

ALMA archive capability

Tien-Hao Hsieh & Arc-Taiwan

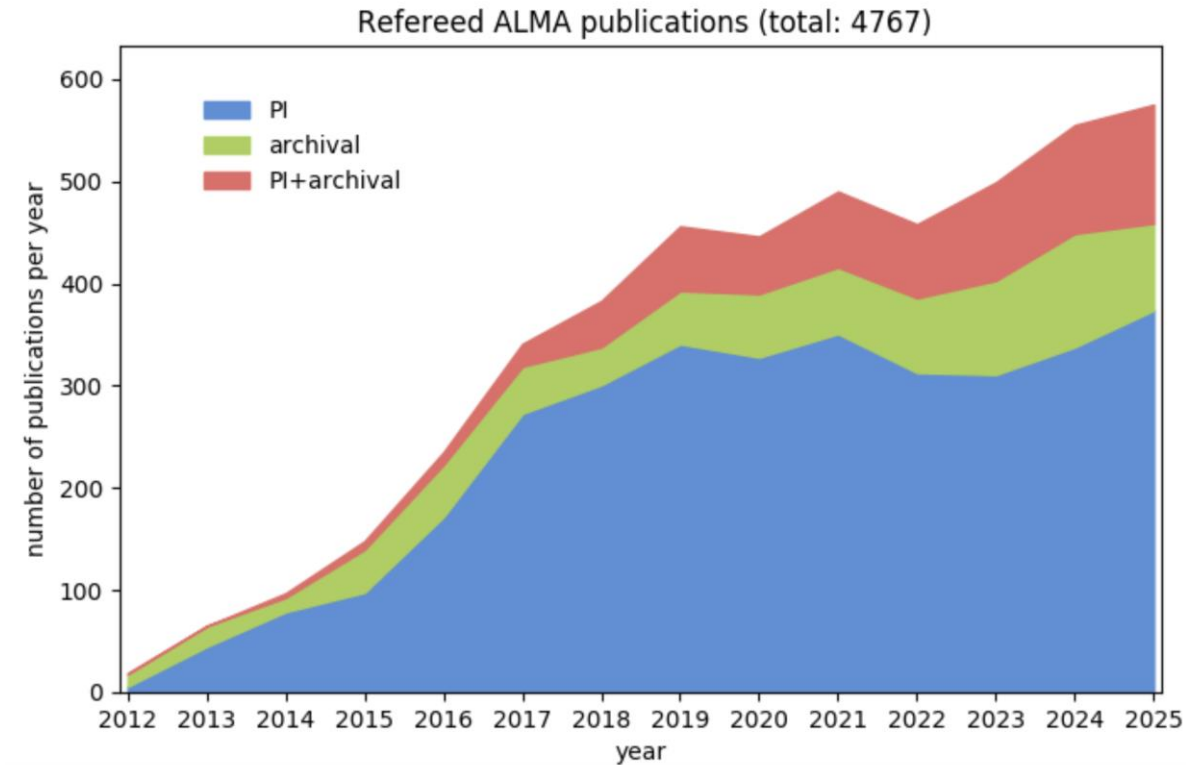
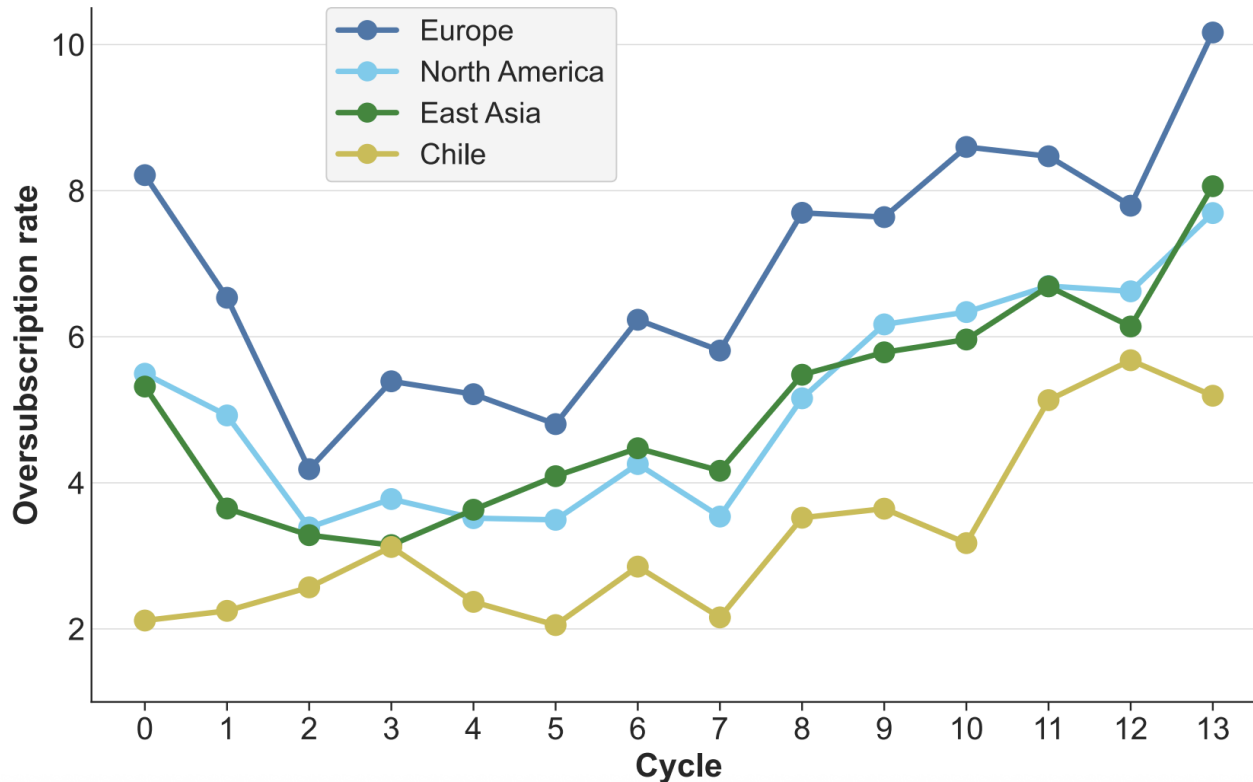
ALMA Imaging workshop, September, 2026

Outline

- Introduction
- Archive webpage (task 1)
- AstroQuery (task 2)
- Similarity (task 3)

Why you need archive?

- Telescope time is very competitive
 - You need to check archive before submitting a proposal
 - Science using ALMA Archive data is increasing



What you can giving a try today:

- Chose a source and line

Active galaxies	Cosmology	Disks and planet formation	Galaxy evolution	ISM and star formation	Local Universe	Solar system	Stars and stellar evolution	Sun
NGC 1068	SDP 0.81	HL Tau	Antennae (NGC 4038/39)	Orion KL	LMC (30 Doradus)	Titan	IRC+10216 (CW Leonis)	Quiet Sun region
Centaurus A	HFLS3	TW Hya	Arp 220	IRAS 16293-2422	SMC	Venus	Betelgeuse	Active region / sunspot
Circinus Galaxy	SMM J2135 (Cosmic Eyelash)	PDS 70	M51	Sgr B2(N)	M33	Ceres	VY Canis Majoris	
NGC 5728	SPT0311-58	HD 163296	NGC 253	NGC 6334I	M31	Comet 46P/Wirtanen	Mira	

What you can giving a try today:

- Chose a source and line

Purpose	Molecule / Line	Typical Band	Notes
General gas tracer	12CO (J=2-1, 3-2)	Band 6, 7	Detected in almost every target -- safe default
Optically thin gas	13CO, C18O	Band 6	Isotopologues; teaches optical-depth effects
Dense gas / star formation	HCN, HCO+	Band 3, 6	Classic dense-gas tracers
Shocks / outflows	SiO	Band 6, 7	Good for jet / outflow discussions
Complex organics	CH3OH, CH3CN	Band 3, 6	Pairs well with Orion KL / Sgr B2
Disk chemistry	HCO+, DCO+, C2H	Band 6, 7	Pairs well with TW Hya / HD 163296
Continuum / dust	(no line -- continuum)	any band	No line processing needed -- good first exercise

Webpage searching

[illegible]

Webpage searching

Search

ALMA source name: HLLine: CO

Download

Position

Source name

ALMA source name

HL

RA Dec

Galactic

Ecliptic

Target List

Angular Resolution

Max. Recoverable Scale

Energy

Frequency

Band

Spectral resolution

Continuum sensitivity

Line sensitivity (10 km/s)

Rest Frequency

Line

Rest Frequency

Line

CO

Redshift

VLSR

SNR

FWHM

Peak Intensity

Project

Project code

Project Title

Project abstract

PI Full Name

Proposal authors

Science keyword

Publication

BibCode

Publication Title

Abstract

First Author

Authors

Observation

Observation Date

Polarisation Type

Member ous id

Object type

Public data only

Calibration observations

Lines

Redshift

0.00002368361estimated

5

HCO⁺ v=0 2-1

t-HCOOH 50(4,46)-49(6,43)

CH₂CHO v=0 5(2,2)-3(0,3) f=2-2 A

CH₃CO 7(2,6)-6(1,6) e0

HDCO 3(1,2)-3(0,3)

H₂O v=0 3(1,3)-2(2,0)

D₂CO 3(1,2)-2(1,1)

D₂S 3(2,1)-3(1,2)

N₂H⁺ v=0 j=2-1

8

9

10

Array

Mosaic

Max.reco.scale

arcsec

FOV

arcsec

Scientific cat

2022.1.00905.S

HL_Tau

04:31:38.518 +18:13:57.49±5

0.0723

170.58..186.453 GHz

2025-03-07

3

1

0.049

0.231

12m

1.670

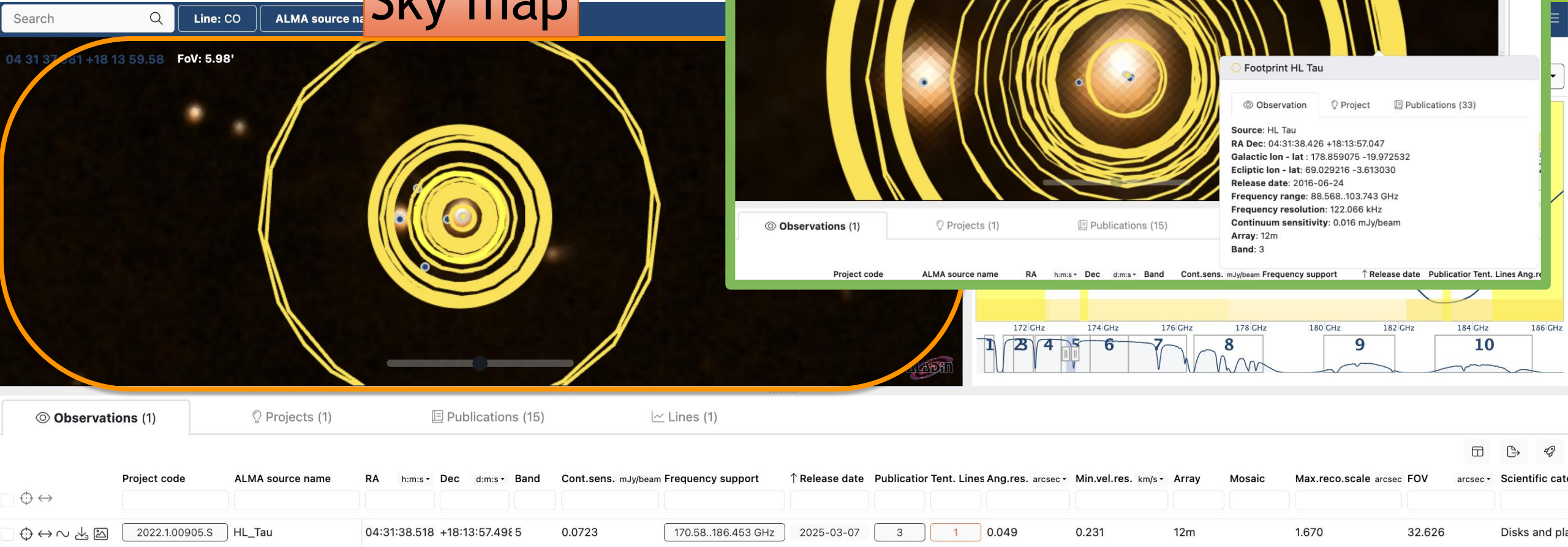
32.626

Disks and p

Webpage searching

Sky map

Zoom in and check obs at the target



Webpage searching

Have a look the PI's proposal abstract

Search Line: CO ALMA source name: HL_Tau

Project 2022.1.00905.S

Project title: The first characterization of the water snowline in a ringed protoplanetary disk

