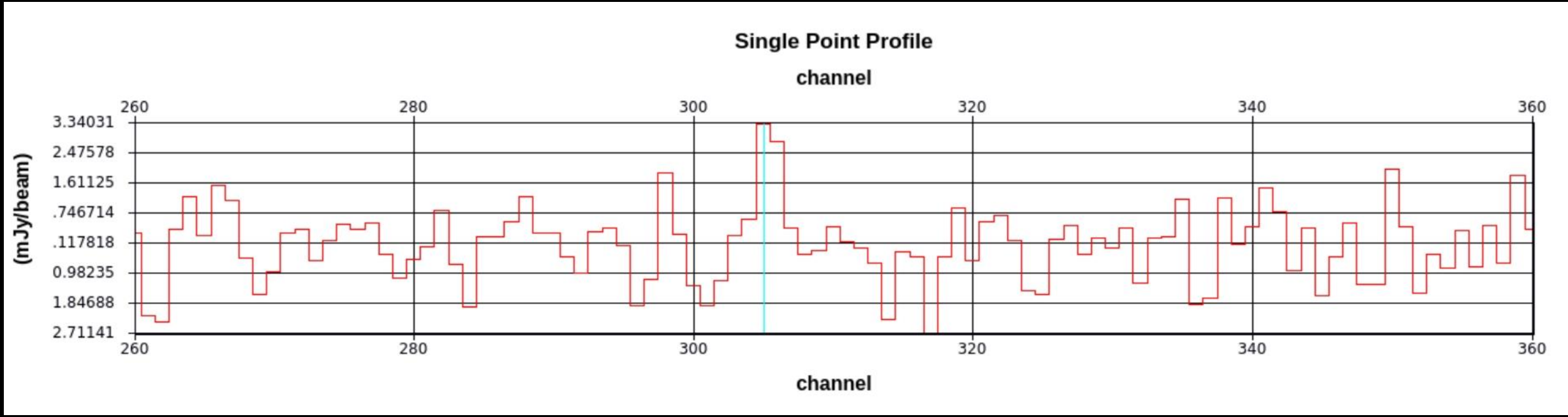
Results

SO_2 ($14_{0,14}$-$13_{1,13}$@244254.205 MHz) - channel map



Uvtaper = 80klambda & Clean mask

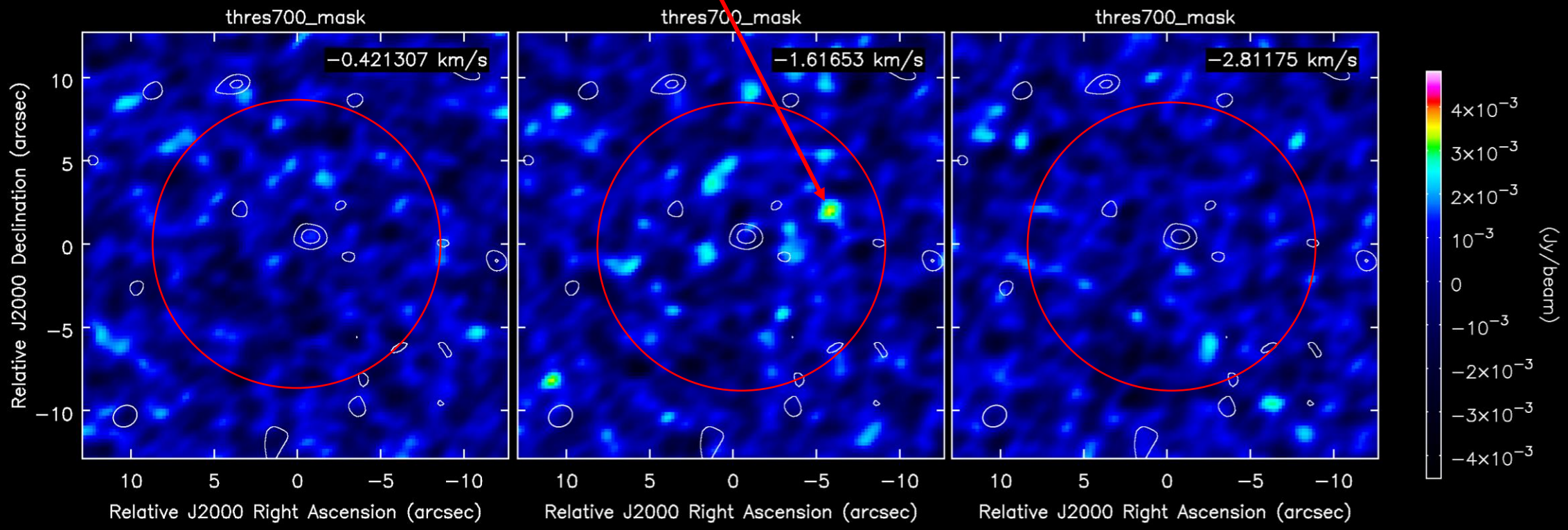
rms = 0.97 mJy/bm
Peak intensity= 3.34 mJy/bm



