Exploring the dust properties of protoplanetary discs in ALMA Bands 1 and 10

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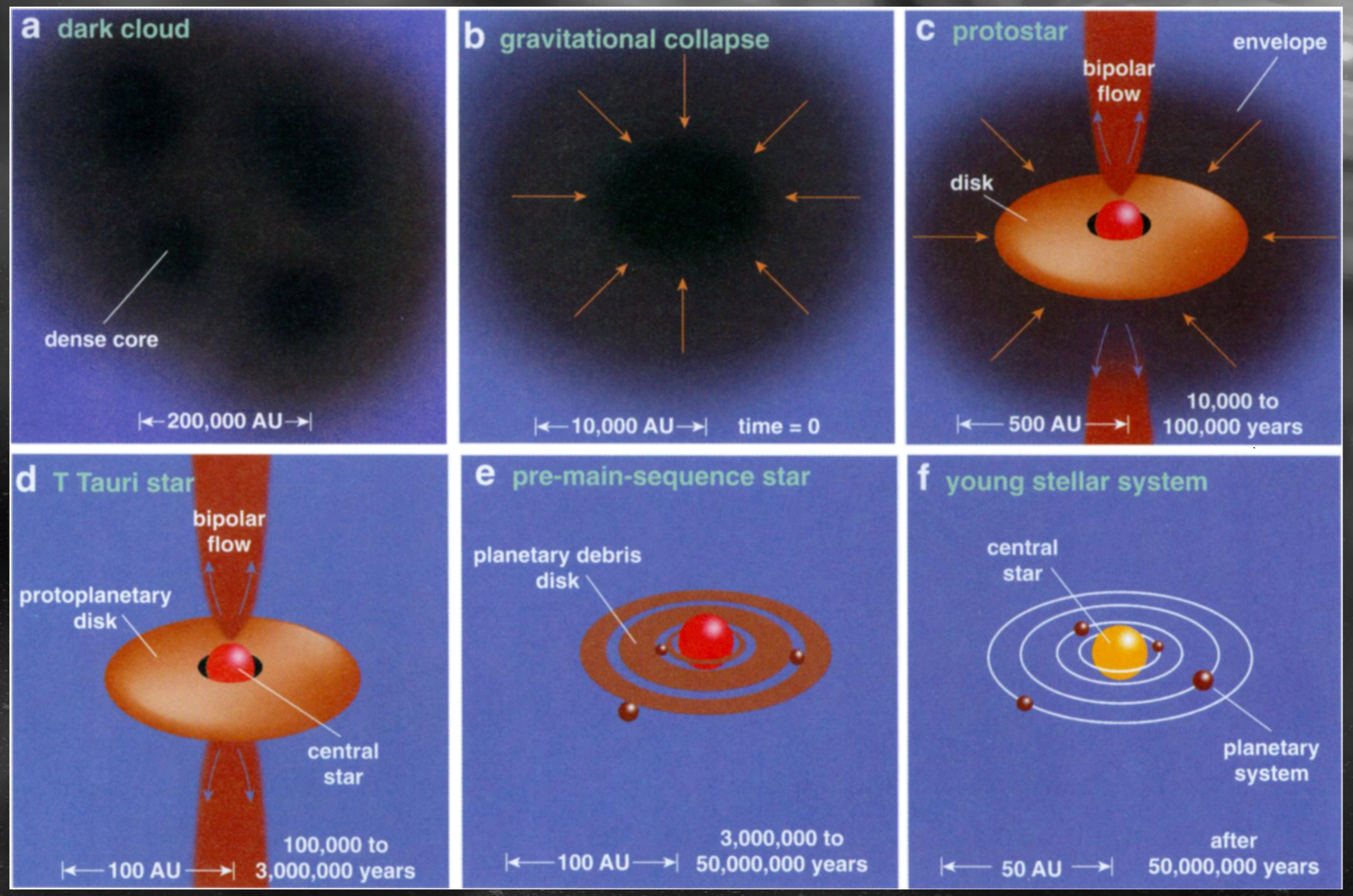
4. November 2026

Meeting of Young Astronomers and Astrophysicists - Fikut Nextgen

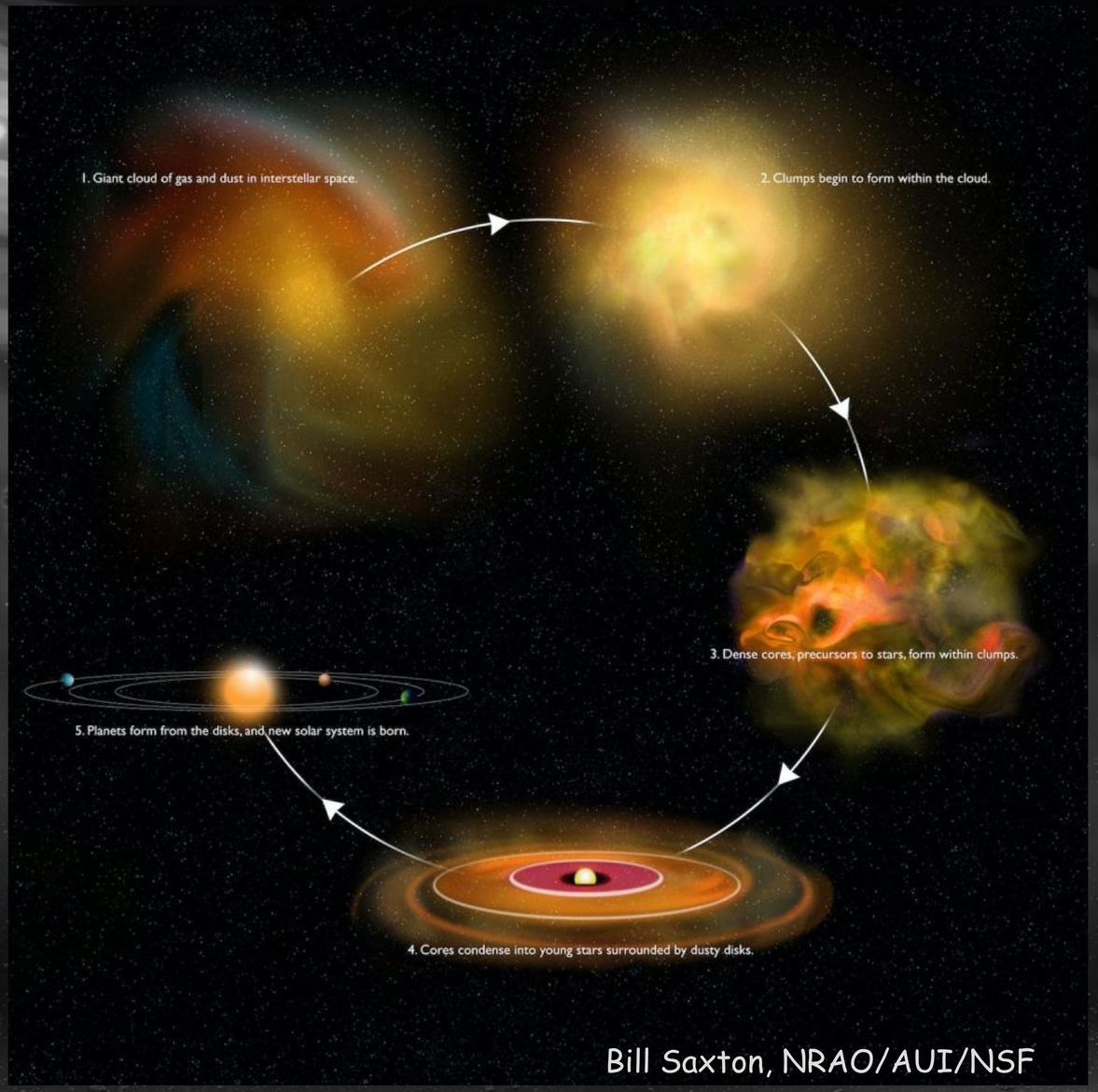
Motivation

- Formation and early evolution of stars and planetary systems
- Cirkumstellar material - flattened disk around central host star
  - Foundational interactions
- But why the disk is so important?
  - Hallmarks of the processes imprinted on it’s structures
- Detailed observations and measurements - evolutionary behavior
- Evolution of our solar system

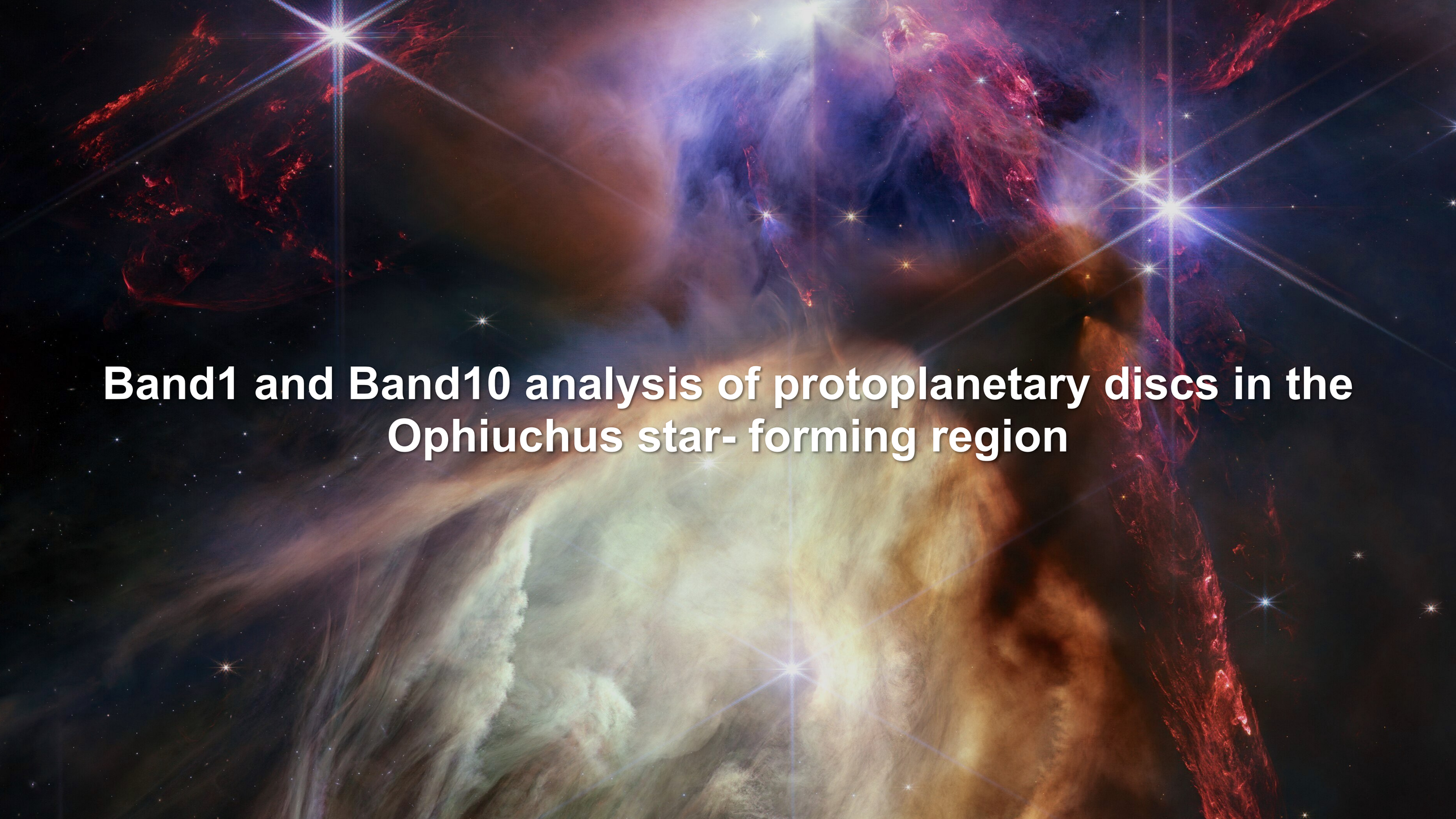
Briefly about star formation...