PI name: Facchini, Stefano

Proposal abstract: The water molecule plays a crucial role in the physics and chemistry of planet formation. In particular, the water snowline defines a specific region where dust grains drastically change their properties, promoting the formation of planets. The position of the snowline also defines the chemistry of the available planet building blocks. No direct imaging of the water snowline has been reported yet. With a resolution of 0.1, we will spatially resolve the water snowline in the HL Tau disk, where archival ALMA data show a robust detection of the Band 5 water line at 183.3 GHz. Motivated by this ground-breaking discovery, we will be able to directly connect the radial location of the snowline to the well-characterized grain distribution of this archetypal disk, a long-awaited constraint in any planet formation model. Additional data in Band 7 will further confirm the detection of the warmer water line at 325.1 GHz from the same archival data, opening a new window into the characterization of spatially resolved excitation studies of water vapour in disks. With this exciting discovery in hand, the time is ripe to fully exploit the ALMA potential on this new frontier in planet formation.

Acknowledgement: This paper makes use of the following ALMA data: ADS/JAO.ALMA#2022.1.00905.S ALMA is a partnership of ESO (representing its member states), NSF (USA) and NINS (Japan), together with NRC (Canada), NSTC and ASIAA (Taiwan), and KASI (Republic of Korea), in cooperation with the Republic of Chile. The Joint ALMA Observatory is operated by ESO, AUI/NRAO and NAOJ. In addition, publications from NA authors must include the standard NRAO acknowledgement: The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc.



Molecules Lines Redshift 0.00002368361 estimated

5

172 GHz 174 GHz 176 GHz 178 GHz 180 GHz 182 GHz 184 GHz 186 GHz

1 2 3 4 5 6 7 8 9 10

Lines (1)

Frequency support	Release date	Publication Tent.	Lines	Ang.res. arcsec	Min.vel.res. km/s	Array	Mosaic	Max.reco.scale arcsec	FOV arcsec	Scientific cat
170.58..186.453 GHz	2025-03-07	3	1	0.049	0.231	12m	1.670	32.626		Disks and pl

Webpage searching

Search Line: CO ALMA source name: HL_Tau x

04 31 37.981 +18 13 59.58 FoV: 5.98'

VO

Molecules Lines Redshift 0.00002368361 estimated

5

172 GHz 174 GHz 176 GHz 178 GHz 180 GHz 182 GHz 184 GHz 186 GHz

1 2 3 4 5 6 7 8 9 10

Observations (1) Projects (1)

Project code ALMA source name RA h:m:s Dec d:m:s Band Cont.sens. mJy/beam Frequency support Release date Publication Tent. Lines Ang.res. arcsec Min.vel.res. km/s Array Mosaic Max.reco.scale arcsec FOV arcsec Scientific

2022.1.00905.S HL_Tau 04:31:38.518 +18:13:57.496 5 0.0723 170.58..186.453 GHz 2025-03-07 3 1 0.049 0.231 12m 1.670 32.626 Disks and pla

Check if the observation match your science goal

Webpage searching

The screenshot displays the ALMA Data Explorer web interface. On the left, there are several filter categories: Position (Source name, ALMA source name, RA Dec, Galactic, Ecliptic, Target List, Angular Resolution, Max. Recoverable Scale), Energy (Frequency, Band, Spectral resolution, Continuum sensitivity, Line sensitivity (10 km/s), Rest Frequency), Line (Rest Frequency, Line, Redshift, VLSR, SNR, FWHM, Peak Intensity), Project (Project code, Project name, PI Name), Publication (BibCode, Authors), and Observation (Observation Date). A large orange box with the text "you can filter the data (resolution, band, time)" is overlaid on the filter section. On the right, there is a spectral plot showing flux density versus frequency (GHz). The plot includes a blue curve representing the continuum and several vertical lines representing spectral lines. A large orange box with the text "If you found a lot of of obs." is overlaid on the bottom right of the plot. The plot also shows a redshift slider set to 0 and a "Download" button.

Observations (97135)

Projects (5611)

Publications (5039)

Lines (161195)

	Project code	ALMA source name	RA	h:m:s	Dec	d:m:s	Band	Cont.sens. mJy/beam	Frequency support	↑ Release date	Publication	Tent. Lines	Ang.res. arcsec	Min.vel.res. km/s	Array	Mosaic	Max.reco.scale arcsec	FOV arcsec	Scientific category
	2011.0.00191.S	Fomalhaut b	22:57:38.685	-29:37:12.616	7			0.1181	343.077..358.839 GHz	2012-12-06	2	0	1.047	0.816	12m		10.640	16.592	Disks and protoplanets
	2011.0.00131.S	R Scl	01:26:58.079	-32:32:36.42	7			0.9115	330.246..346.109 GHz	2012-12-06	5	0	1.043	0.846	12m	mosaic	11.517	62.007	Stars and stellar objects
	2011.0.00101.S	GRB021004	00:26:54.680	+18:55:41.60	7			0.1136	337.009..353.001 GHz	2012-12-06	2	0	1.107	26.541	12m		9.257	16.878	Active galaxies
	2011.0.00397.S	J061200.23-062209.6	06:12:00.230	-06:22:09.60	7			0.5346	337.005..352.989 GHz	2012-12-20	3	0	1.183	26.541	12m		7.819	16.878	Active galaxies
	2011.0.00397.S	J063027.81-212058.6	06:30:27.810	-21:20:58.60	7			0.5346	337.007..352.992 GHz	2012-12-20	3	0	1.183	26.541	12m		8.015	16.878	Active galaxies
	2011.0.00397.S	J041754.10-281655.9	04:17:54.100	-28:16:55.90	7			0.4848	337.023..353.008 GHz	2012-12-20	3	0	1.118	26.541	12m		7.842	16.877	Active galaxies
	2011.0.00397.S	J065142.31-002207.0	06:51:42.310	-00:22:07.00	7			0.1010	337.000..353.001 GHz	2012-12-20	3	0	1.100	26.541	12m		7.050	16.877	Active galaxies

Webpage searching

Download 221 GB

Download 221 GB Download Cut-Out Open legacy Request Handler Login

Project (1) Group ObsUnitSet (1) Member ObsUnitSet (1) Source (1) Collection (1) Array (1) File type (7) File class (11)

Project 2022.1.00905.S Group OUS uid://A001/X2d20/X1ed1

Project 2022.1.00905.S Group OUS uid://A001/X2d20/X1ed1 Member OUS uid://A001/X2d20/X1ed2 README QA2 report Weblog (6.5.4.9) (2024-09-23)

☒	2022.1.00905.S_uid_A001_X2d20_X1ed2_001_of_001.tar	product	217 GB	✓
☒	2022.1.00905.S_uid_A001_X2d20_X1ed2_auxiliary.tar	auxiliary	2 GB	✓
☐	2022.1.00905.S_uid_A002_X1097a87_X48ec.asdm.sdm.tar	raw	121 GB	✓
☐	2022.1.00905.S_uid_A002_X109a1cb_Xa531.asdm.sdm.tar	raw	146 GB	✓
☐	2022.1.00905.S_uid_A002_X10ca5ad_X3755.asdm.sdm.tar	raw	127 GB	✓
☐	2022.1.00905.S_uid_A002_X10d4e2e_X11ee9.asdm.sdm.tar	raw	139 GB	✓
☐	2022.1.00905.S_uid_A002_X10d4e2e_X12869.asdm.sdm.tar	raw	165 GB	✓
☐	2022.1.00905.S_uid_A002_X10d4e2e_X1a564.asdm.sdm.tar	raw	165 GB	✓
☐	2022.1.00905.S_uid_A002_X10d4e2e_X1b0b3.asdm.sdm.tar	raw	165 GB	✓
☐	member.uid_A001_X2d20_X1ed2.admit.product_rename.txt	auxiliary, admit	32 Bytes	✓
☐	member.uid_A001_X2d20_X1ed2.calimage.product_rename.txt	auxiliary, script	31 KB	✓
☒	member.uid_A001_X2d20_X1ed2.hifa_calimage_selfcal_auxproducts.tgz	auxiliary, calibration	105 KB	✓
☐	member.uid_A001_X2d20_X1ed2.hifa_calimage_selfcal_casa_commands.log	auxiliary, log	1 MB	✓
☐	member.uid_A001_X2d20_X1ed2.hifa_calimage_selfcal_casa_piperestorescript.py	auxiliary, script	389 Bytes	✓
☐	member.uid_A001_X2d20_X1ed2.hifa_calimage_selfcal_casa_piperescript.py	auxiliary, script	3 KB	✓

Explore and download

Preparing data to be downloaded...

Cancel request

Download the data



2022.1.00905.S

HL_Tau

04:31:38.518 +18:13:57.495

0.0723

170.58..186.453 GHz

2025-03-07

3

0.049

0.231

12m

1.670

32.626

Disks and pl

Once you get something to download

2015.1.00041.S

---Project ID
---Science Goal
---Group OUS
---MOUS

```
└─ science_goal.uid___A001_X340_X1f7
   └─ group.uid___A001_X340_X1f8
      └─ member.uid___A001_X340_X1f9
         └─ calibration
            └─ log
               └─ product
                  └─ qa
                     └─ script
                        └─ raw_data
```

----- If you click at the download page (for scriptForPI.py)

```
└─ script
   └─ casa_piperestorescript.py
      └─ casa_pipescript.py
         └─ PPR_uid___A001_X340_X1fa.xml
            └─ scriptForImaging.py
               └─ scriptForPI.py
```

Webpage searching

Search ALMA source name: HL_Tau

04 31 38.518 +18 13 57.50 FoV: 2.25'

[member.uid A001_X133d_X28e2.HL_Tau_sci.spw25_27_29_31_33_35_37_39_41_43_45_47_49.cont.l.pbcor.fits](#) 2 MB

Combined continuum : 225.663..245.43GHz, kHz, XX YY

member.uid A001_X133d_X28e2.HL_Tau_sci.spw25_27_29_31_33_35_37_39_41_43_45_47_49.cont.l.pbcor.fits

Band: 6
Frequency type: line
Frequency range: 225.663..245.43
Continuum sensitivity: 0.053
Line sens. (10km/s): 0.267 mJy/beam
Line sens. (native): 0.053 uJy/beam
Polarisations: XX YY
Array: 12m

[member.uid A001_X133d_X28e2.HL_Tau_sci.spw27.cube.l.pbcor.fits](#) 1 GB

SPW 0 : 225.663..225.721GHz, 141.113 kHz, XX YY

member.uid A001_X133d_X28e2.HL_Tau_sci.spw27.cube.l.pbcor.fits

Band: 6
Frequency type: line
Frequency range: 225.663..225.721
Frequency resolution: 141.113 kHz
Continuum sensitivity: 0.053
Line sens. (10km/s): 0.985 mJy/beam

Explore data

Observations (1) Projects (1)

2022.1.00905.S HL_Tau

Webpage searching

Search

ALMA source name: HL_Tau

04 31 38.518 +18 13 57.50

FoV: 2.25'

Observations (1)

Projects (1)