Uvtaper = 80klambda & Clean mask

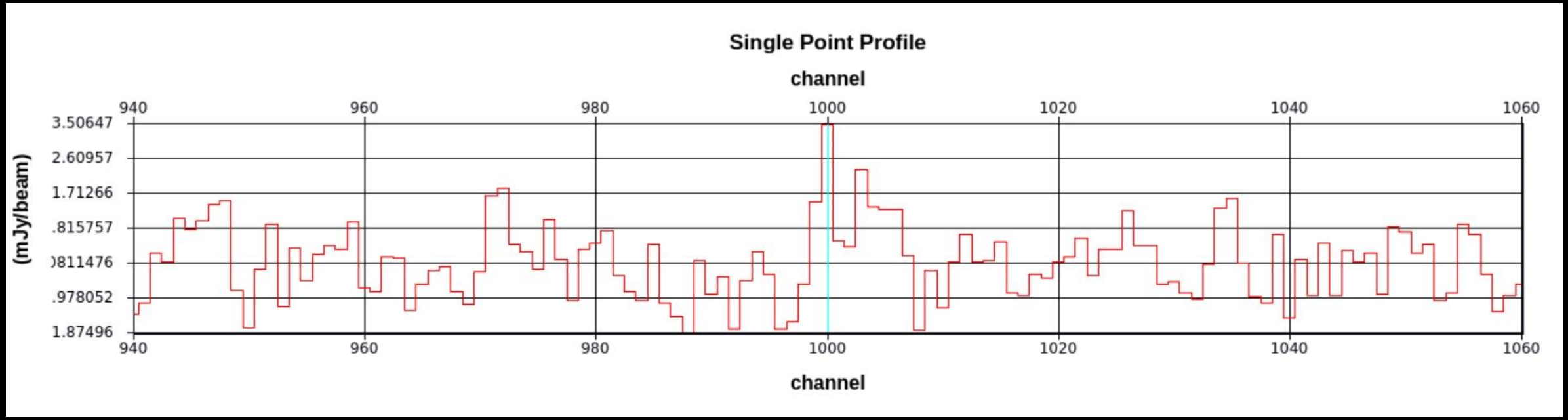
Results

CS (5-4@244935.556 MHz) - channel map



Clean mask

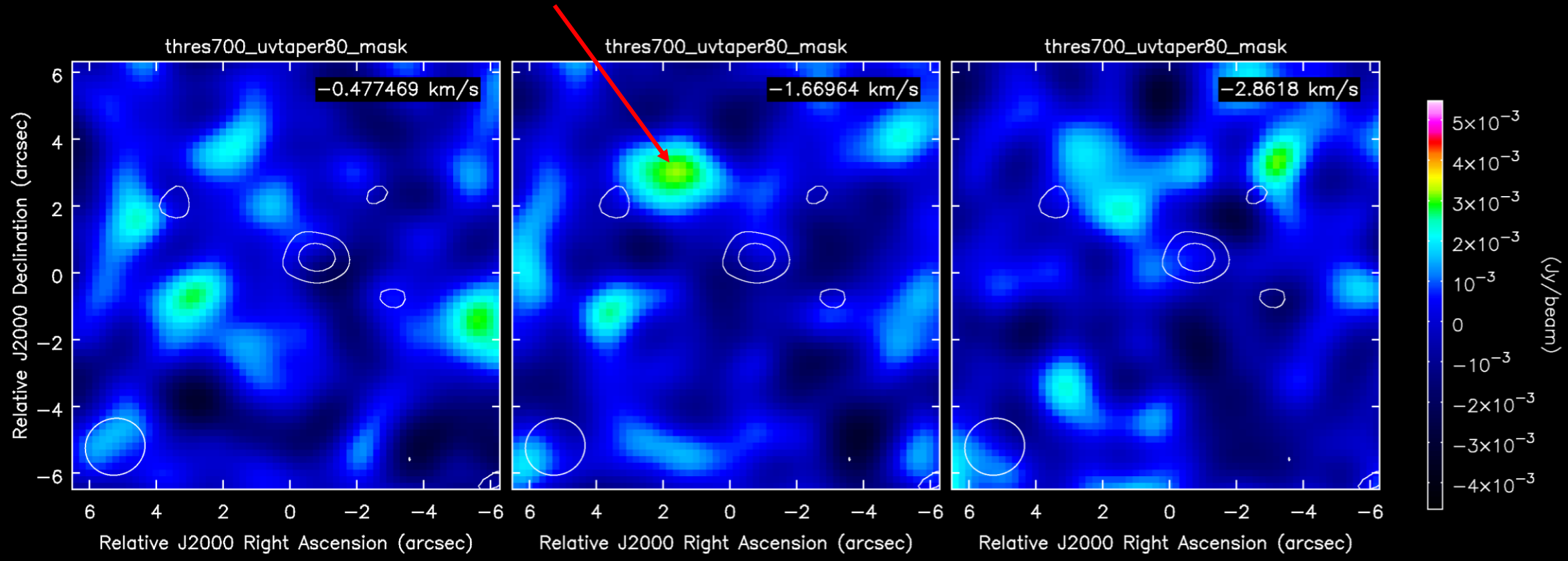
rms = 0.86 mJy/bm
Peak intensity = 3.506 mJy/bm



Clean mask

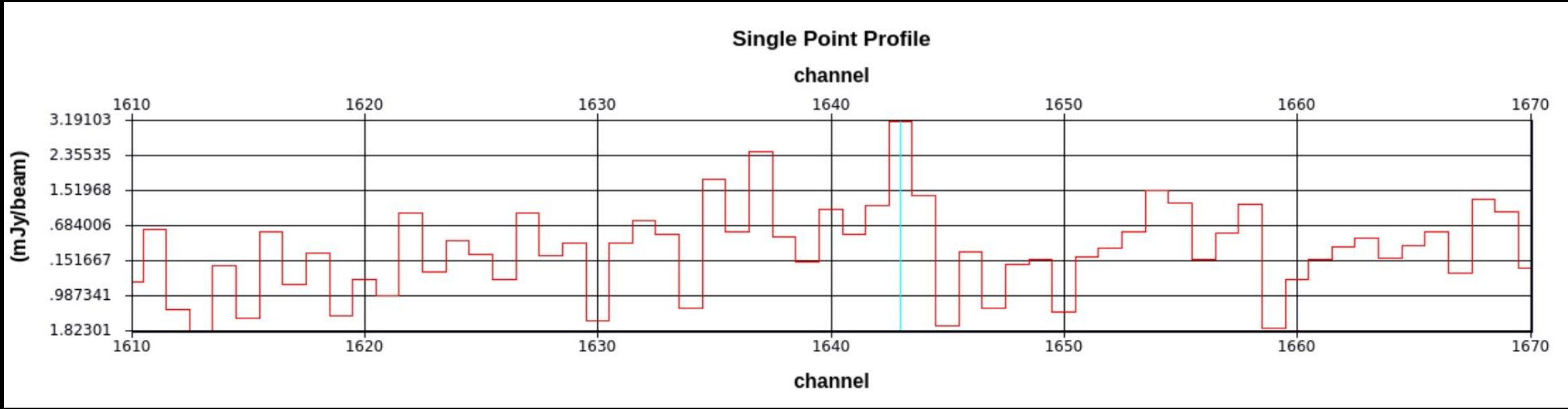
Results

SO_2 ($10_{3,7}$-$10_{2,8}$@245563.410 MHz) - channel map



Uvtaper = 80klambda & Clean mask

rms = 0.97 mJy/bm
Peak intensity = 3.191 mJy/bm



Uvtaper = 80klambda & Clean mask

Summary

- Two SO_2 lines are tentatively detected at two different cometocentric velocities and at two separate locations from the cometary nucleus.
- However, the detected velocities of SO_2 are a little bit too high with respect to the comet.
- We also have CS line tentatively detected but the image is still too noisy which needs to be further improved.


Thanks for your time
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