Greene 2001

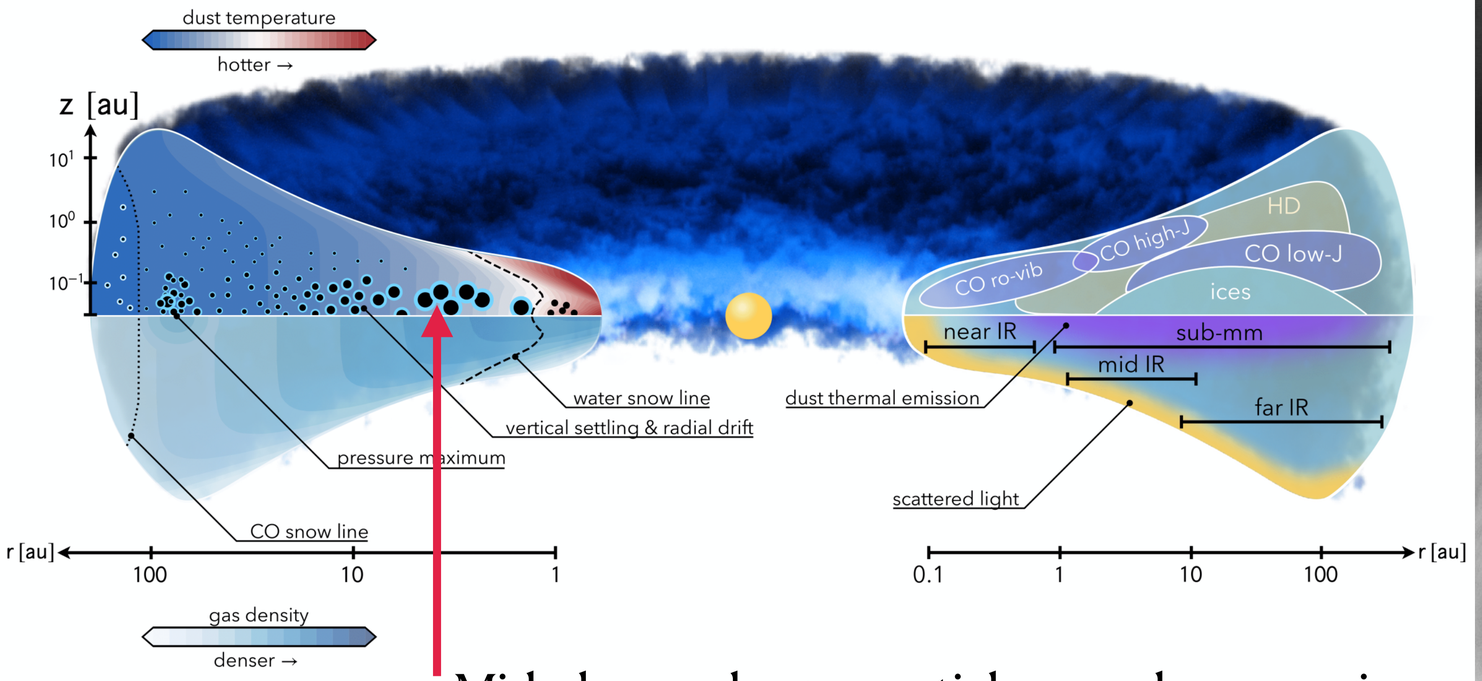


Bill Saxton, NRAO/AUI/NSF

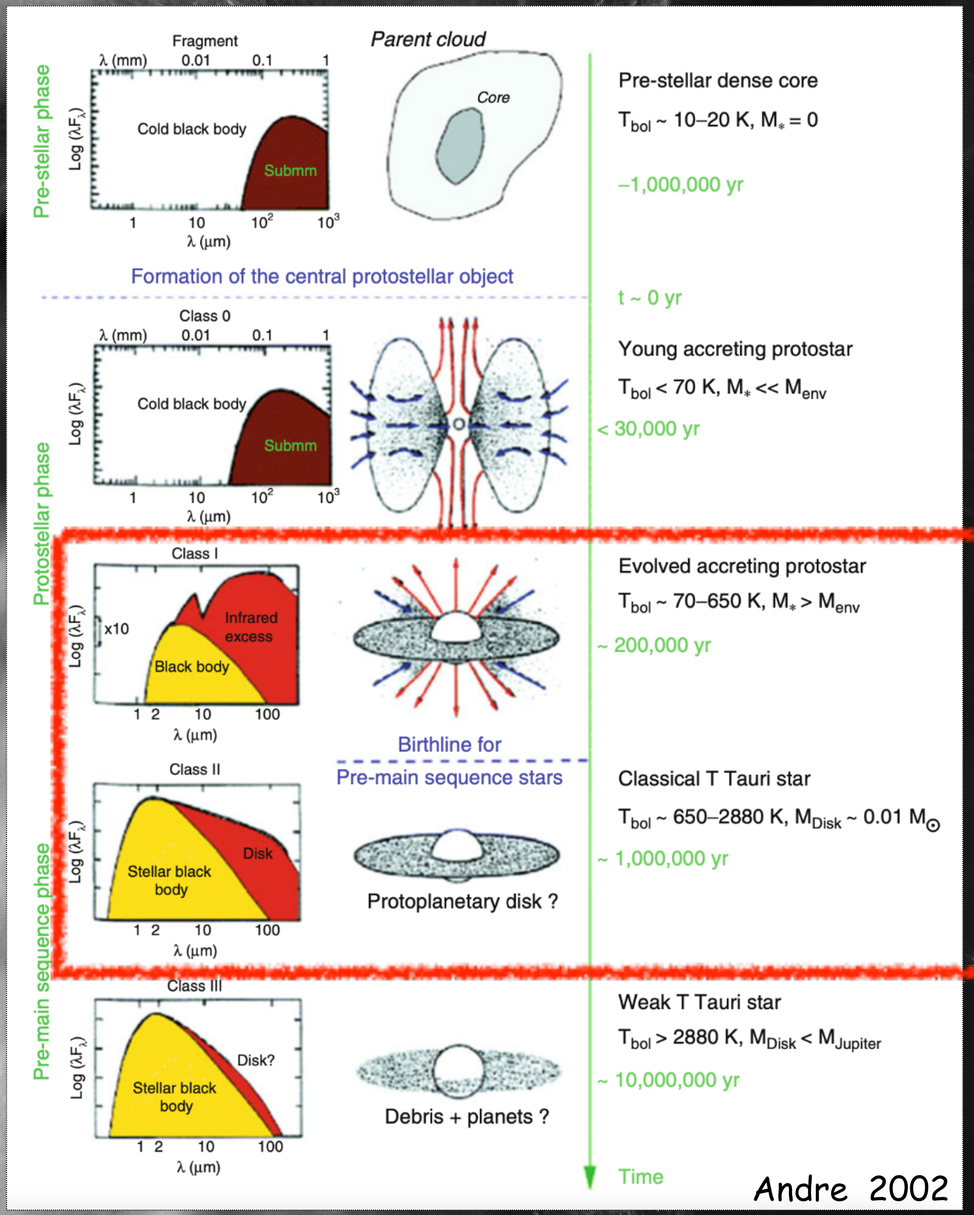

Band1 and Band10 analysis of protoplanetary discs in the Ophiuchus star- forming region

Protoplanetary disk

Til Birnstiel et al.



Mid plane -> larger particles -> sub-mm region



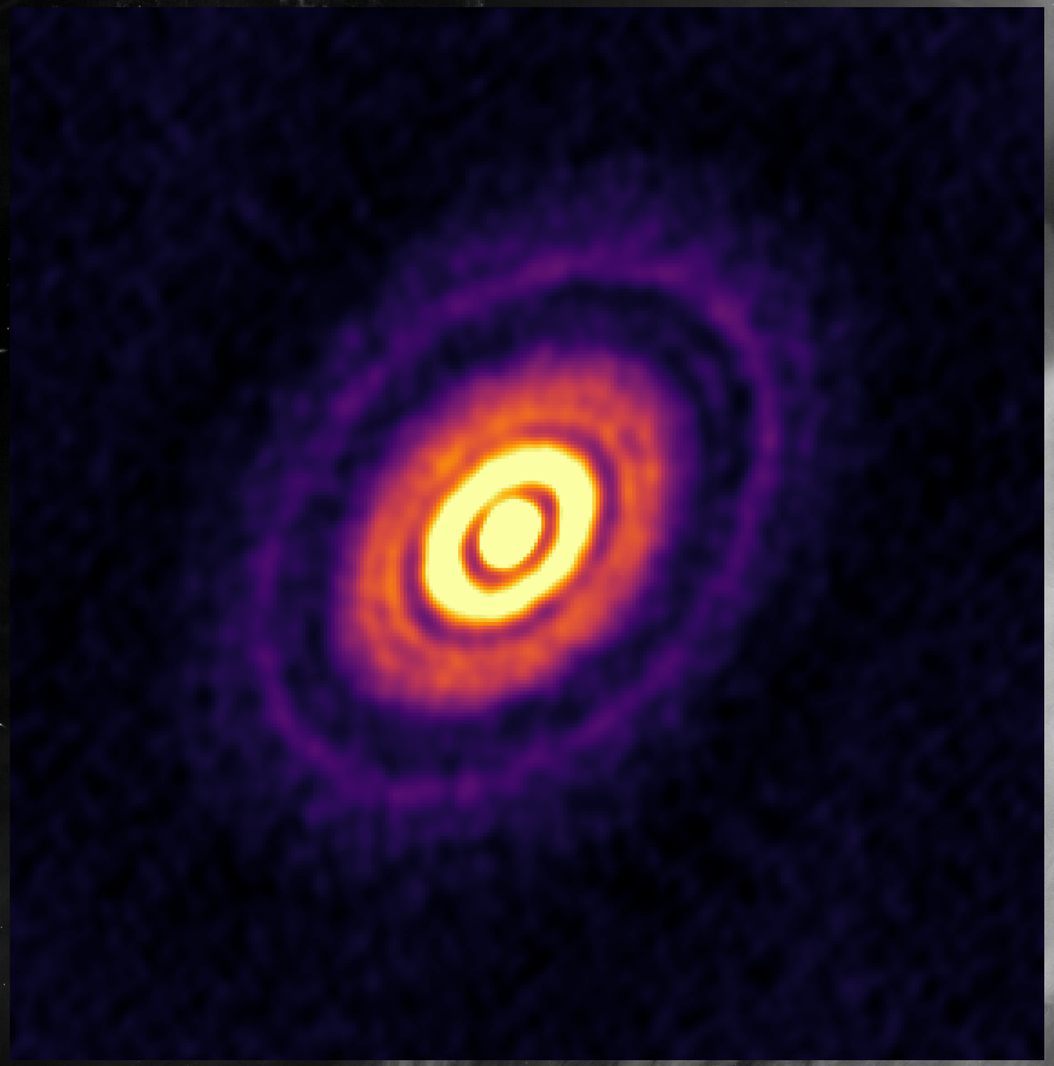
How we can trace these sub-mm particles?

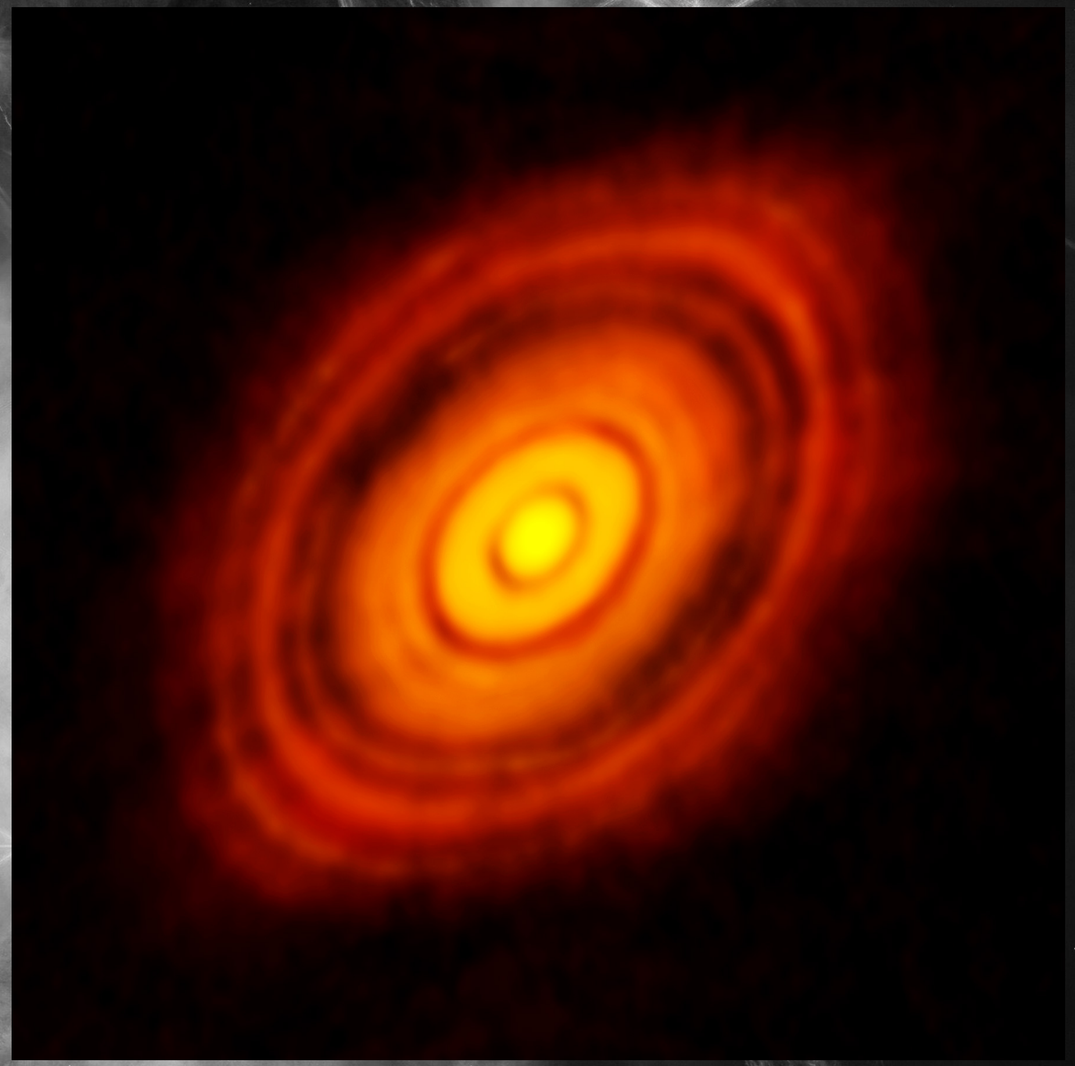
Atacama Large Millimeter/submillimeter Array (ALMA)