2022.1.00905.S

HL_Tau

Previews for HL_Tau

ALMA

README

QA2 report

Weblog

Weblog

SPW 9 : 241.58..241.639GHz, 141.113 kHz, XX YY

member.uid_A001_X133d_X28e2.HL_Tau_sci.spw47.cube.l.pbcor.fits

1 GB

Band: 6

Frequency type: line

Frequency range: 241.58..241.639

Frequency resolution: 141.113 kHz

Continuum sensitivity: 0.053

Line sens. (10km/s): 0.941 mJy/beam

Line sens. (native): 0.349 uJy/beam

Polarisations: XX YY

Array: 12m

SPW 10 : 241.756..241.814GHz, 141.113 kHz, XX YY

member.uid_A001_X133d_X28e2.HL_Tau_sci.spw45.cube.l.pbcor.fits

1 GB

You might find some line detection

Tentative line detections

SO2v=0 5(2,4)-4(1,3)

Download

Redshift

0.00002368361

estimated

CH2CHCN v=0 3(2,2)-3(0,3), F=2-2, A

CH3CHO v=2 6(1,6)-6(1,5), F=0

HDCO 3(1,2)-3(0,3)

H2O v=0 3(1,3)-2(2,0)

D2S 3(2,1)-3(1,2)

D2CO 3(1,2)-2(1,1)

D2CH3CN 8(3,6)-7(2,5), F=8-7

180 GHz

182 GHz

184 GHz

186 GHz

9

10

RA

h:m:s

Dec

d:m:s

Band

Cont.sens. mJy/beam

Frequency support

Release date

Publication

Tent. Lines

Ang.res. arcsec

Min.vel.res. km/s

Array

Mosaic

Max.reco.scale arcsec

FOV

arcsec

Scientific cat

04:31:38.518

+18:13:57.49

5

0.0723

170.58..186.453 GHz

2025-03-07

3

1

0.049

0.231

12m

1.670

32.626

Disks and pl

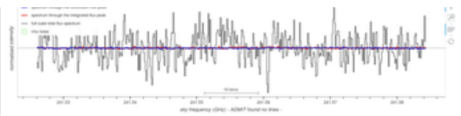
Explore data

Webpage searching

Previews for HL_Tau

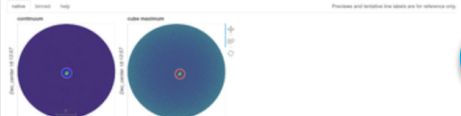
ALMA

[README](#) [QA2 report](#) [Weblog](#) [Weblog](#)



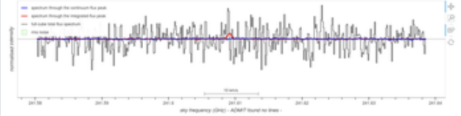
Line sens. (native): 0.349 uJy/beam
Polarisations: XX YY
Array: 12m

SPW 9 : 241.58..241.639GHz, 141.113 kHz, XX YY



Band: 6
Frequency type: line
Frequency range: 241.58..241.639
Frequency resolution: 141.113 kHz
Continuum sensitivity: 0.053
Line sens. (10km/s): 0.941 mJy/beam
Line sens. (native): 0.349 uJy/beam
Polarisations: XX YY
Array: 12m

SPW 10 : 241.756..241.814GHz, 141.113 kHz, XX YY



[member.uid__A001_X133d_X28e2.HL_Tau_sci.spw45.cube](#)

Open with CARTA

Explore data

RA h:m:s Dec d:m:s Band Cont.sens. mJy

04:31:38.518 +18:13:57.495 5 0.0723

2022.1.00905.S HL_Tau

CARTA

File View Widgets Help

member.uid__A001_X133d_X28e2.HL_Tau_sci.spw25_27_29_31_33_35_37_39_41_43_45_47

WCS: (4:31:36.592, 18:13:59.19); Image: (887, 429); Polarization: Stokes I

Declination (ICRS)

Right ascension (ICRS)

X Profile: Cursor X

Image Active Region Active

Value

X coordinate

Y Profile: Cursor X

Image Active Region Active

Value

Y coordinate

Render Configuration X

90% 95% 99% 99.5% 99.9% 99.95% 99.99% 100% Custom

Clip min -0.002780353679

Clip max 0.0240792873832

Scaling Linear

Colormap

Invert colormap

Image List X Animator X

Image	Layers	Matching	Char
0 member.uid__A001_X133d_X28e2.HL_Tau_sci.spw25_27_29_31_33_35_37_39_41_43_45_47	R	XY R	0

Webpage searching

ALMA source name: HL

Line: CO

Project abstract: Class 0

Download

Position

Source name

ALMA source name

HL

RA Dec

Energy

Frequency

Band

Spectral resolution

Line

Rest Frequency

Line

CO

Redshift

Project

Project code

Project Title

Project abstract

Class 0

Publication

BibCode

Publication Title

Observation

Observation Date

Polarisation Type

Lines

Redshift

0

estimated

HCO⁺ v=0-4-2

CO v=0-3-2

13CH3OH v=1-2(4-2)

CI 3P1-3P0

CO v=0-4-3

CO v=0-5-4

H2O v=0-2(1,1)-2(0,2)

CO v=0-6-5

H2O v=0-2(1,1)-2(0,2)

CO v=0-7-6

CH3OH v=1-12(-1,1)

HDO 1(1,1)-0(0,0)

CO v=0-8-7

H2O v=0-2(0,2)-1(1,1)

Although evidence has been piling up that planet formations begins when the disk is still forming within its envelope, the physical

It is well known that low-mass protostellar cores show significant chemical diversity. One distinct case is hot corino chemistry char

The organic composition, and hence prebiotic potential, of planets and comets is set by the planet disk. Disks are known to contain

A model for low-mass star formation is generally understood to incorporate a bipolar jet/outflow, envelope, and disk. Until now, the

A principal goal of this proposal is to reveal the velocity structure and the angular momentum distribution of the protostellar core c

A significant fraction of all main-sequence star are found in binary/multiple systems, and this high fraction of multiplicity must mar

A thorough understanding of chemical composition of low-mass star forming regions and its evolution to protoplanetary disks is one of the central issues for astrochemistry, astrophysics, and planetary science, since it is eventually related to an origin of rich substan

ALMA has greatly advanced our understanding of planet formation, yet we still lack a holistic view of the full disk life cycle in a single star-forming region, from the initial **Class 0/I** embedded stage (<1 Myr), to the Class II protoplanetary phase (1-5Myr), to the final Cl

ALMA has shown protoplanetary disks with rich substructures and even with protoplanets. These features and the gas depletion timescale of protoplanetary disks (about 2 Myr) suggest that planet formation may start in earlier young stellar objects (YSOs). To study

ALMA is uniquely suited to answer questions about how circumstellar disks form around low-mass protostars and how their physics and chemistry evolve until the planet-forming stages. We here propose to utilise the high angular resolution of ALMA to study a candi

Project abstract

Info:
Abstract text as submitted by the PI.

Description:
Case-insensitive full-text search on the project abstract text

Examples:
[hydrogen fluoride](#)
[clusters of galaxies](#)

ed. An important parameter is the disk temperature structure as this determines

while the other distinct case is warm carbon chain chemistry (WCCC) character

younger sources, we know relatively little about the disk complex organic molec

ng, infall and envelope rotation -- relating all of these complementary protostell

8-3359 and characterize its turbulent eddies/elements. In this source, two pas

IA in Cycle 3, we surveyed 331 protostars in the Orion molecular clouds at 0.08

Task: combine filters (~10-15 min)

- Go back to your source from the last task (or pick a new one from Slide 4)
- Try the Line filter: search by molecule name (e.g. CO, HCN), or browse the Lines panel on the right
 - If your source is high redshift (e.g. SPT0311-58, HFLS3, SDP0.81, Cosmic Eyelash), set the Redshift field so the line list shows the correct observed frequency
- Combine at least 2 filter categories at once (e.g. Position + Line, or Position + Project abstract)
- Try a Project abstract keyword search related to your science goal (e.g. "outflow", "disk", "AGN") -- how many projects match?
- Check: does the observation's band actually cover the frequency of your line? (rest frequency $\times (1+z)$ should fall inside the observed frequency range)
- Open the image in CARTA (quick-look) and take a look -- does what you see actually match what you were hoping to find?
- Bonus: find a project whose abstract really matches your goal, then check its delivered resolution/sensitivity

Astroquery -- script it!

- ▣ Same searches as the archive webpage -- reproducible & automatable

Functions we'll use:

- ▣ query_object
- ▣ query_region
- ▣ get_data_info
- ▣ download_files

Four scripts today:

- ▣ 01 by name -> 02 by region/ADQL -> 03 download -> 04 visualize

Alma.query_object() -- search by name

- Resolves "HL Tau" to coordinates, then runs a cone search

```
(py313) thhsieh@almat2:/almabeegfs/scratch/thhsieh/ImagingWorkshop2026$ python 01_query_by_name.py
Querying ALMA archive for object name 'HL Tau' ...

Total rows returned: 771
Total columns: 73

Distinct target_name values found near 'HL Tau':
- 04287+1801
- 04288+1802
- BHS98_MHO_5
```

```
result = Alma.query_object(
    "HL Tau",
    public=True,
    science=True,
    payload=None,
    enhanced_results=False,
)
```

All 4 parameters (every call sets all of them, even at default):

- public=True -- True/False/None: public only / proprietary only / both
- science=True -- True/False/None: science obs only / calib only / both
- payload=None -- dict: extra ObsCore filters, e.g. {'band_list': ['7']}
- enhanced_results=False -- True adds Quantity columns + a sky-footprint column

The result is an astropy Table

- query_object() returns an astropy Table -- browse it like a dataframe

```
>>> result = Alma.query_object(
...     "HL Tau",
...     public=True,
...     science=True,
...     payload=None,
...     enhanced_results=False,
... )
>>> result.columns
<TableColumns names=('obs_publisher_id','obs_collection','facility_name','instrument_name','obs_id','dataprodect_type','calib_level','collections','target_name','s_ra','s_dec','s_fov',
's_region','s_xel1','s_xel2','em_xel','t_xel','pol_xel','s_resolution','t_min','t_max','t_exptime','t_resolution','em_min','em_max','em_res_power','pol_states','o_uctd','access_url','a
ccess_format','access_estsize','proposal_id','data_rights','gal_longitude','gal_latitude','band_list','em_resolution','bandwidth','antenna_arrays','is_mosaic','obs_release_date','spati
al_resolution','frequency_support','frequency','velocity_resolution','obs_creator_name','pub_title','first_author','authors','pub_abstract','publication_year','proposal_abstract','sche
dblock_name','proposal_authors','sensitivity_10kms','cont_sensitivity_bandwidth','pwv','group_ous_uid','member_ous_uid','asdm_uid','obs_title','type','scan_intent','science_observation
','spatial_scale_max','qa2_passed','bib_reference','science_keyword','scientific_category','pi_userid','pi_name','spectral_resolution','lastModified')>
>>> result['obs_publisher_id','obs_id','target_name','s_ra','s_dec','proposal_id','spatial_resolution','pi_name']
<Table length=775>
      obs_publisher_id      obs_id      target_name      s_ra      s_dec      proposal_id      spatial_resolution      pi_name
              str33              str64              str256      float64      float64              str64      float64              str256
-----
ADS/JAO.ALMA#2011.0.00619.S uid://A001/Xca/X5.source.L1551 NE.spw.17 L1551 NE 67.93540416666667 18.142131111111112 2011.0.00619.S 0.5717667379425295 Takakuwa, Shigehisa
ADS/JAO.ALMA#2011.0.00619.S uid://A001/Xca/X5.source.L1551 NE.spw.19 L1551 NE 67.93540416666667 18.142131111111112 2011.0.00619.S 0.5717667379425295 Takakuwa, Shigehisa
ADS/JAO.ALMA#2011.0.00619.S uid://A001/Xca/X5.source.L1551 NE.spw.23 L1551 NE 67.93540416666667 18.142131111111112 2011.0.00619.S 0.5717667379425295 Takakuwa, Shigehisa
ADS/JAO.ALMA#2011.0.00619.S uid://A001/Xca/X5.source.L1551 NE.spw.21 L1551 NE 67.93540416666667 18.142131111111112 2011.0.00619.S 0.5717667379425295 Takakuwa, Shigehisa
ADS/JAO.ALMA#2019.1.00393.S uid://A001/X1465/X3167.source.HL_Tau.spw.25 HL_Tau 67.91020070802584 18.23256011073085 2019.1.00393.S 0.9202653524457668 Zhang, Ke
ADS/JAO.ALMA#2019.1.00393.S uid://A001/X1465/X3167.source.HL_Tau.spw.29 HL_Tau 67.91020070802584 18.23256011073085 2019.1.00393.S 0.9202653524457668 Zhang, Ke
ADS/JAO.ALMA#2019.1.00393.S uid://A001/X1465/X3167.source.HL_Tau.spw.31 HL_Tau 67.91020070802584 18.23256011073085 2019.1.00393.S 0.9202653524457668 Zhang, Ke
ADS/JAO.ALMA#2019.1.00393.S uid://A001/X1465/X3167.source.HL_Tau.spw.27 HL_Tau 67.91020070802584 18.23256011073085 2019.1.00393.S 0.9202653524457668 Zhang, Ke
ADS/JAO.ALMA#2019.1.00393.S uid://A001/X1465/X3167.source.HL_Tau.spw.35 HL_Tau 67.91020070802584 18.23256011073085 2019.1.00393.S 0.9202653524457668 Zhang, Ke
ADS/JAO.ALMA#2019.1.00393.S uid://A001/X1465/X3167.source.HL_Tau.spw.33 HL_Tau 67.91020070802584 18.23256011073085 2019.1.00393.S 0.9202653524457668 Zhang, Ke
```