- Chile, Chajnantor plateau
- Altitude: 5058 m
- Interferometer with 66 antennas
- Range: 3.6 to 0.32 mm (31 to 1000 GHz)
- 7 m and 12 m antennas
- Baseline up to 16 km

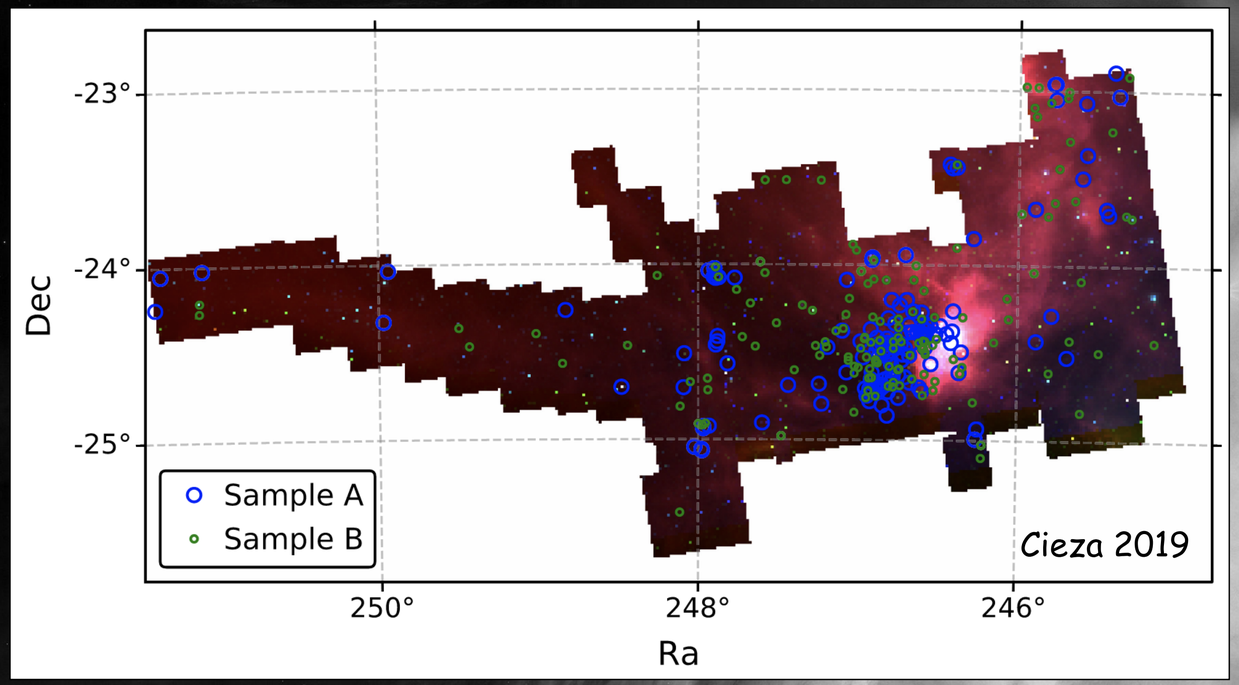


Learning the data reduction



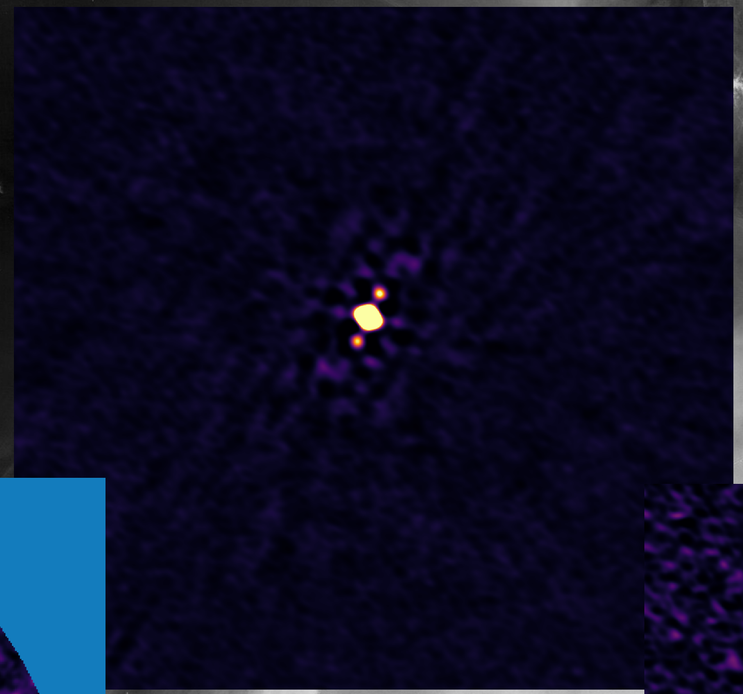


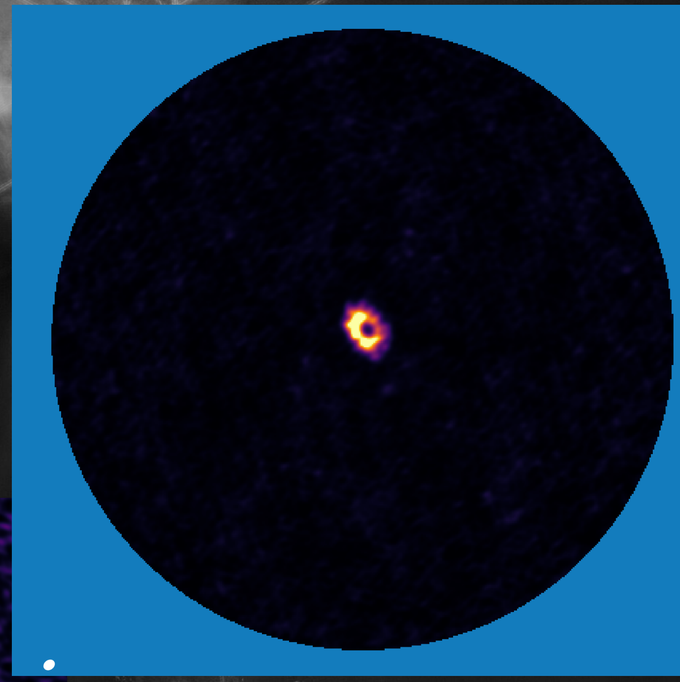
The Ophiuchus Disk Survey Employing ALMA (ODISEA)

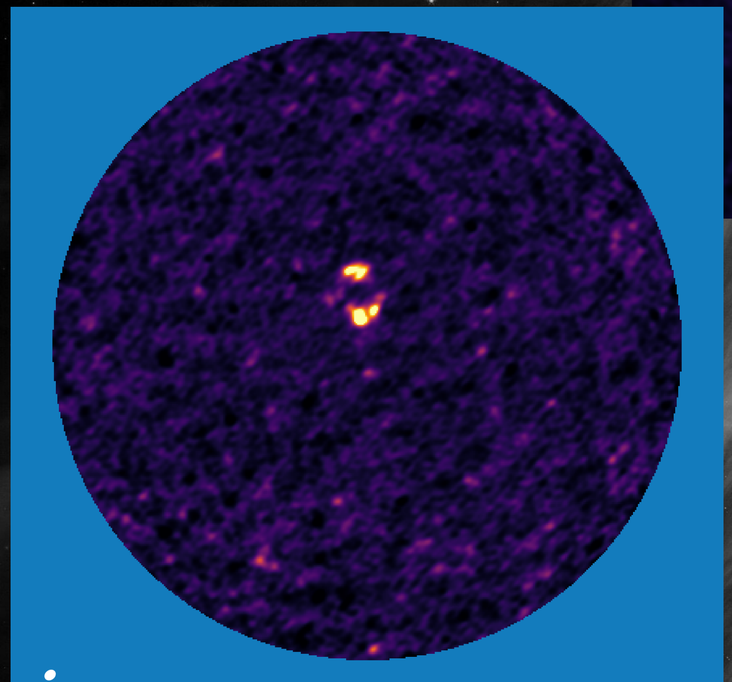


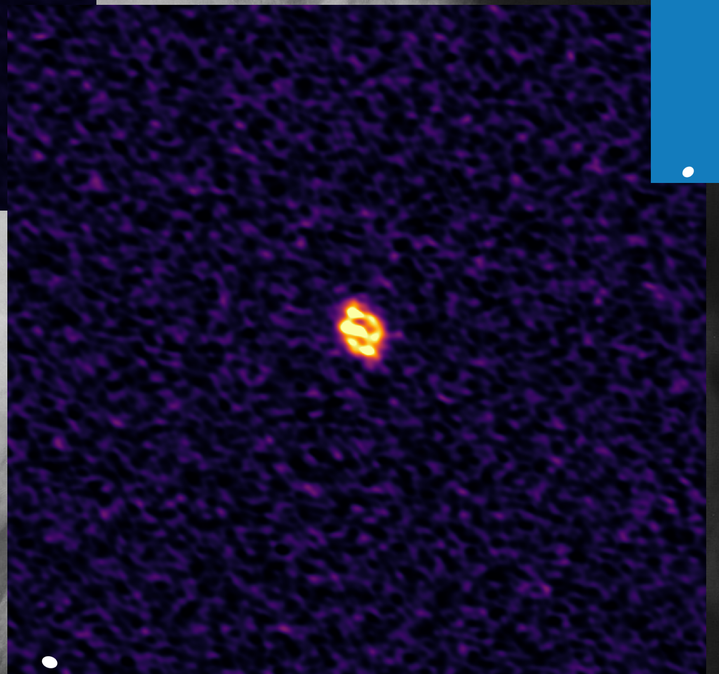
- PI: Lucas Cieza (UDP, Chile)
- Largest complete ALMA disk survey of a single region ~300 disks
- Closest star-forming region ~140 pc
- Younger population (Class I & II; ~ 0.2-1 Myr) - insights into early stages

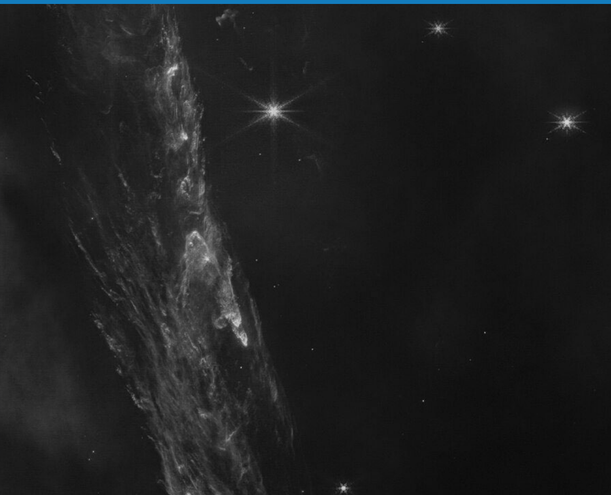
Compact disks, disks with gaps and more...