The result is an astropy Table

- query_object() returns an astropy Table -- browse it like a dataframe
Filter with your parameter
result[result['spatial_resolution']<0.05][...]

```
>>> result[result['spatial_resolution']<0.05]['obs_publisher_id','obs_id','target_name','s_ra','s_dec','proposal_id','spatial_resolution','pi_name']
<Table length=64>
  obs_publisher_id      obs_id      target_name      s_ra      s_dec      proposal_id      spatial_resolution      pi_name
                str33                str64                str256      float64      float64                str64      float64                str256
-----
ADS/JAO.ALMA#2017.1.00388.S uid://A001/X1288/Xb6c.source.L1551_IRS_5.spw.25 L1551_IRS_5 67.89198750003972 18.1346944444449106 2017.1.00388.S 0.04457437409379539 Liu, Hanyu Baobab
ADS/JAO.ALMA#2017.1.00388.S uid://A001/X1288/Xb6c.source.L1551_IRS_5.spw.27 L1551_IRS_5 67.89198750003972 18.1346944444449106 2017.1.00388.S 0.04457437409379539 Liu, Hanyu Baobab
ADS/JAO.ALMA#2017.1.00388.S uid://A001/X1288/Xb6c.source.L1551_IRS_5.spw.29 L1551_IRS_5 67.89198750003972 18.1346944444449106 2017.1.00388.S 0.04457437409379539 Liu, Hanyu Baobab
```

- Or Query_object with payload={'spatial_resolution': '<0.05'}

```
>>> result = Alma.query_object(
...     "HL Tau",
...     public=True,
...     science=True,
...     payload={'spatial_resolution': '<0.05'},
...     enhanced_results=False,
... )

>>> result['obs_publisher_id','obs_id','target_name','s_ra','s_dec','proposal_id','spatial_resolution','pi_name']
<Table length=64>
  obs_publisher_id      obs_id      target_name      s_ra      s_dec      proposal_id      spatial_resolution      pi_name
                str33                str64                str256      float64      float64                str64      float64                str256
-----
ADS/JAO.ALMA#2017.1.00388.S uid://A001/X1288/Xb6c.source.L1551_IRS_5.spw.25 L1551_IRS_5 67.89198750003972 18.1346944444449106 2017.1.00388.S 0.04457437409379539 Liu, Hanyu Baobab
ADS/JAO.ALMA#2017.1.00388.S uid://A001/X1288/Xb6c.source.L1551_IRS_5.spw.27 L1551_IRS_5 67.89198750003972 18.1346944444449106 2017.1.00388.S 0.04457437409379539 Liu, Hanyu Baobab
ADS/JAO.ALMA#2017.1.00388.S uid://A001/X1288/Xb6c.source.L1551_IRS_5.spw.29 L1551_IRS_5 67.89198750003972 18.1346944444449106 2017.1.00388.S 0.04457437409379539 Liu, Hanyu Baobab
ADS/JAO.ALMA#2017.1.00388.S uid://A001/X1288/Xb6c.source.L1551_IRS_5.spw.31 L1551_IRS_5 67.89198750003972 18.1346944444449106 2017.1.00388.S 0.04457437409379539 Liu, Hanyu Baobab
```

Alma.query_region() -- search by region

- Cone search around explicit coordinates -- same idea as query_object

```
01_query_by_name.py 02_query_by_region.py 03_get_data_and_download.py 04_results.py 05_alma_download.py
(py313) thhsieh@almat2:/almabeegfs/scratch/thhsieh/ImagingWorkshop2026$ python 02_query_by_region.py
Resolving 'HL Tau' to coordinates via astropy's name resolver ...
RA = 67.910461 deg
Dec = 18.232739 deg

Running query_region() with radius = 30.0 arcsec ...

Total rows returned: 337

Distinct target_name values within the search radius:
- HL Tau
- HLTau
```

```
result = Alma.query_region(
    coord,
    search_radius,
    public=True,
    science=True,
    payload=None,
    enhanced_results=False,
)
```

All 6 parameters:

- coordinate=coord -- SkyCoord (or string), the search center
- radius=30*u.arcsec -- Quantity, the search radius
- public=True -- public only / proprietary only / both
- science=True -- science obs only / calib only / both
- payload=None -- dict, extra ObsCore filters
- enhanced_results=False -- adds Quantity columns + sky-footprint

Alma.get_data_info() -- list files

- Lists every file/package attached to one "member_ous_uid"
i.e. `result['member_ous_uid']='uid://A002/X91a40d/X4'` from query
- `Info = Alma.get_data_info('uid://A002/X91a40d/X4')`

```
(py313) thhsieh@almat2:/almabeegfs/scratch/thhsieh/ImagingWorkshop2026$ python 03_get_data_and_download.py
Requesting file listing for uid://A002/X91a40d/X4 ...
Total files/packages listed: 16

All files, sorted by size:
  0.01 MB  2011.0.00015.SV_2011-08-01_006_of_006.tar
  0.01 MB  2011.0.00015.SV_2011-08-01_003_of_006.tar
 15.61 MB  2011.0.00015.SV_2011-08-01_004_of_006.tar
 16.30 MB  2011.0.00015.SV_2011-08-01_001_of_006.tar
1863.05 MB 2011.0.00015.SV_2011-08-01_002_of_006.tar
7584.31 MB 2011.0.00015.SV_uid__A002_X928687_X446.asdm.sdm.tar
```

```
info = Alma.get_data_info(TARGET_UID)
```

All 4 parameters:

- `uids='uid://A002/X91a40d/X4'` -- member_ous_uid or asdm_uid
- `expand_tarfiles=False` -- True lists files INSIDE each package
- `with_auxiliary=True` -- include logs/weblogs/calibration tables
- `with_rawdata=True` -- include raw ASDM packages (huge!)

Alma.get_data_info() -- list files

- Lists every file/package attached to one "**member_ous_uid**"
i.e. `result['member_ous_uid']='uid://A002/X91a40d/X4'` from query
- `Info = Alma.get_data_info('uid://A002/X91a40d/X4')`

```
>>> info
<Table length=16>
      ID                                     access_url
      object                                object
-----
uid://A002/X91a40d/X4  https://almascience.nao.ac.jp/dataPortal/2011.0.00015.SV_2011-08-01_001_of_006.tar
uid://A002/X91a40d/X4  https://almascience.nao.ac.jp/dataPortal/2011.0.00015.SV_2011-08-01_002_of_006.tar
uid://A002/X91a40d/X4  https://almascience.nao.ac.jp/dataPortal/2011.0.00015.SV_2011-08-01_003_of_006.tar
uid://A002/X91a40d/X4  https://almascience.nao.ac.jp/dataPortal/2011.0.00015.SV_2011-08-01_004_of_006.tar
uid://A002/X91a40d/X4  https://almascience.nao.ac.jp/dataPortal/2011.0.00015.SV_2011-08-01_005_of_006.tar
...
uid://A002/X91a40d/X4  https://almascience.nao.ac.jp/dataPortal/2011.0.00015.SV_uid__A002_X920302_X826.asdm.sdm.tar
uid://A002/X91a40d/X4  https://almascience.nao.ac.jp/dataPortal/2011.0.00015.SV_uid__A002_X920302_Xacd.asdm.sdm.tar
uid://A002/X91a40d/X4  https://almascience.nao.ac.jp/dataPortal/2011.0.00015.SV_uid__A002_X925649_X2e6.asdm.sdm.tar
uid://A002/X91a40d/X4  https://almascience.nao.ac.jp/dataPortal/2011.0.00015.SV_uid__A002_X925649_X2e6.asdm.sdm.tar
```

The url Link

product

Raw data (asdm.sdm)

Alma.get_data_info() -- list files

- Lists every file/package attached to one "member_ous_uid"
i.e. `result['member_ous_uid']='uid://A002/X91a40d/X4'` from query
- `Info = Alma.get_data_info('uid://A002/X91a40d/X4')`

```
(py313) thhsieh@almat2:/almabeegfs/scratch/thhsieh/ImagingWorkshop2026$ python 03_get_data_and_download.py
Requesting file listing for uid://A002/X91a40d/X4 ...
Total files/packages listed: 16
```

```
All files, sorted by size:
  0.01 MB  2011.0.00015.SV_2011-08-01_006_of_006.tar
  0.01 MB  2011.0.00015.SV_2011-08-01_003_of_006.tar
 15.61 MB  2011.0.00015.SV_2011-08-01_004_of_006.tar
```

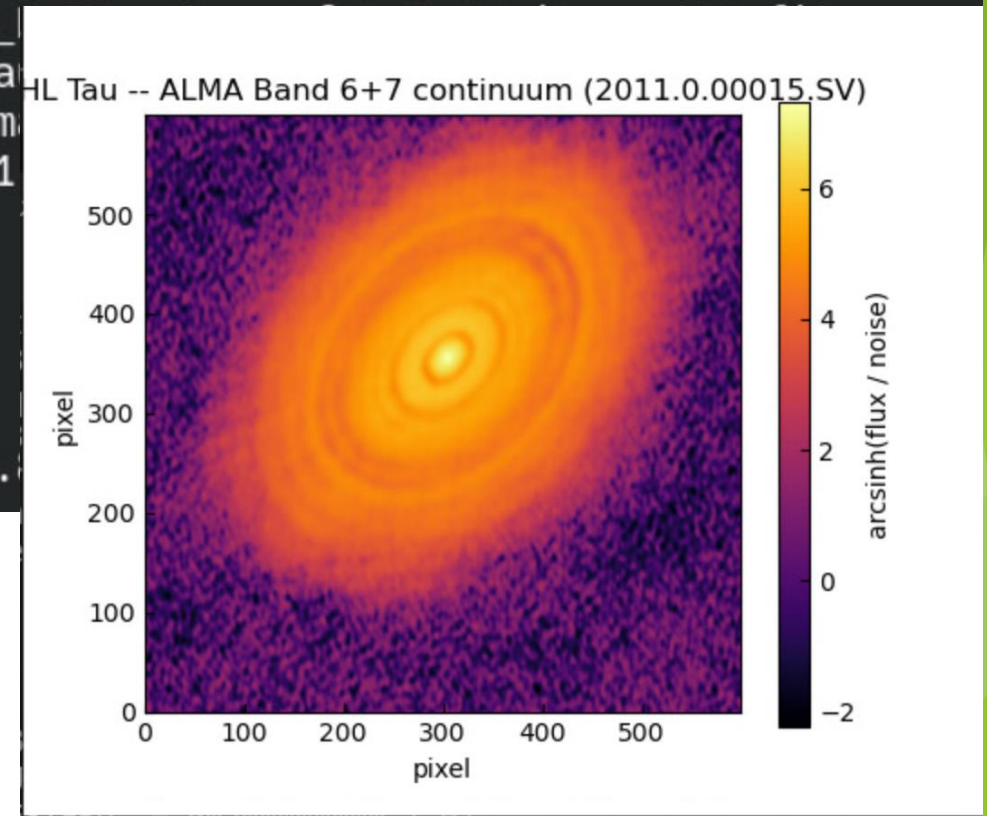
```
downloaded = Alma.download_files(
    [chosen_url],
    savedir=savedir,
    cache=True,
    continuation=True,
    skip_unauthorized=True,
    verify_only=False,
```

All 5 parameters:

- `files=[chosen_url]` -- list of access_url strings
- `savedir='./alma_downloads'` -- where to save (must already exist!)
- `cache=True` -- skip re-download if already present
- `continuation=True` -- resume a partial download
- `skip_unauthorized=True` -- silently skip files you can't access
- `verify_only=False` -- True = dry run, just check reachability

Open it with CARTA or astropy.io.fits

```
(py313) thhsieh@almat2:/almabeegfs/scratch/thhsieh/ImagingWorkshop2026$ python 04_visualize.py
Extracting alma_downloads/2011.0.00015.SV_2011-08-01_001_of_006.tar -> alma_extracted ...
Opening alma_extracted/HLTau_Band6+7_ReferenceImages/HLTau_
Filename: alma_extracted/HLTau_Band6+7_ReferenceImages/HLTau_
No.      Name      Ver      Type      Cards      Dimensions      Form
  0  PRIMARY          1 PrimaryHDU    1701      (2048, 2048, 1, 1)
Key header values:
  OBJECT    = HL_Tau
  BUNIT      = Jy/beam
  RESTFRQ    = 905000000000.1 Hz
  BMAJ/BMIN/BPA (synthesized beam) = 9.303485146827e-06, 5.
  Data shape = (1, 1, 2048, 2048)
```



Calls used:

- ▣ `tf.extractall(EXTRACT_DIR, filter='data')` -- filter='data' = safe extraction
- ▣ `fits.open(fits_path)` -- returns header + data
- ▣ `np.squeeze(data)` -- CASA's 4D array -> 2D image

Task: run it yourself (~10-15 min)

```
• (py313) thhsieh@almat7:/almabeegfs/scratch/thhsieh/ImagingWorkshop2026$ python
Python 3.13.7 | packaged by Anaconda, Inc. | (main, Sep  9 2025, 19:59:03) [GCC 11.4.0]
Type "help", "copyright", "credits" or "license()" for more information.
Ctrl click to launch VS Code Native REPL
• >>> from astroquery.alma import Alma
• >>> Alma.help()

Most common ALMA query keywords are listed below. These keywords are part of the
presentation (3rd column). They were also present in original ALMA Web form and, for
names (2nd column).
```

```
result = Alma.query_object(
    "HL Tau",
    public=True,
    science=True,
    payload=None,
    enhanced_results=False,
)
```

```
result = Alma.query_region(
    coord,
    search_radius,
    public=True,
    science=True,
    payload=None,
    enhanced_results=False,
)
```

```
result['member_ous_uid']
```

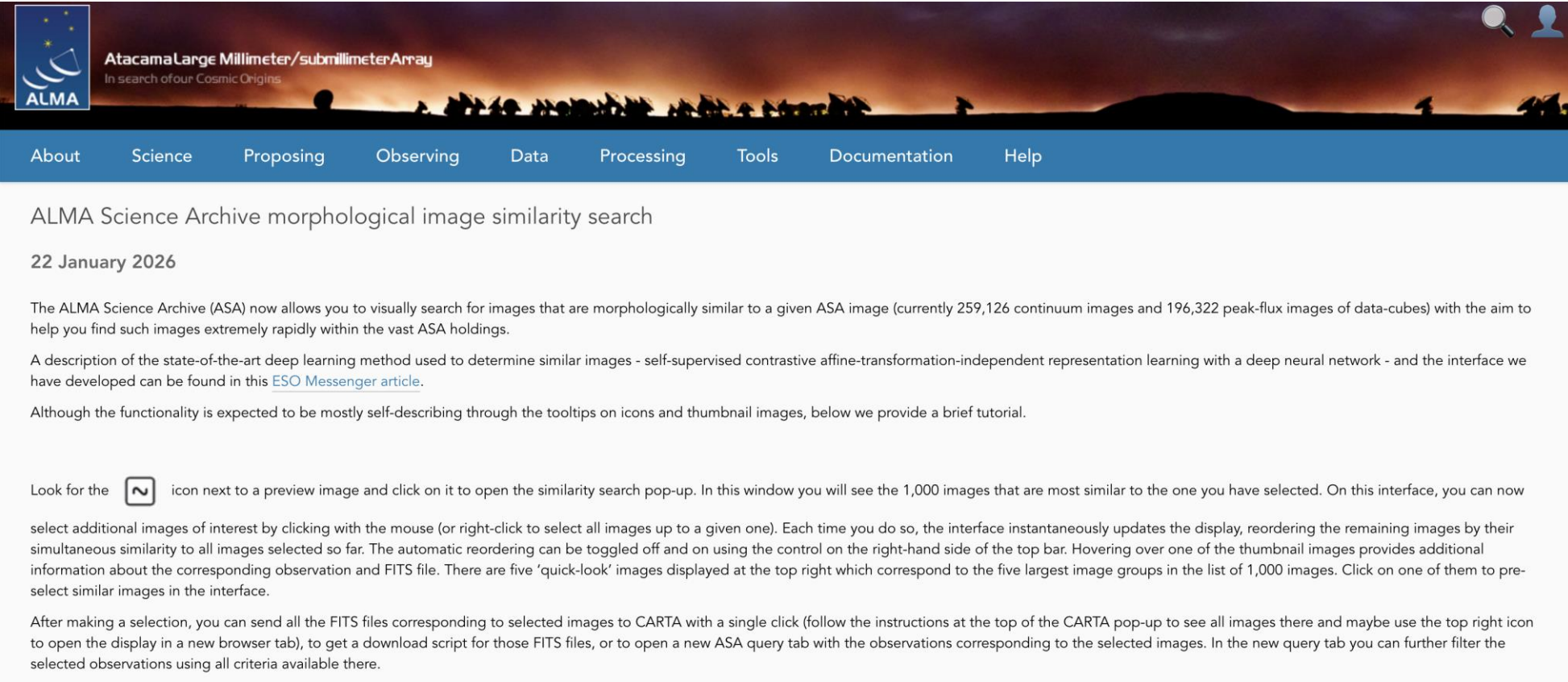
```
info = Alma.get_data_info(TARGET_UID)
```

```
downloaded = Alma.download_files(
    [chosen_url],
    savedir=savedir,
    cache=True,
    continuation=True,
    skip_unauthorized=True,
    verify_only=False,
)
```

- Open 01_query_by_name.py, change "HL Tau" to your own source (Slide 4)
- Re-run 01 -> 02 -> 03 -> 04 in order
 - Trying to filter the results after query
 - Trying to filter the results before query
 - update the target UID by hand between steps
 - Download the product: Is this what you want?
 - Open the file with CARTA or Plot the data
- Try Alma.help() to find a filter keyword we didn't cover in the demo
- Compare your final plot to what you saw in CARTA earlier (Slide 17) -- does it match?

Introduction

□ ALMA Science Archive morphological image similarity search



The image shows a screenshot of the ALMA Science Archive website. The header features the ALMA logo and the text "Atacama Large Millimeter/submillimeter Array" and "In search of our Cosmic Origins". Below the header is a navigation bar with links: About, Science, Proposing, Observing, Data, Processing, Tools, Documentation, and Help. The main content area is titled "ALMA Science Archive morphological image similarity search" and dated "22 January 2026". The text describes the new functionality of the ALMA Science Archive (ASA), which allows users to visually search for images that are morphologically similar to a given ASA image. It mentions that the ASA currently holds 259,126 continuum images and 196,322 peak-flux images of data-cubes. A description of the state-of-the-art deep learning method used to determine similar images is provided, along with a link to an ESO Messenger article. The text also mentions that the functionality is expected to be mostly self-describing through tooltips on icons and thumbnail images, and provides a brief tutorial. The tutorial explains how to use the similarity search pop-up, how to select additional images of interest, and how to send the FITS files corresponding to selected images to CARTA.

ALMA Science Archive morphological image similarity search

22 January 2026

The ALMA Science Archive (ASA) now allows you to visually search for images that are morphologically similar to a given ASA image (currently 259,126 continuum images and 196,322 peak-flux images of data-cubes) with the aim to help you find such images extremely rapidly within the vast ASA holdings.

A description of the state-of-the-art deep learning method used to determine similar images - self-supervised contrastive affine-transformation-independent representation learning with a deep neural network - and the interface we have developed can be found in this [ESO Messenger article](#).

Although the functionality is expected to be mostly self-describing through the tooltips on icons and thumbnail images, below we provide a brief tutorial.

Look for the  icon next to a preview image and click on it to open the similarity search pop-up. In this window you will see the 1,000 images that are most similar to the one you have selected. On this interface, you can now select additional images of interest by clicking with the mouse (or right-click to select all images up to a given one). Each time you do so, the interface instantaneously updates the display, reordering the remaining images by their simultaneous similarity to all images selected so far. The automatic reordering can be toggled off and on using the control on the right-hand side of the top bar. Hovering over one of the thumbnail images provides additional information about the corresponding observation and FITS file. There are five 'quick-look' images displayed at the top right which correspond to the five largest image groups in the list of 1,000 images. Click on one of them to pre-select similar images in the interface.

After making a selection, you can send all the FITS files corresponding to selected images to CARTA with a single click (follow the instructions at the top of the CARTA pop-up to see all images there and maybe use the top right icon to open the display in a new browser tab), to get a download script for those FITS files, or to open a new ASA query tab with the observations corresponding to the selected images. In the new query tab you can further filter the selected observations using all criteria available there.

Stoehr et al.

<https://almascience.eso.org/news/alma-science-archive-morphological-image-similarity-search>

Introduction

□ ALMA Science Archive morphological image similarity search

Astronomical News

DOI: 10.18727/0722-6691/5396

Morphological Image Similarity Search on the ALMA Science Archive Query Interface Using Deep Unsupervised Contrastive Representation Learning

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image similarity search has been offered in an astronomical science archive.

Introduction

The amount of astronomical data is growing exponentially (for example, Stoehr, 2019) resulting in an exponential increase of data available per astronomer. No longer data but now astronomers are becoming — or have already become — the rare resource in astronomy (Stoehr et al., 2015). For science archives like the

learning without using human classification (labels). Recently, however, a breakthrough has been achieved such that contrastive unsupervised methods perform as well as, or even better than, supervised methods. Such methods have already been applied successfully to astrophysics. For a summary see Huertas-Company et al. (2023).