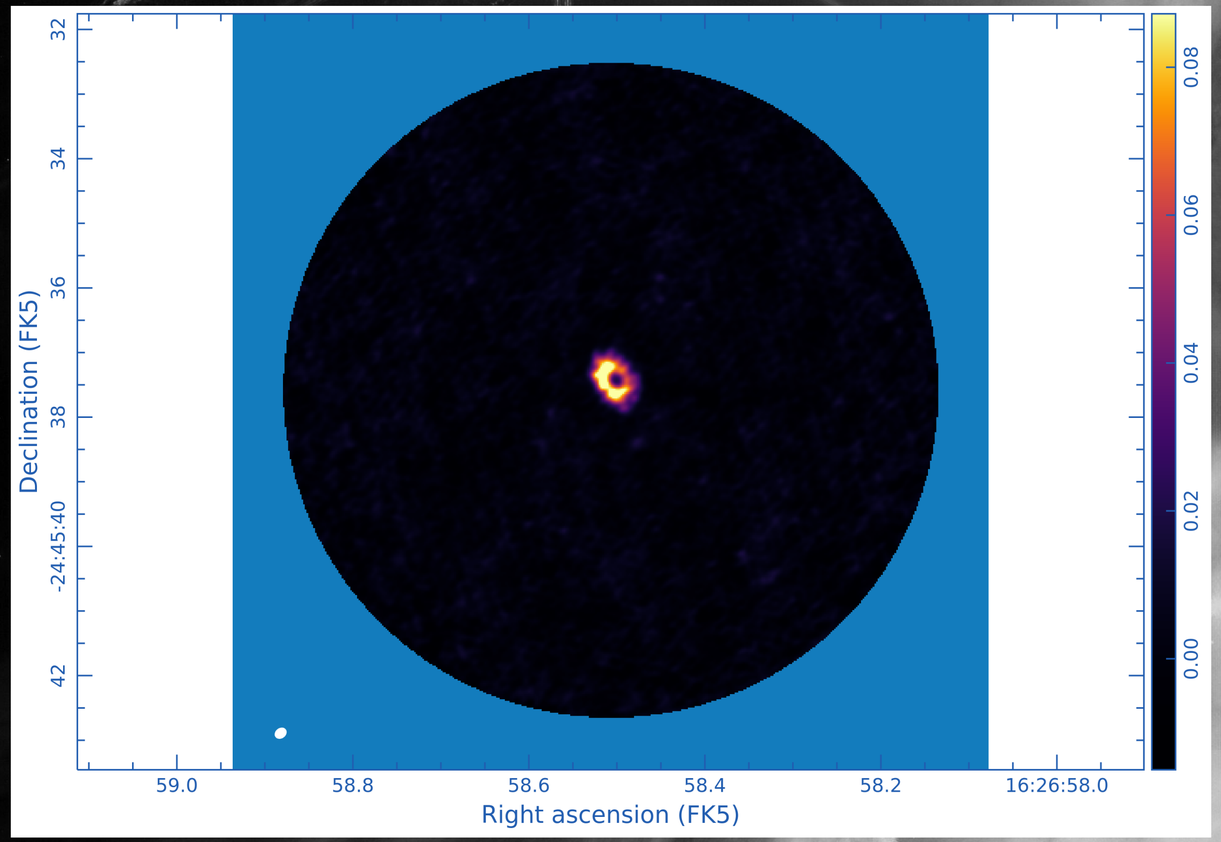




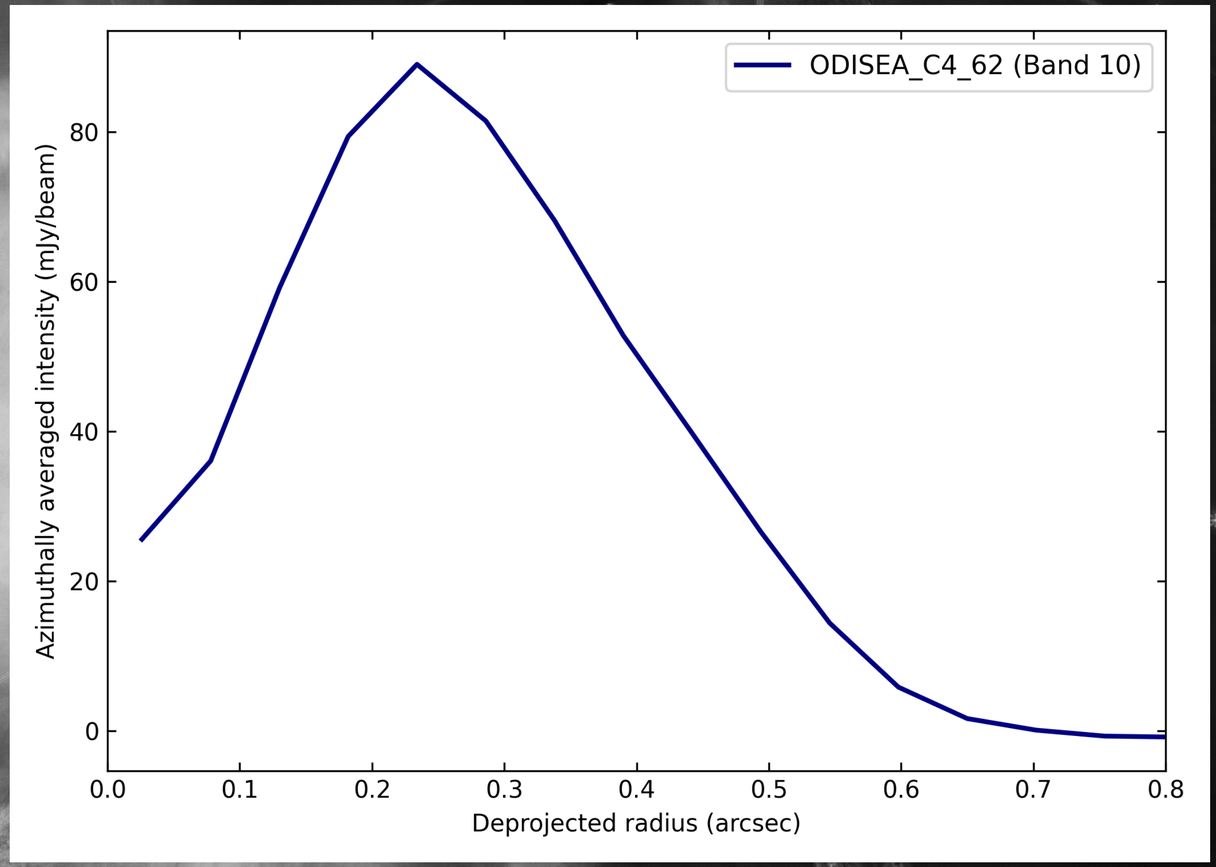
Bands

Band	Frequency (GHz)	In wavelengths (mm)	No. of objects	Sources
1	35 - 50	8.5-6.0	13	2024.1.00253.S PI: Cieza,L
10	787 - 950	0.32 – 0.38	45	2023.1.00131.S PI:Cieza,L

Data reduction and radial profiles



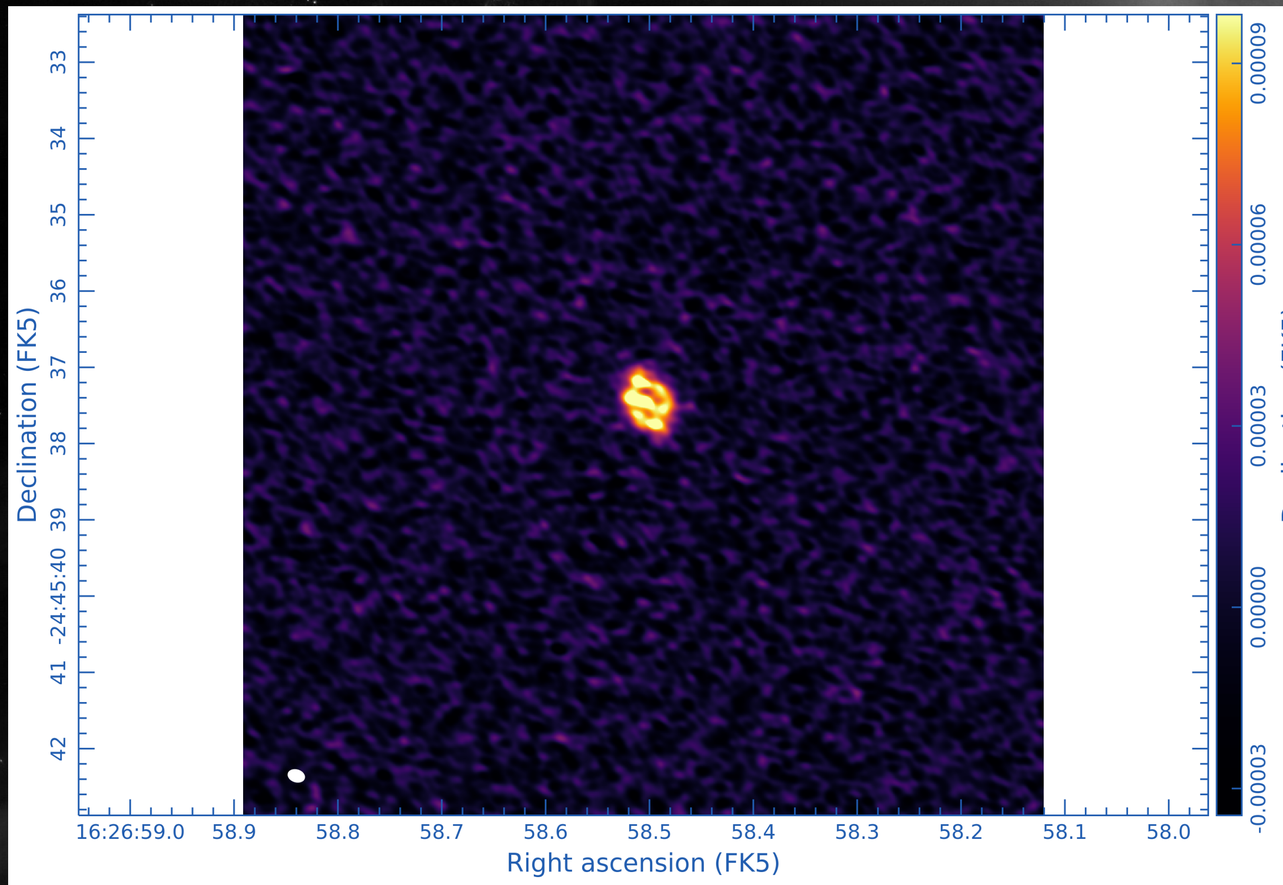
- Imaging: CASA - tclean
  - Natural
  - Briggs, robust=0.5



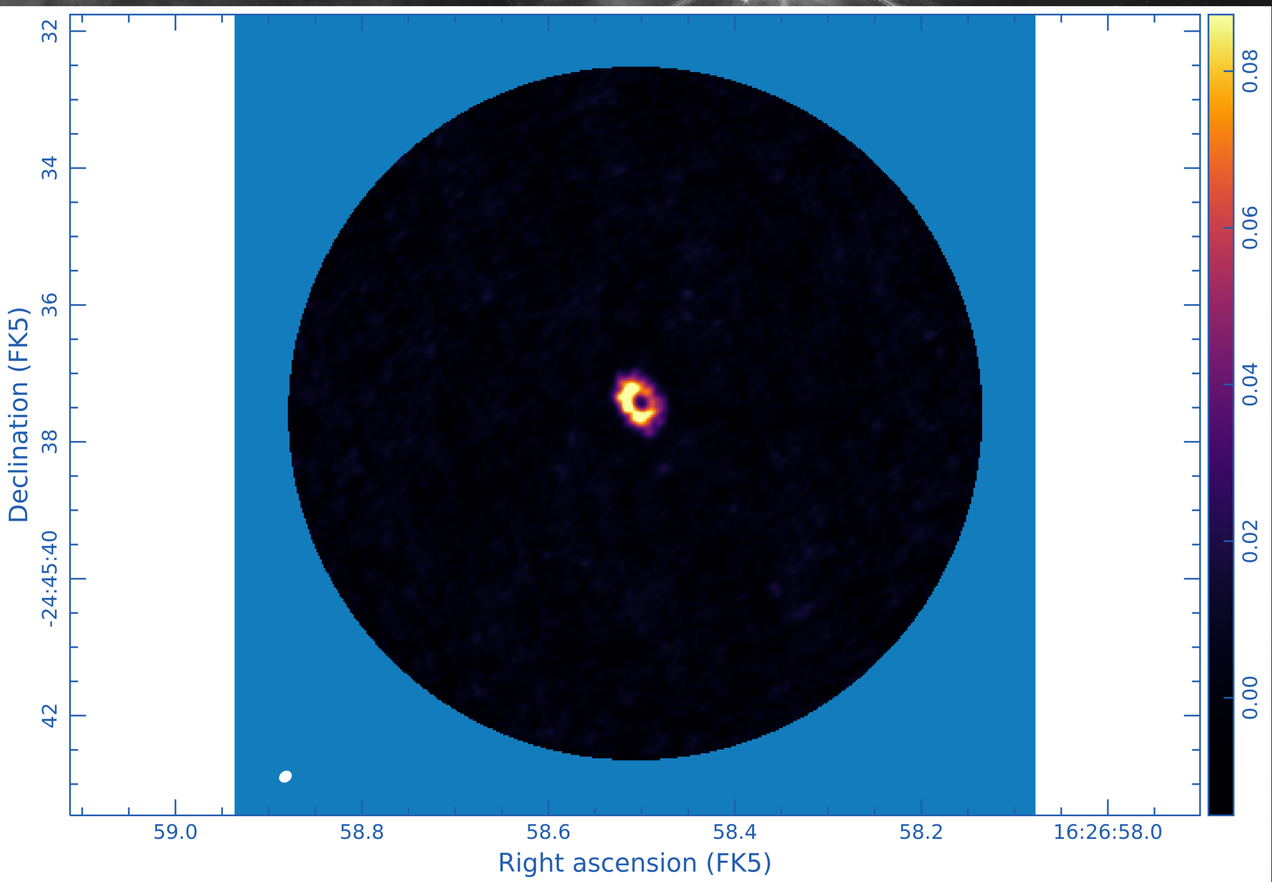
- Deprojected images using disk PA and inclination
- Extracted radial intensity profiles