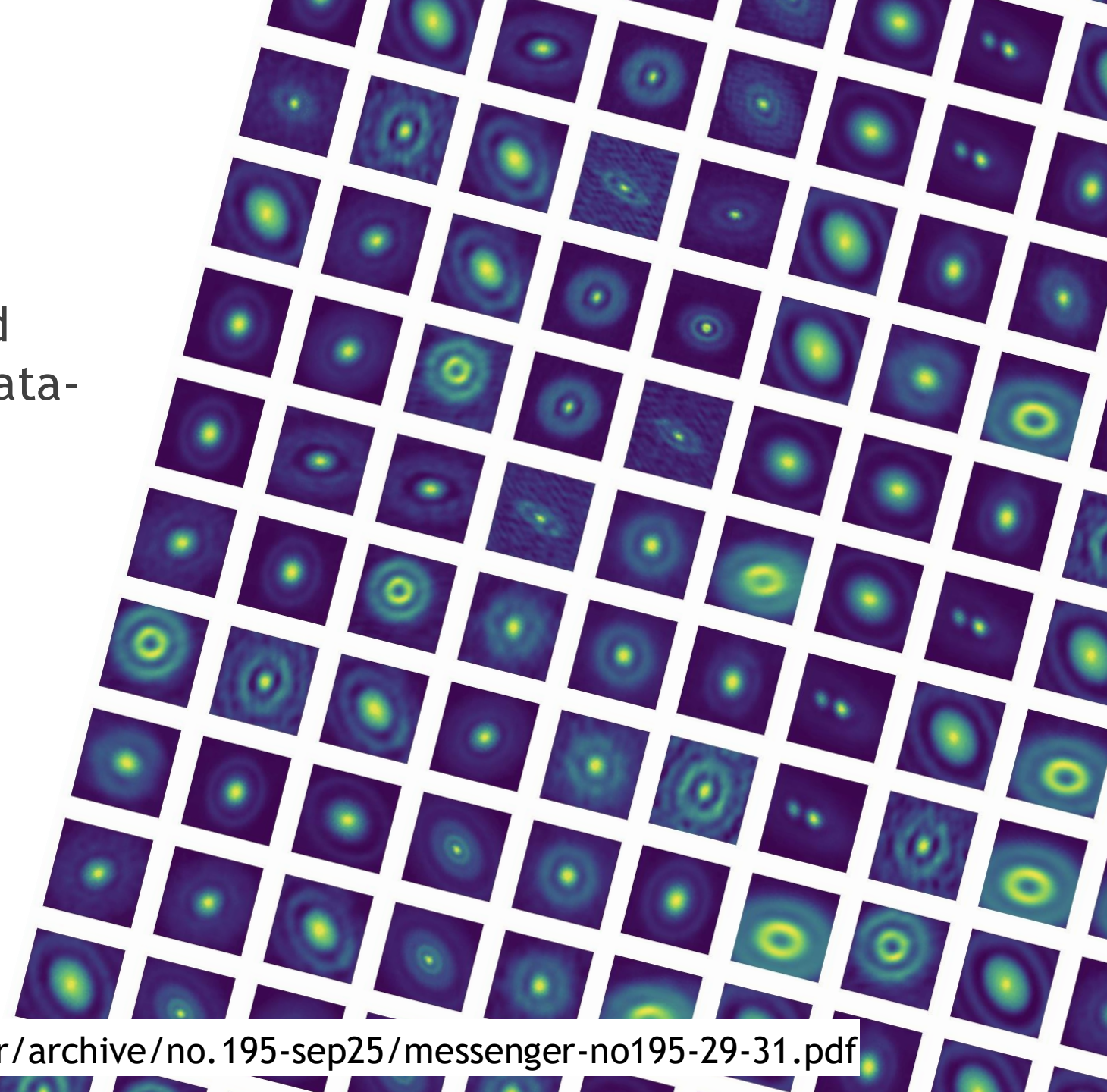
Here, we use the SimCLR algorithm (Chen et al., 2020) in the implementation made by da Costa et al. (2022)². SimCLR uses self-supervised learning by applying

Stoehr et al.

<https://almascience.eso.org/news/alma-science-archive-morphological-image-similarity-search>

Introduction

- Applied to a vast archive of 259,126 continuum images and 196,322 peak-flux images of data-cubes
- Model: A deep neural network utilizing self-supervised contrastive representation learning

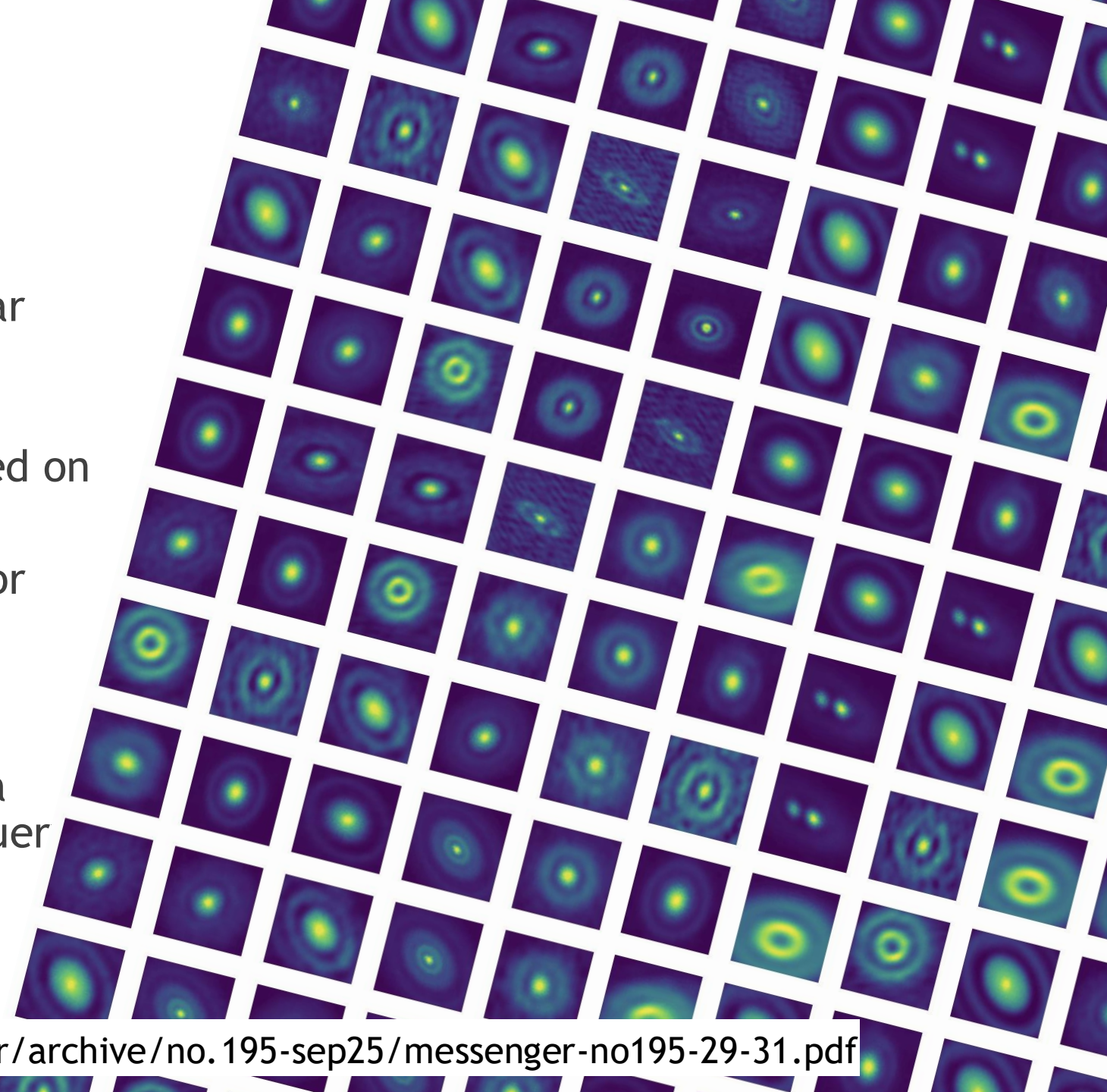


Stoehr et al.

<https://www.eso.org/sci/publications/messenger/archive/no.195-sep25/messenger-no195-29-31.pdf>

Introduction

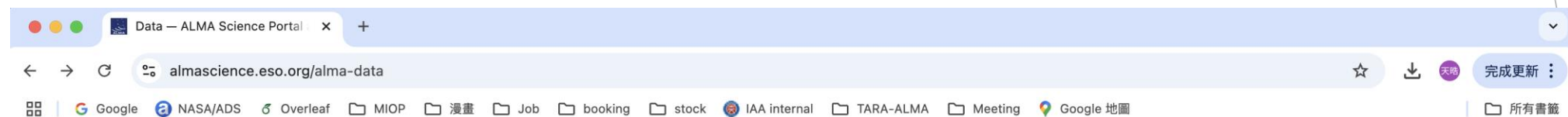
- **Search:** Click the icon next to a preview image to find 1,000 similar images
- **Refine:** Select images to instantly reorder the remaining results based on your combination
- **Explore:** Hover over thumbnails for FITS details, or click the top-right 'quick-look' images to find major groups
- **Export:** Send files to CARTA, get a download script, or open a new query tab



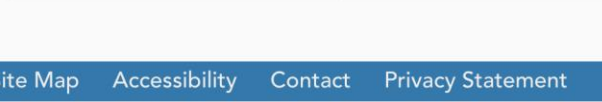
Stoehr et al.

<https://www.eso.org/sci/publications/messenger/archive/no.195-sep25/messenger-no195-29-31.pdf>

ALMA Archive



Archive	holds all public and proprietary
Large Programs	A list of Large Programs with lin
ACA Observatory Filler Programs	Observatory programs designe
Science Verification	Data from observations perform
ARI-L	The Additional Representative
EHT	The Event Horizon Telescope 2
Calibrator Catalog	A web-based user interface to
Publication Acknowledgement	



Project code	ALMA source name	Ra	Dec	Band	Cont. sens.	Frequency support	Release date	Publications	Ang. res.	Min. vel. res.	Array	Mosaic	Max. reco. scale	FOV	Scientific category	Science keyword	Int. Time	Gal. lon.	Gal. lat.
2013.1.00196.S	TW_Hya	11:01:51.875	-34:42:17.155	7	0.0620	329.56-341.01GHz	2016-06-12	2	0.648	0.108	12m	7.027	17.367	13.676	Disks and planet formati...	Disks around low-mass s...	6441.120	278.679	22.955
2011.0.00001.SV	TW_Hya	11:01:51.906	-34:42:17.021	7	0.3687	343.51-358.23GHz	2016-06-24	8	1.671	0.204	12m	10.917	16.596	16.596	Disks and planet formati...	Disks around low-mass s...	7106.400	278.679	22.955
2015.A.00005.S	TW_Hya	11:01:51.824	-34:42:17.267	6	0.0146	223.00-242.98GHz	2016-07-05	6	0.045	38.872	12m	0.613	24.992	24.992	Disks and planet formati...	Disks around low-mass s...	2431.296	278.679	22.954
2015.A.00005.S	TW_Hya	11:01:51.824	-34:42:17.267	4	0.0106	137.00-152.98GHz	2016-07-05	6	0.072	62.042	12m	0.922	40.162	40.162	Disks and planet formati...	Disks around low-mass s...	2540.160	278.679	22.954
2013.1.01397.S	TW_Hya	11:01:51.824	-34:42:17.246	7	0.1805	329.27-342.94GHz	2016-07-14	2	0.378	0.027	12m	3.642	17.325	17.325	Disks and planet formati...	Disks around low-mass s...	3144.918	278.679	22.954
2012.1.00400.S	TW_Hya	11:01:51.826	-34:42:17.242	7	0.2276	358.48-372.79GHz	2016-07-28	0	0.588	0.098	12m	7.484	15.949	15.949	Disks and planet formati...	Disks around low-mass s...	6217.762	278.679	22.954
2012.1.00422.S	TW_Hya	11:01:51.768	-34:42:17.514	7	0.0833	328.94-332.19GHz	2016-08-20	7	0.320	0.221	12m	4.457	17.652	17.652	Solar system	Solar system - Comets	1149.120	278.678	22.954
2013.1.00192.S	TW_Hya	11:01:51.824	-34:42:17.247	7	0.0508	279.45-294.99GHz	2016-09-10	0	0.362	0.129	12m	4.087	20.274	20.274	Disks and planet formati...	Disks around low-mass s...	1028.160	278.679	22.954
2013.1.00387.S	TW_Hya	11:01:51.824	-34:42:17.246	6	0.0263	226.64-244.96GHz	2016-09-16	9	0.530	0.037	12m	5.551	24.694	24.694	Disks and planet formati...	Disks around low-mass s...	2661.120	278.679	22.954

<https://almascience.eso.org/alma-data/archive/archive-query-interface>

ALMA Archive

Search

Angular Resolution: <0.1

Band: 7

Source name: HL Tau

Download

04 31 36.299 +18 11 1.41 FoV: 25.82'

VO

Molecules

Lines

Redshift

Splat details

Species: CS v=0
Name: Carbon Monosulfide
Transition: 3-2
Frequency: 146.969 GHz
Redshifted frequency: 146.969 GHz

7

H2O v=0 5(1,5)-4(2,2)
NH2D 16(10,6)-15(12,3)0a
C18O 3-2
13CO v=0 3-2
NH2D 1(0,1)-0(0,0)0s
HDO 3(3,1)-4(2,2)
C17O J=3-2
SO 3Sigma v=0 7(8)-6(7)
CS v=0 7-6
HC15N v=0 4-3
CO v=0 3-2
SiO v=0 8-7
CCH v=0 N=4-3 J=7/2-5/2, F=...