Comparison of Band1 and Band10 data

ODISEA_C4_62 - Band1

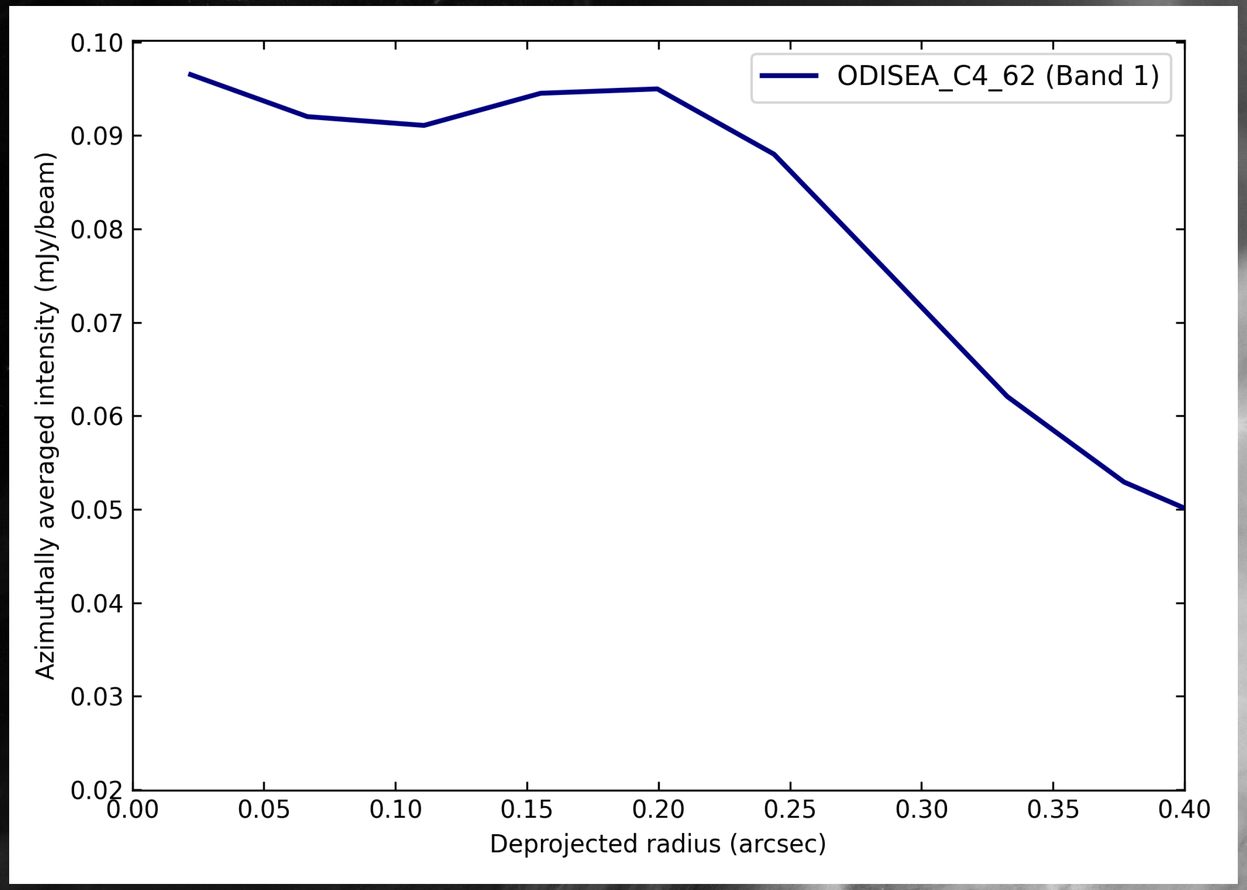


ODISEA_C4_62 - Band10

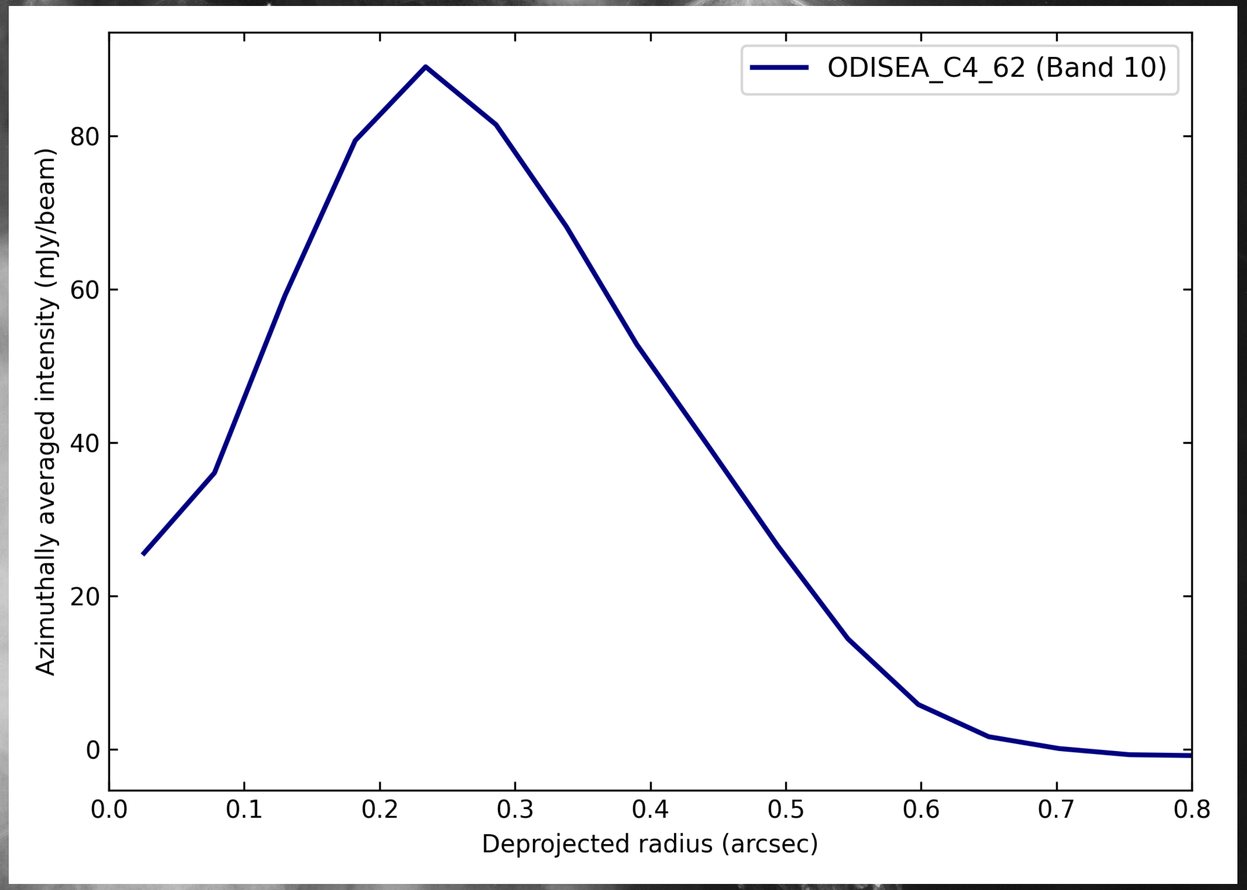


Comparison of Band1 and Band10 data

ODISEA_C4_62 - Band1

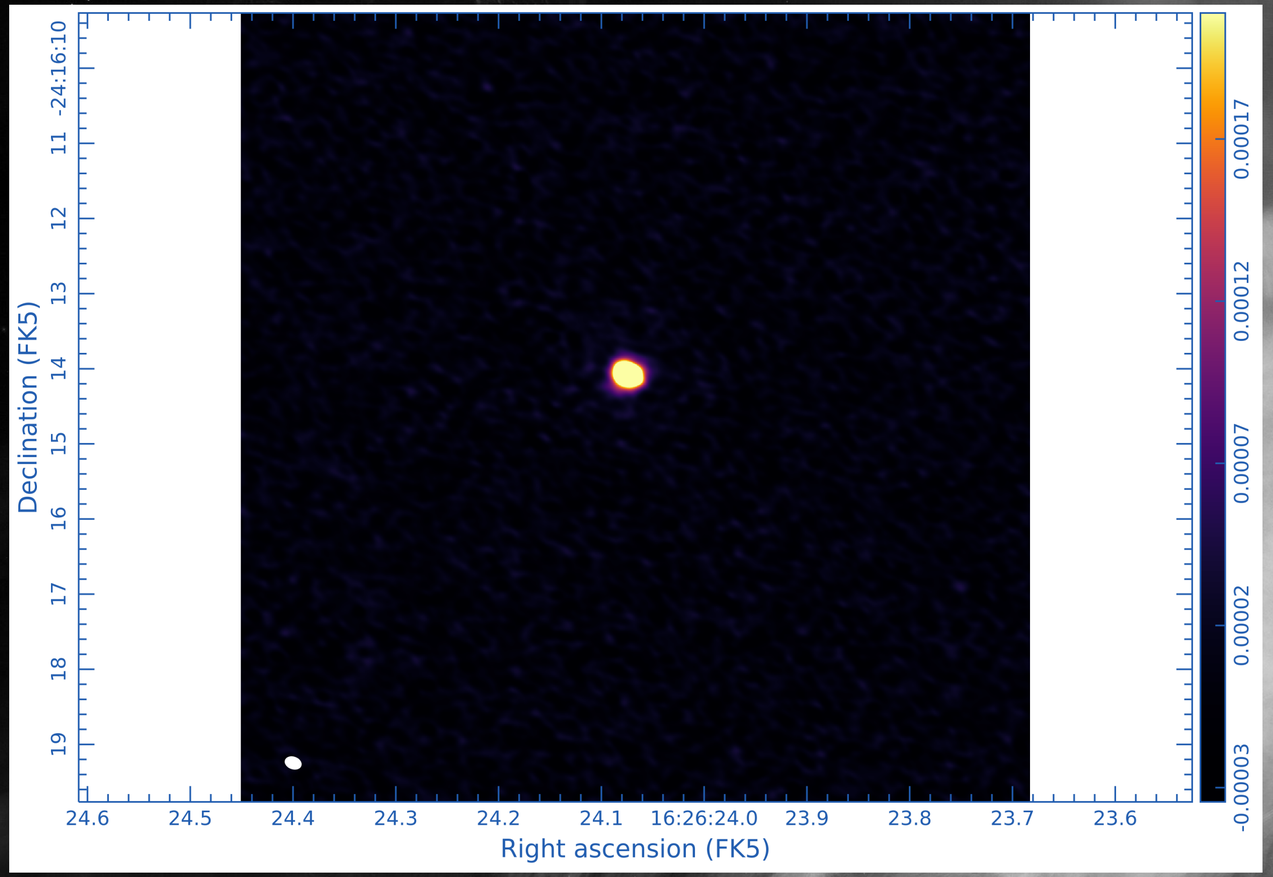


ODISEA_C4_62 - Band10

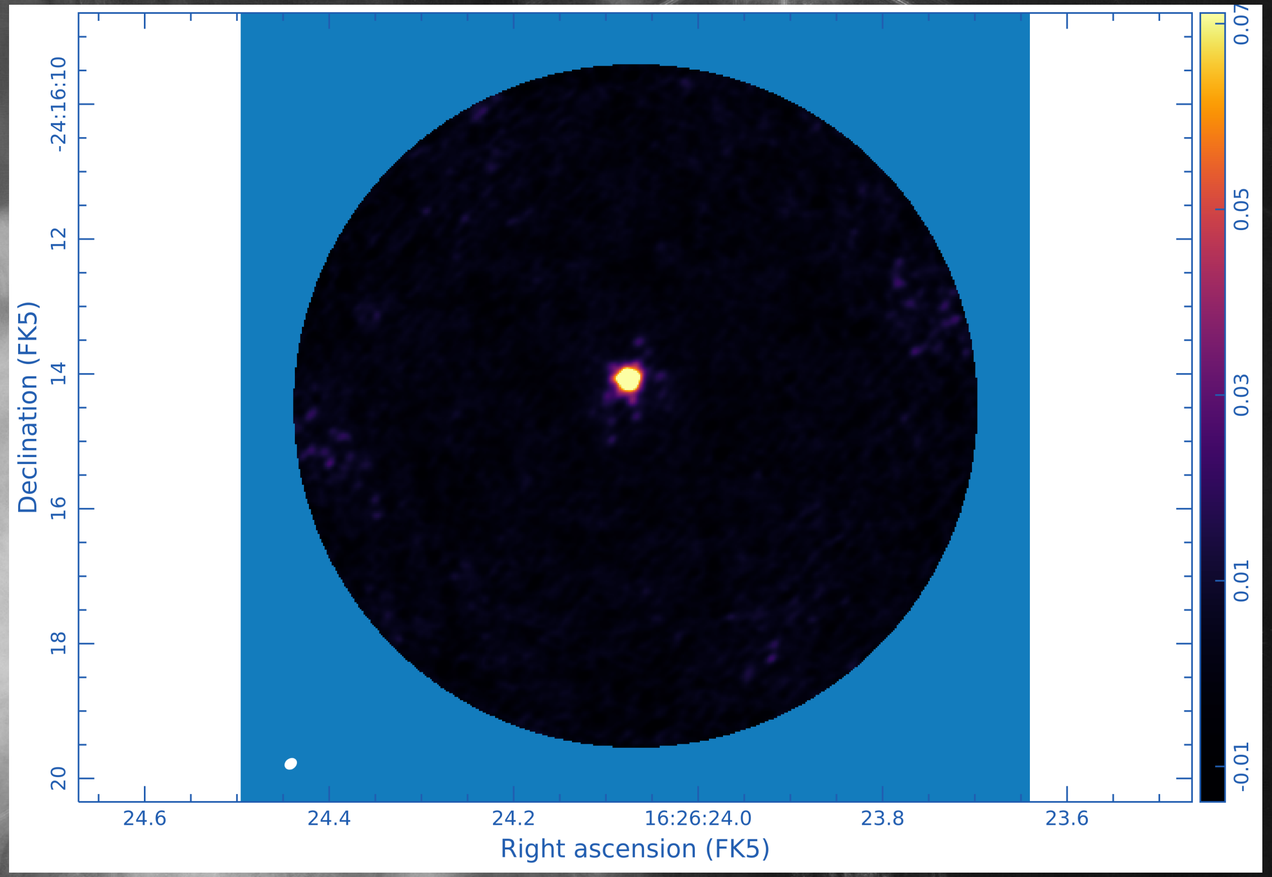


Comparison of Band1 and Band10 data