315 GHz

320 GHz

325 GHz

330 GHz

335 GHz

340 GHz

345 GHz

350 GHz

1

3

4

5

6

7

8

9

10

Observations (5)

Projects (4)

Publications (54)

	Project code	ALMA source name	RA	h:m:s	Dec	d:m:s	Band	Cont.sens. mJy/beam	Frequency support	Release date	Publication	Ang.res. arcsec	Min.vel.res. km/s	Array	Mosaic	Max.reco.scale arcsec	FOV
	2011.0.00015.SV	HL_Tau	04:31:38.426	+18:13:57.047	7		0.0357	335.498..351.486 GHz	2016-06-24	33	0.020	26.654	12m	1.719	16.953		
	2017.1.01178.S	HL_Tau	04:31:38.425	+18:13:57.242	7		0.0310	320.991..336.737 GHz	2019-02-22	5	0.038	0.263	12m	0.763	17.706		
	2016.1.00138.S	L1551IRS5	04:31:34.140	+18:08:05.10	7		0.0763	329.096..343.117 GHz	2019-05-09	11	0.083	0.214	12m	2.236	17.325		
	2017.1.01178.S	HL_Tau	04:31:38.425	+18:13:57.242	7		0.0265	311.062..325.387 GHz	2021-02-12	5	0.082	0.260	12m	1.291	18.298		
	2019.1.01051.S	HL_Tau	04:31:38.449	+18:13:57.179	7		0.0239	335.519..351.454 GHz	2023-07-26	6	0.023	53.612	12m	0.804	16.957		

Download/view the data

ALMA Archive

Angular Resolution: <0.1

Band: 7

Source name: HL Tau

Download

04 31 36.299 +18 11 1.41 FoV: 25.82'

VO

Molecules

Lines

Redshift 0 estimated

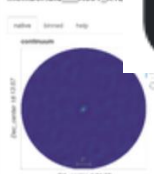
Previews for HL_Tau

ALMA

README

Combined ci

member.uid_A001_X12



Observation



lz, XX YY



[member.uid_A001_X1284_X1742.HL_Tau_sci.spw25_27_29_31.cont.l.manual.pbcor.fits](#) 9 MB



Band: 7

Frequency type: line

Frequency range: 311.062..325.387

Continuum sensitivity: 0.026

Line sens. (native): 0.026 uJy/beam

Polarisations: XX YY

Array: 12m

























ALMA Archive

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Open legacy Request Handler

Project (1)

Group ObsUniSet (1)

Member ObsUniSet (1)

Source (1)

Collection (1)

Array (1)

File type (9)

File class (12)

Select all

Readme

Product tar

Auxiliary tar

Raw tgz

Raw (semipass) tgz

External tar

	Name		Size	↑ Project	↑ GOUS
☐	uid_A002_Xdff8	(auxiliary, qa)	30 KB	2017.1.01178.S	uid://A001/X128
☐	member.uid_A001_X1284_X1742.calimage.product.rename.txt	(auxiliary, admit)	77 KB	2017.1.01178.S	uid://A001/X128
☒	2017.1.01178.S_uid_A001_X1284_X1742.HL_Tau_sci.spw25.cube.l.manual.pbcor.admit.native.xml	(auxiliary)	135 MB	2017.1.01178.S	uid://A001/X128
☐	member.uid_A001_X1284_X1742.HL_Tau_sci.spw25_27_29_31.cont.l.manual.pbcor.fits	(product)	9 MB	2017.1.01178.S	uid://A001/X128
☒	member.uid_A001_X1284_X1742.HL_Tau_sci.spw25.cube.l.manual.pbcor.admit.binned16.tgz	(auxiliary, admit)	4 MB	2017.1.01178.S	uid://A001/X128
☐	uid_A002_Xdff8c8_X3ffc_qa2_part3.png	(auxiliary, qa)	6 MB	2017.1.01178.S	uid://A001/X128
☐	member.uid_A001_X1284_X1742.calimage.product.rename.txt	(auxiliary, script)	5 KB	2017.1.01178.S	uid://A001/X128
☐	member.uid_A001_X1284_X1742.scriptForPI.py	(auxiliary, script)	20 KB	2017.1.01178.S	uid://A001/X128
☒	member.uid_A001_X1284_X1742.HL_Tau_sci.spw25_27_29_31.cont.l.manual.pbcor.admit.tgz	(auxiliary, admit)	1 MB	2017.1.01178.S	uid://A001/X128



Band: 7

Array: 12m

Find This icon

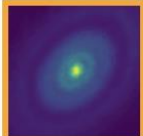
ALMA Archive

Image Morphology Similarity Search

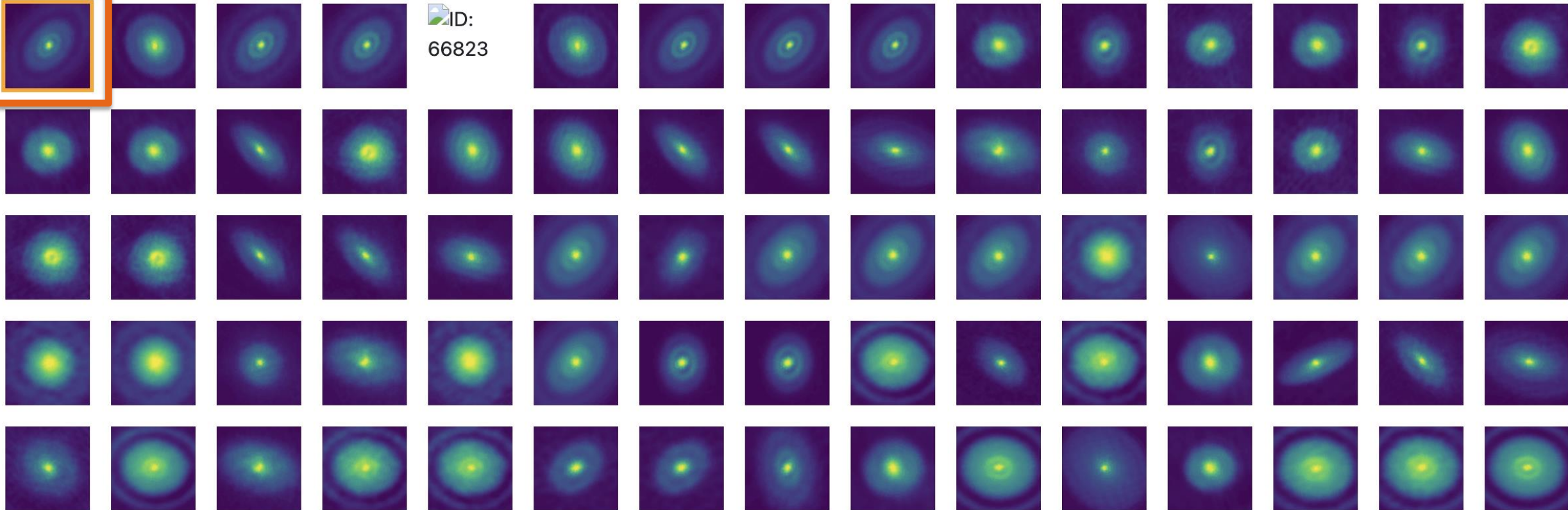
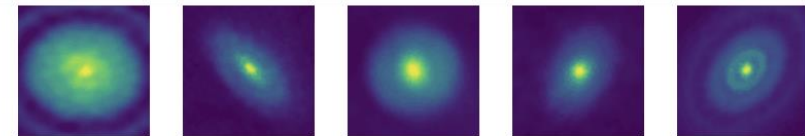
Five major types of categories