ODISEA_C4_41 - Band1

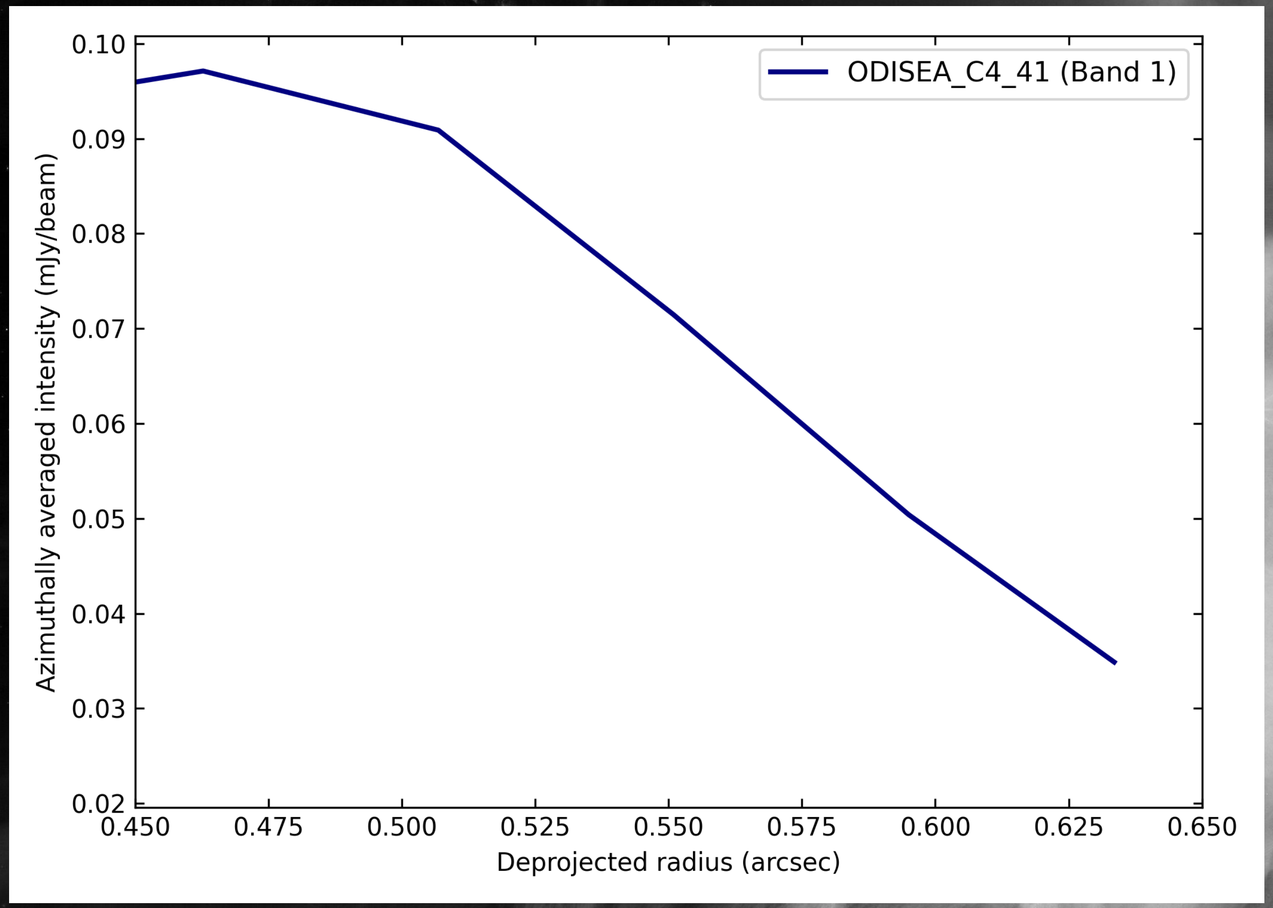


ODISEA_C4_41 - Band10

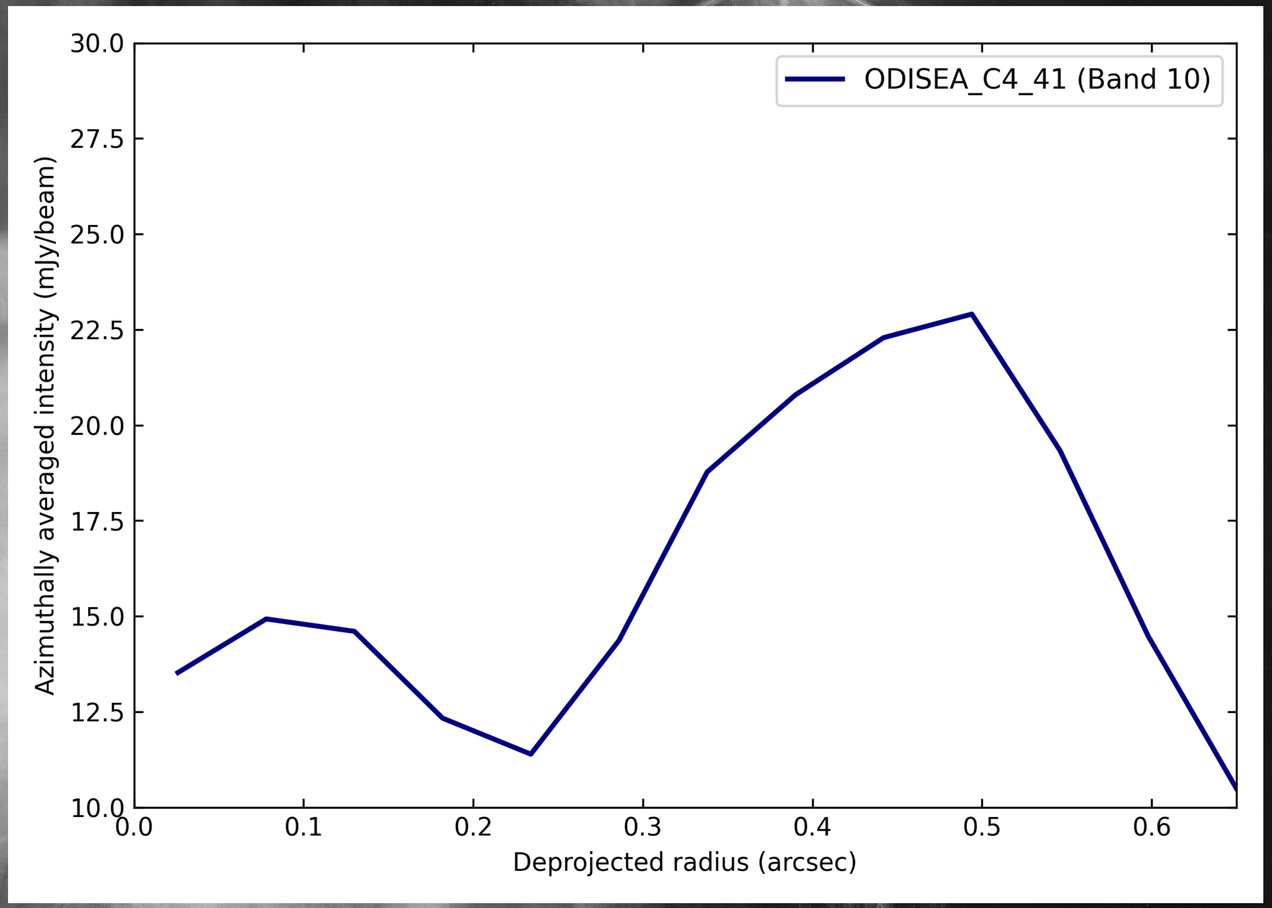


Comparison of Band1 and Band10 data

ODISEA_C4_41 - Band1

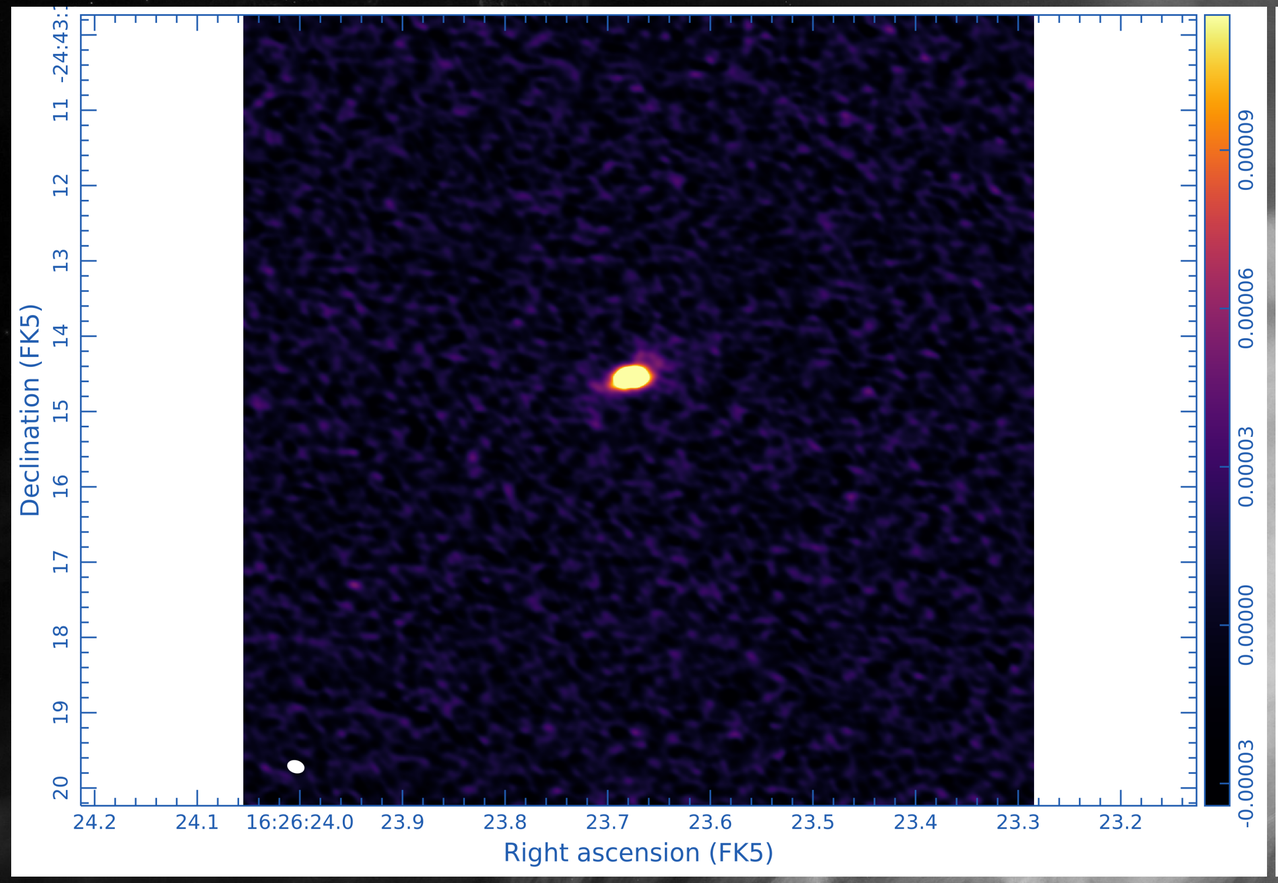


ODISEA_C4_41 - Band10

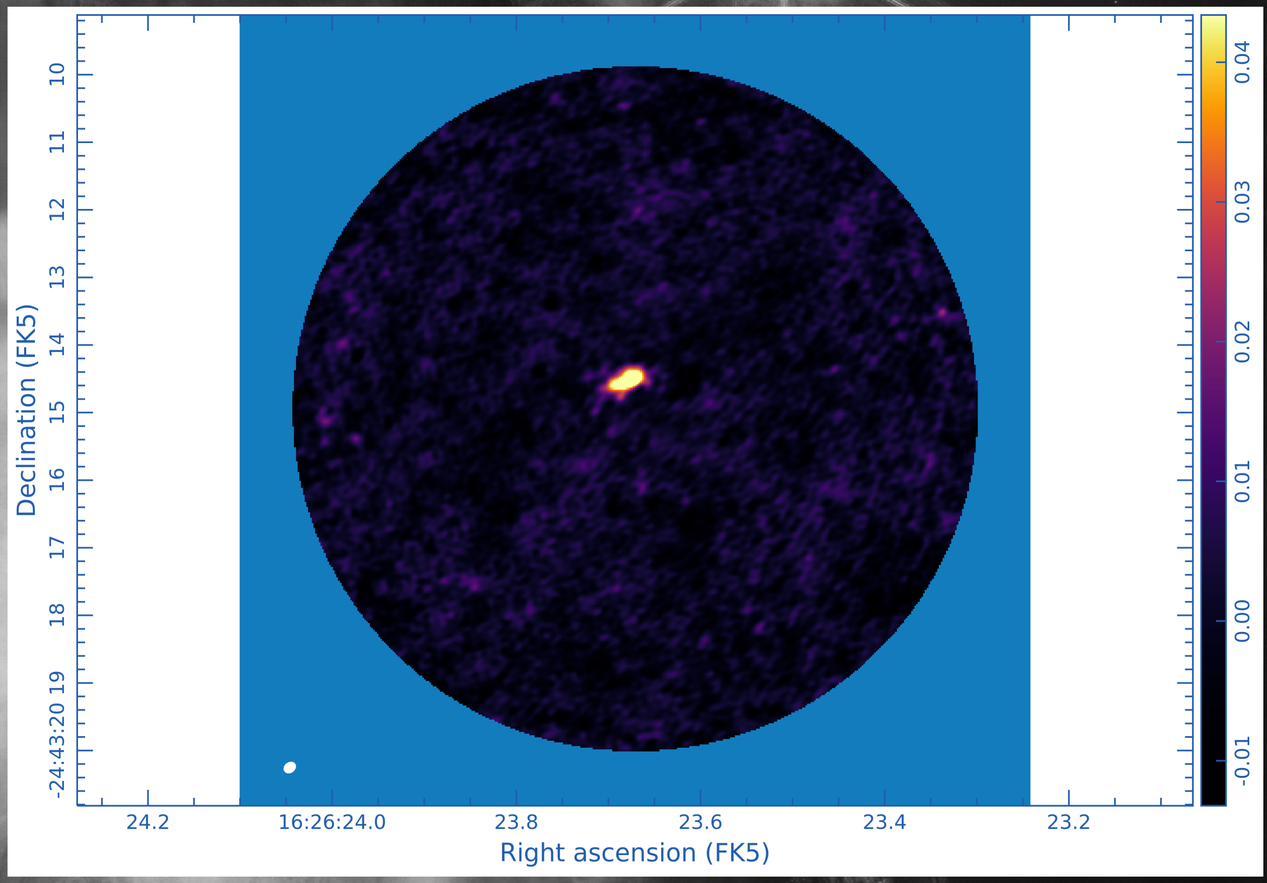


Comparison of Band1 and Band10 data

ODISEA_C4_39 - Band1

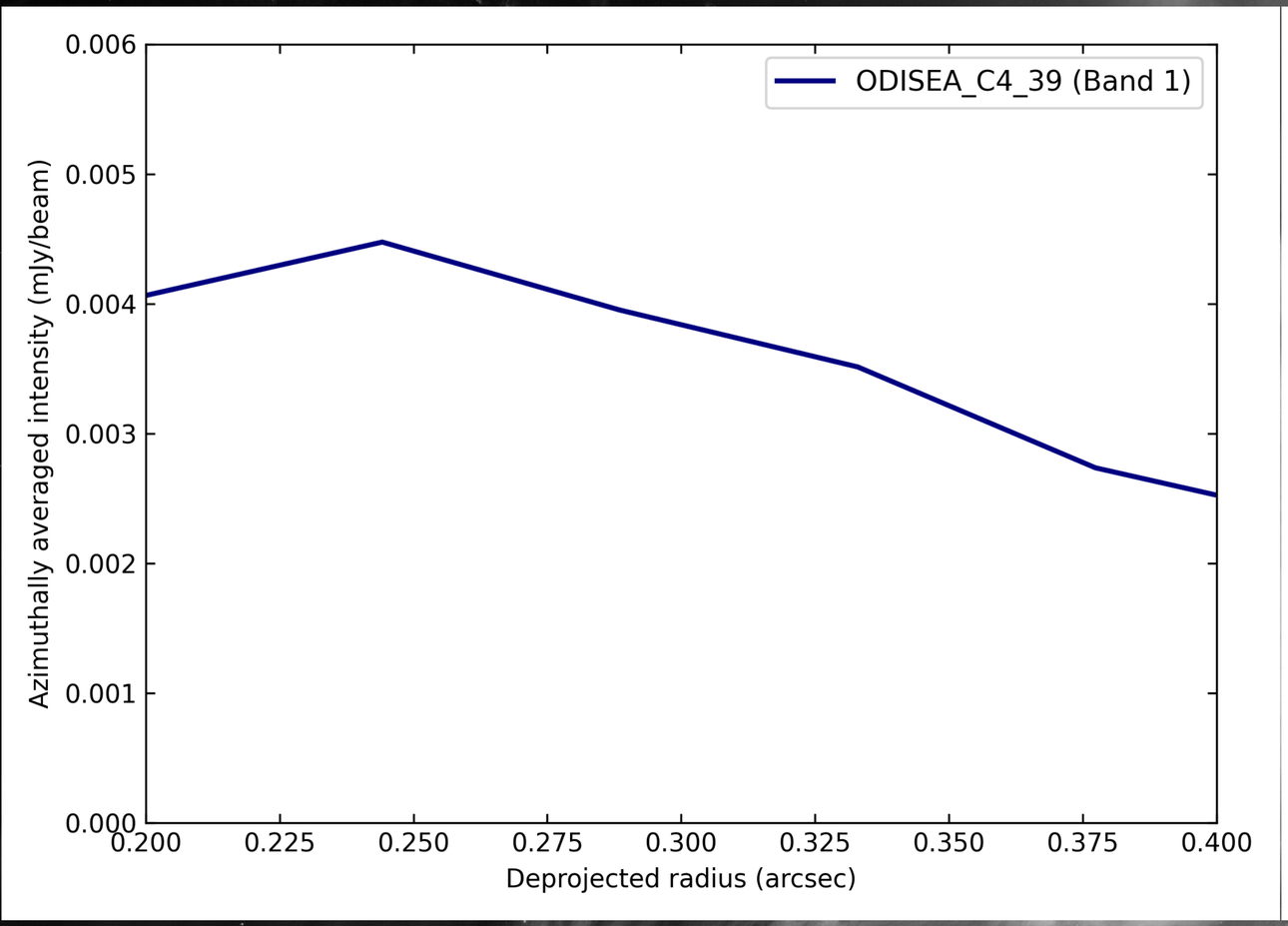


ODISEA_C4_39 - Band10

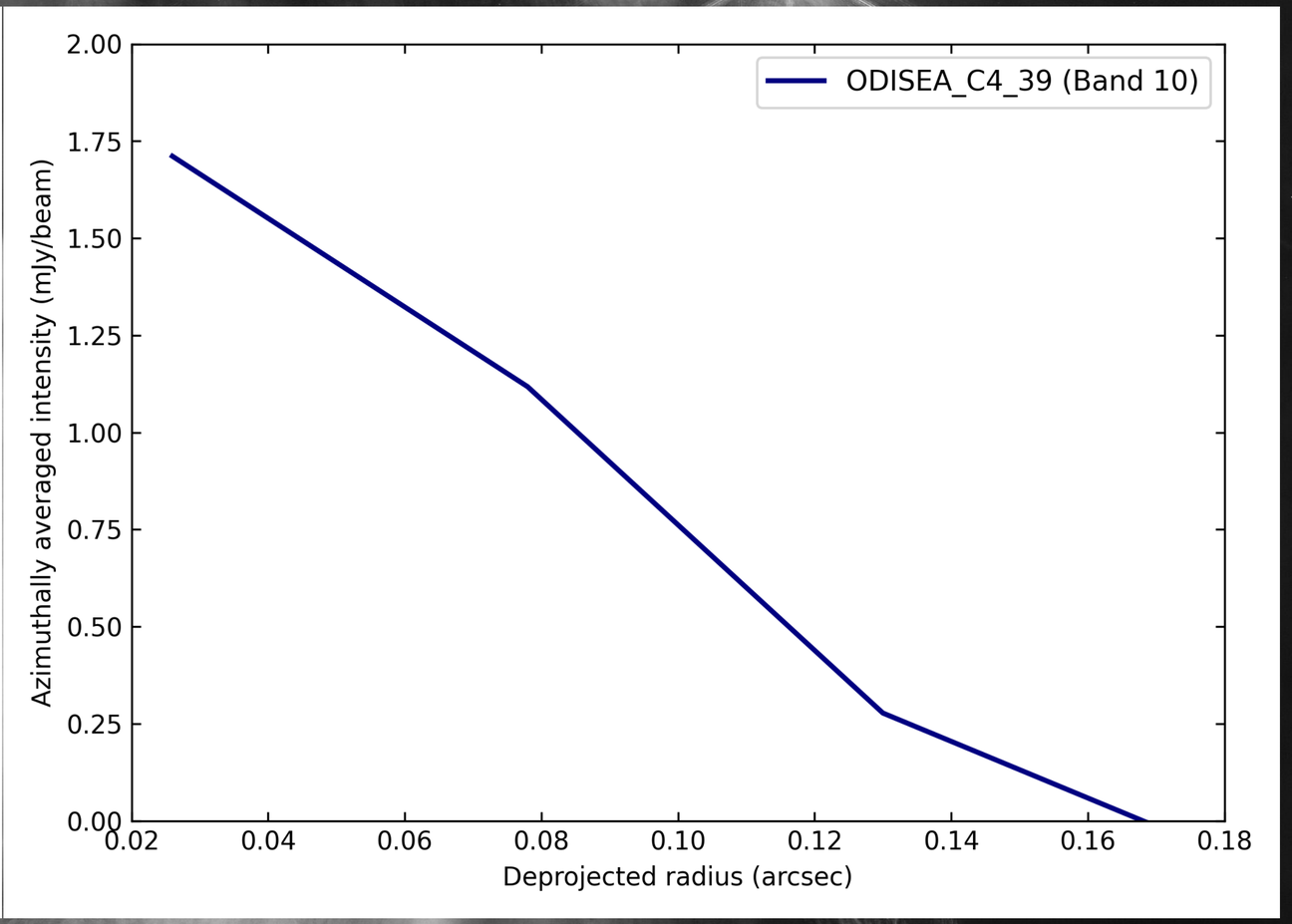


Comparison of Band1 and Band10 data

ODISEA_C4_39 - Band1

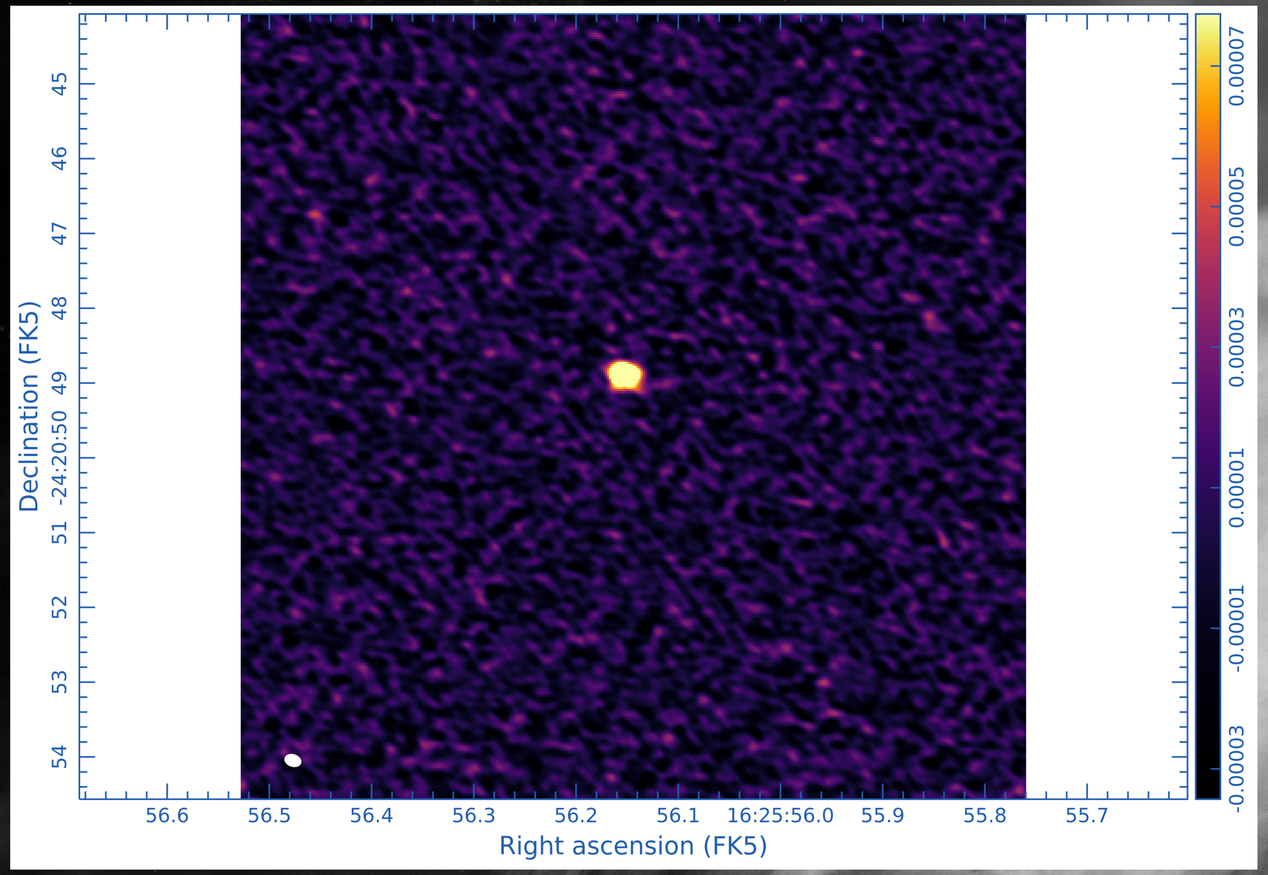


ODISEA_C4_39 - Band10

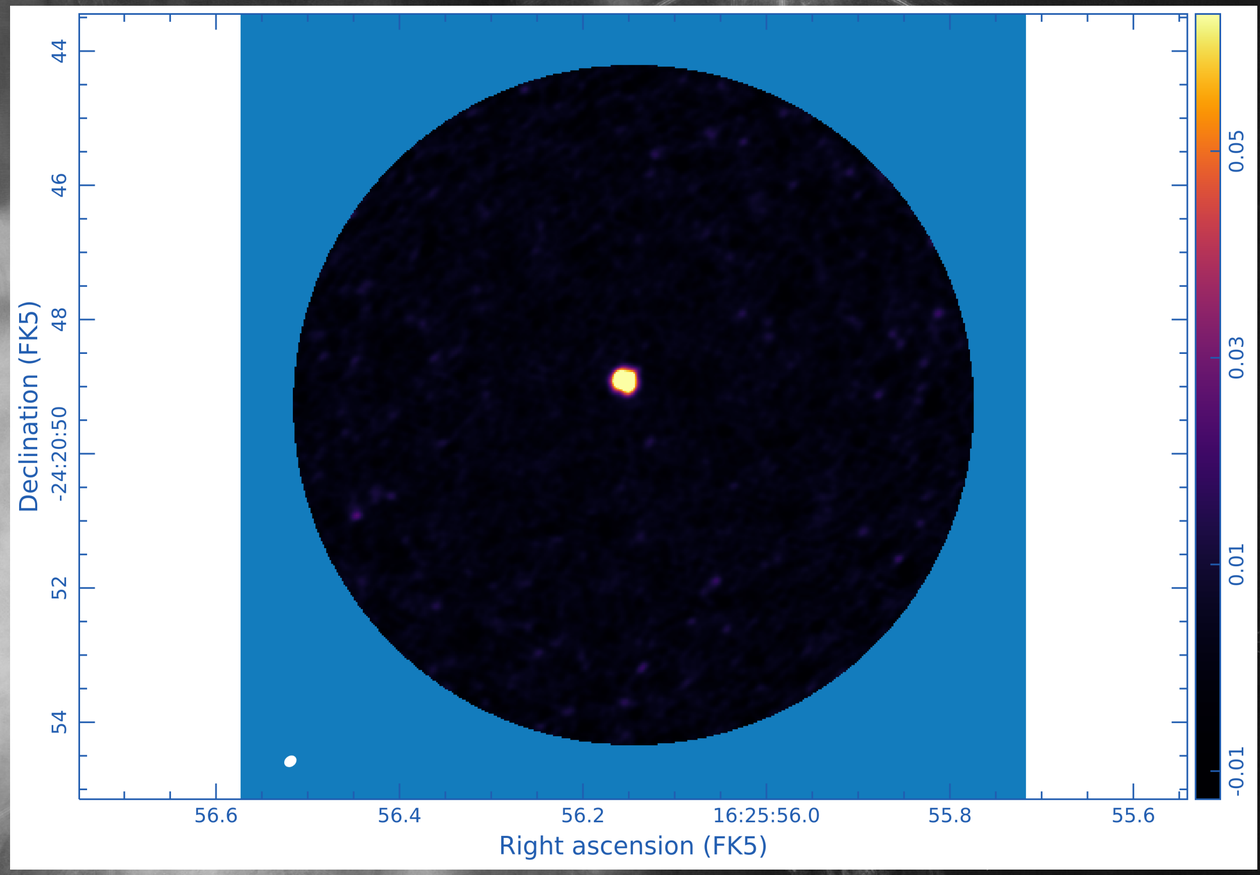


Comparison of Band1 and Band10 data

ODISEA_C4_27 - Band1

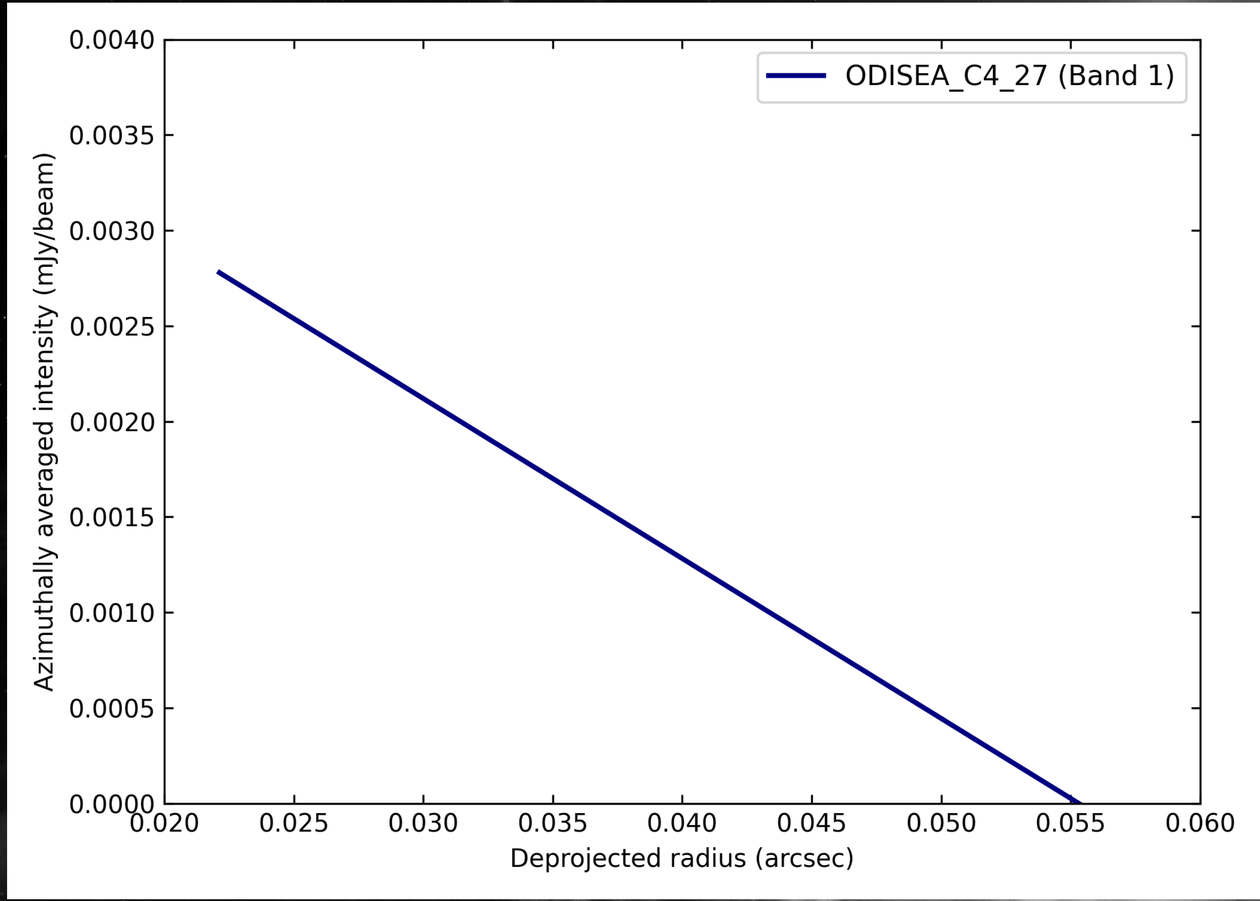


ODISEA_C4_27 - Band10

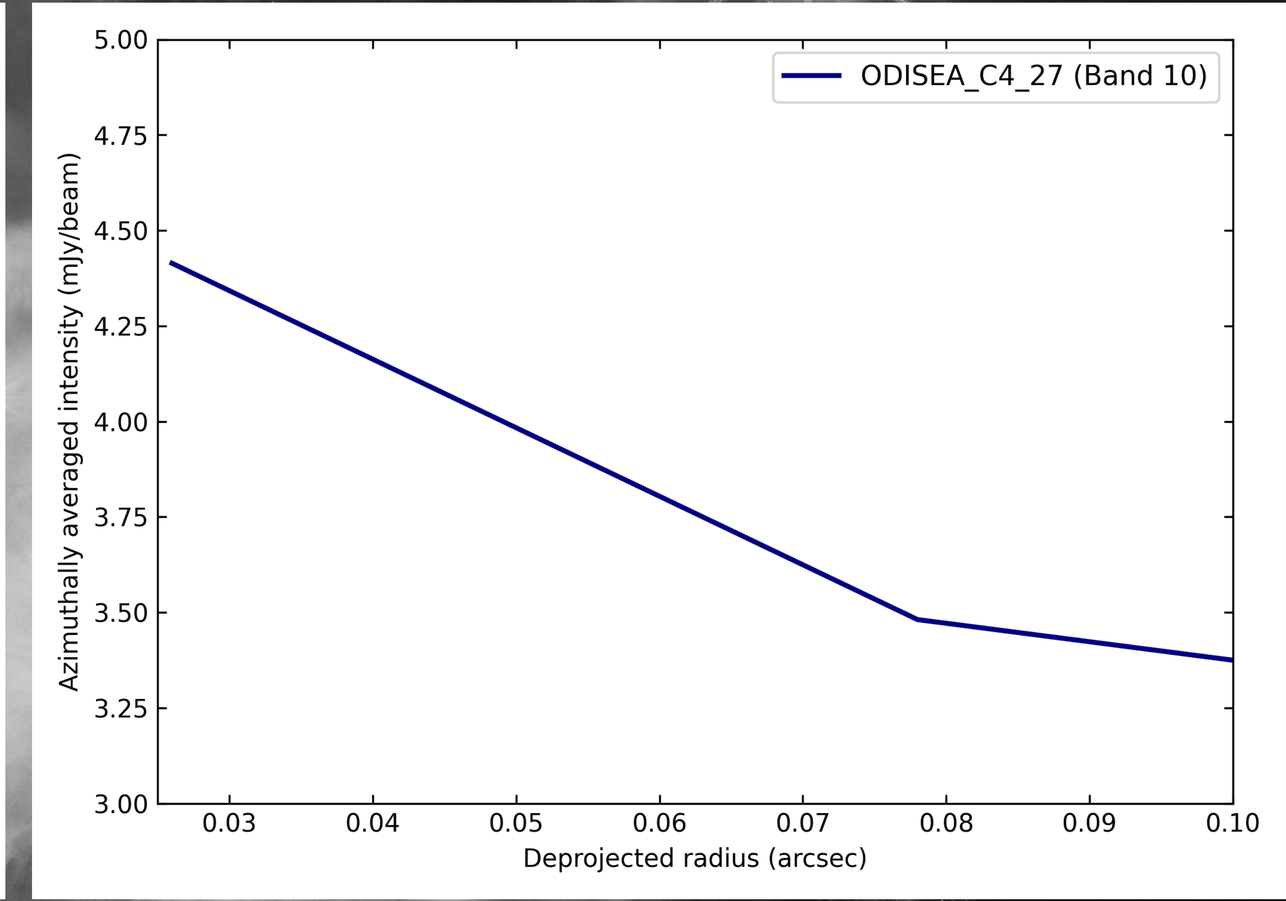


Comparison of Band1 and Band10 data

ODISEA_C4_27 - Band1



ODISEA_C4_27 - Band10



Further plans

- Better self- calibration
- Adding more epochs
- Possibility of adding results for multifrequency analysis
- Constraining dust properties in protoplanetary disks