member.uid: A001_X1284_X1742_HL_Tau_sci_snw25_27_29_31.cont.l.manual.pbcor.fits

The chosen target image



ID:
66823

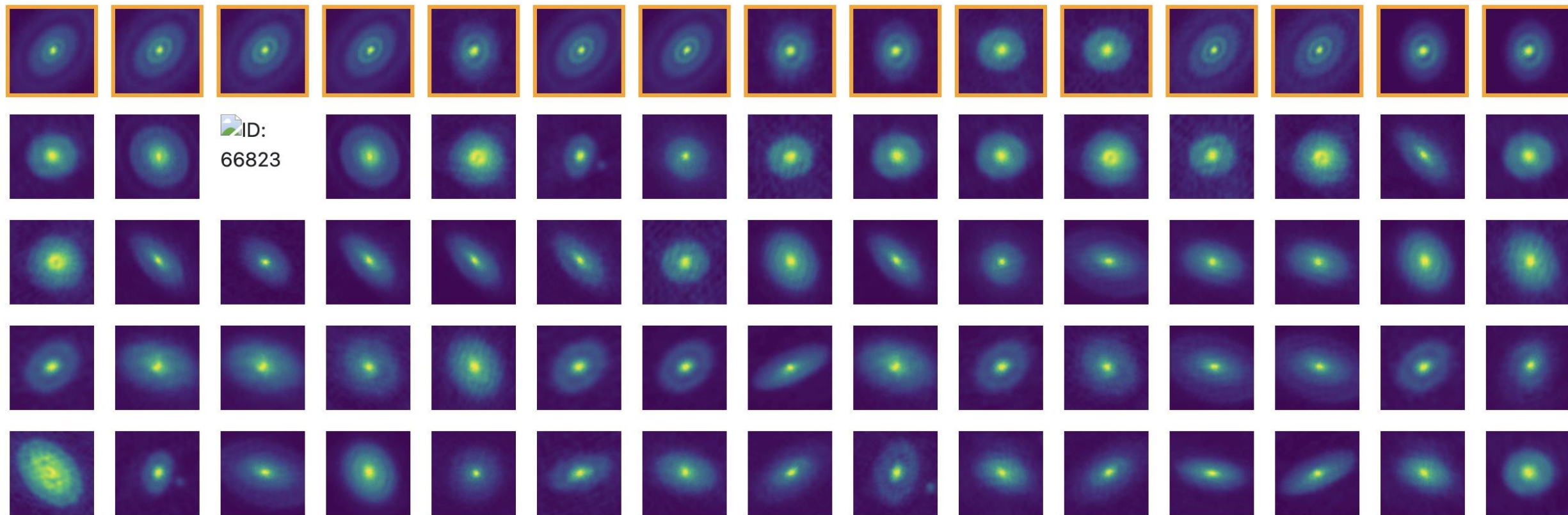


ALMA Archive

Image Morphology Similarity Search

Quickly select a group

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ALMA Archive

Create download script

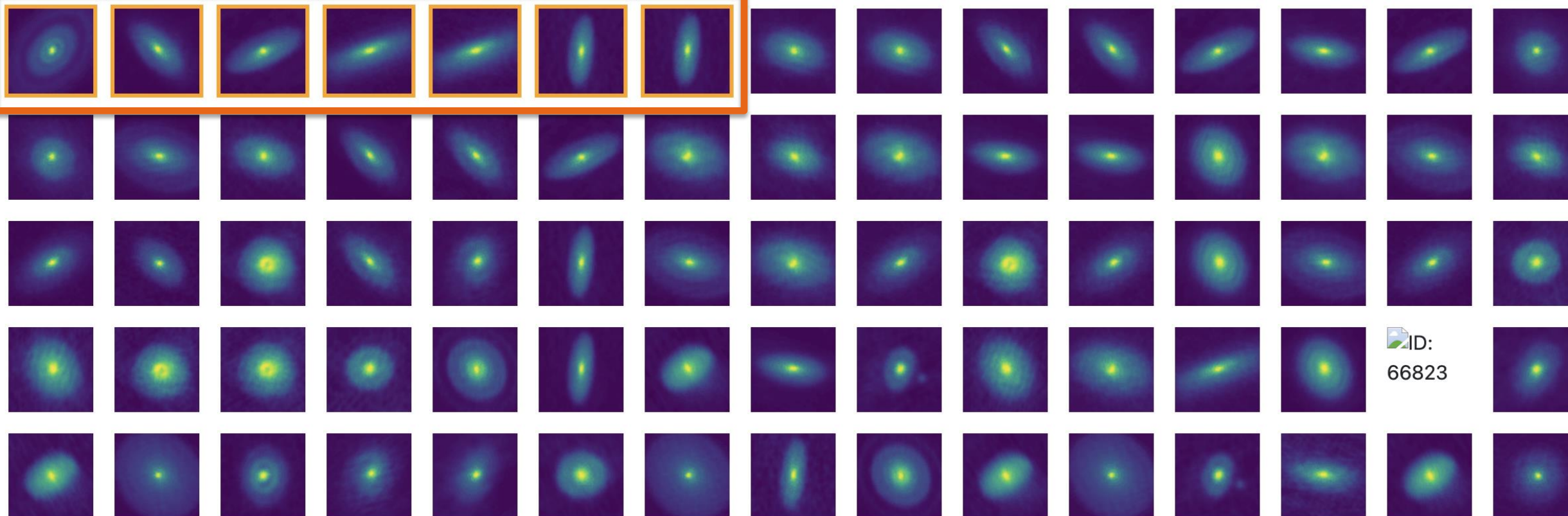
Image Morphology Similarity Search



Automatic reordering

member.uid__A001_X1284_Y1742_HL_Tau_csi_cpw25_27_29_31_cent.l.manual.pbcor.fits

Select multiple targets



ALMA Archive

Image Morphology Similarity Search

member.uid__A001_X1284_X1742.HL_Tau_sci.spw25_27_29_31.cont.l.manual.pbcor.fits

Observation details

Image id: 162108

Source: GW_Ori

Category: Disks and planet formation

Keywords: Disks around low-mass stars

Frequency: 231.55 - 233.42 GHz

Project: 2021.1.01661.S

Member OUS: uid://A001/X158f/Xe7

File: member.uid__A001_X158f_Xe7.GW_Ori_sci.spw31.mfs.l.pbcor.fits

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Stop your cursor on
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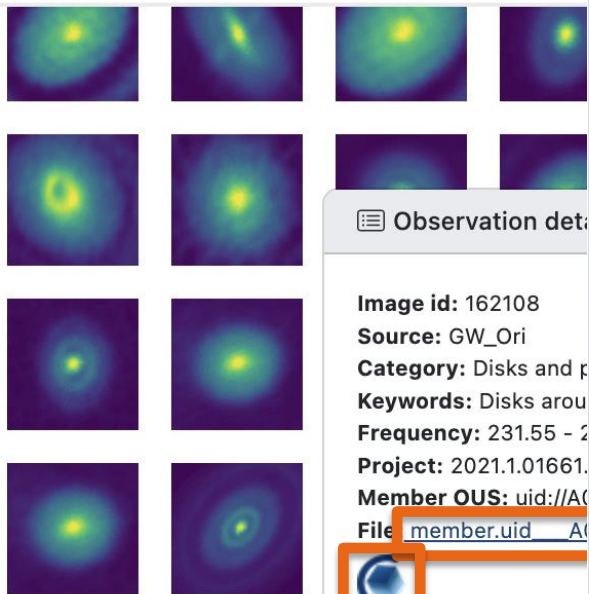
ID:
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66823

ALMA Archive

Image Morphology Similarity Search

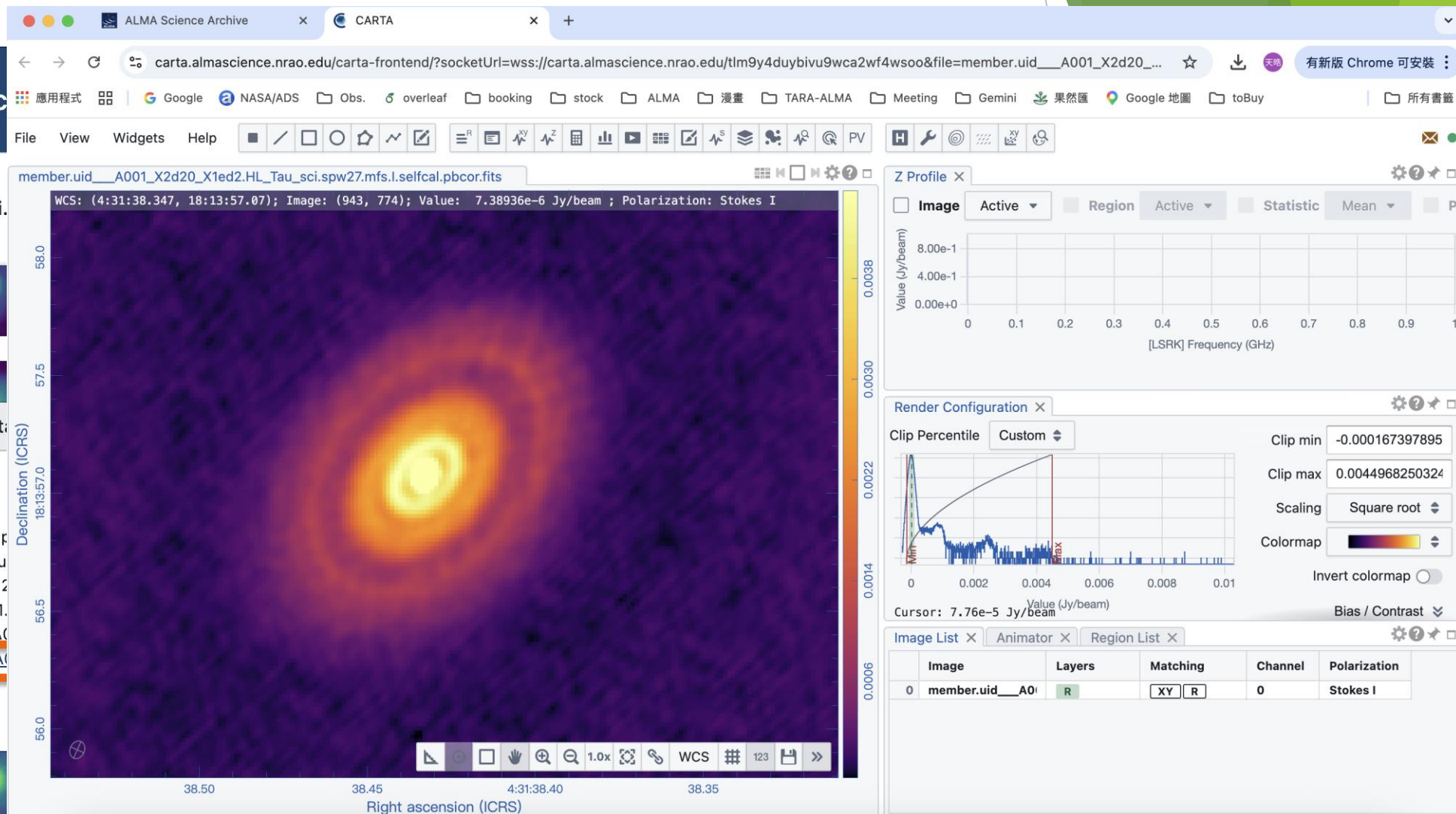
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Observation details

Image id: 162108
Source: GW_Ori
Category: Disks and protoplanets
Keywords: Disks around stars
Frequency: 231.55 - 232.00 GHz
Project: 2021.1.01661
Member OUS: uid://ALMA/...
File: member.uid__A001_X1284_X1742.HL_Tau_sci.

Open in CARTA

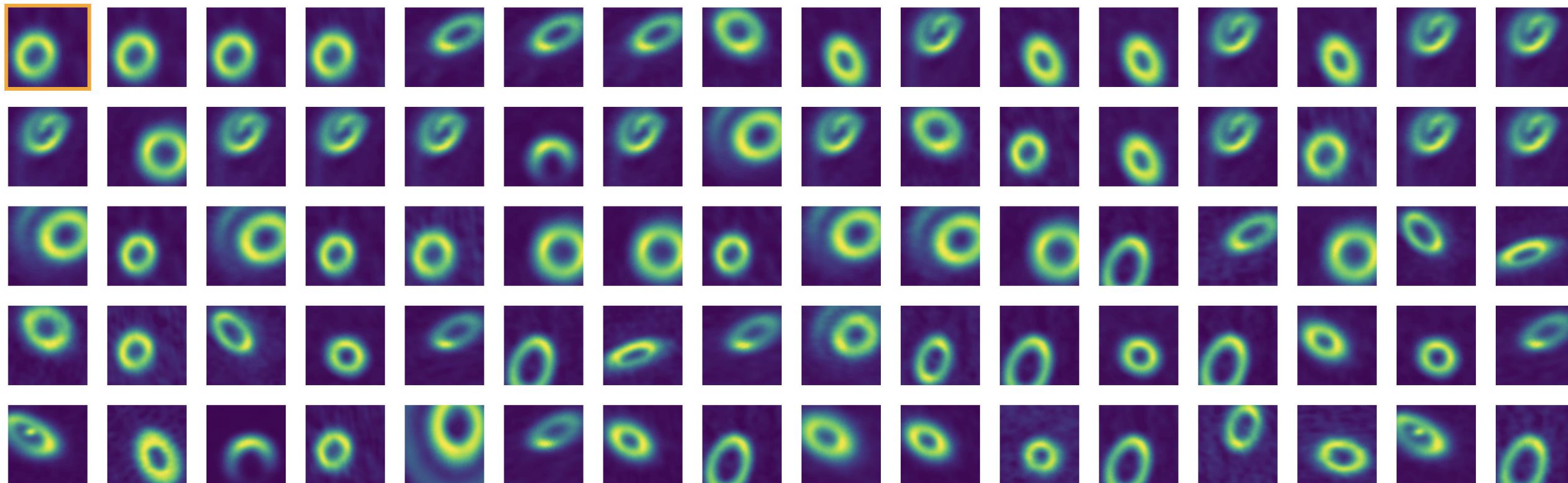
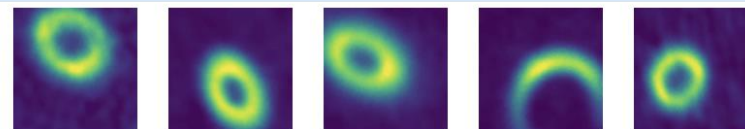


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Image Morphology Similarity Search



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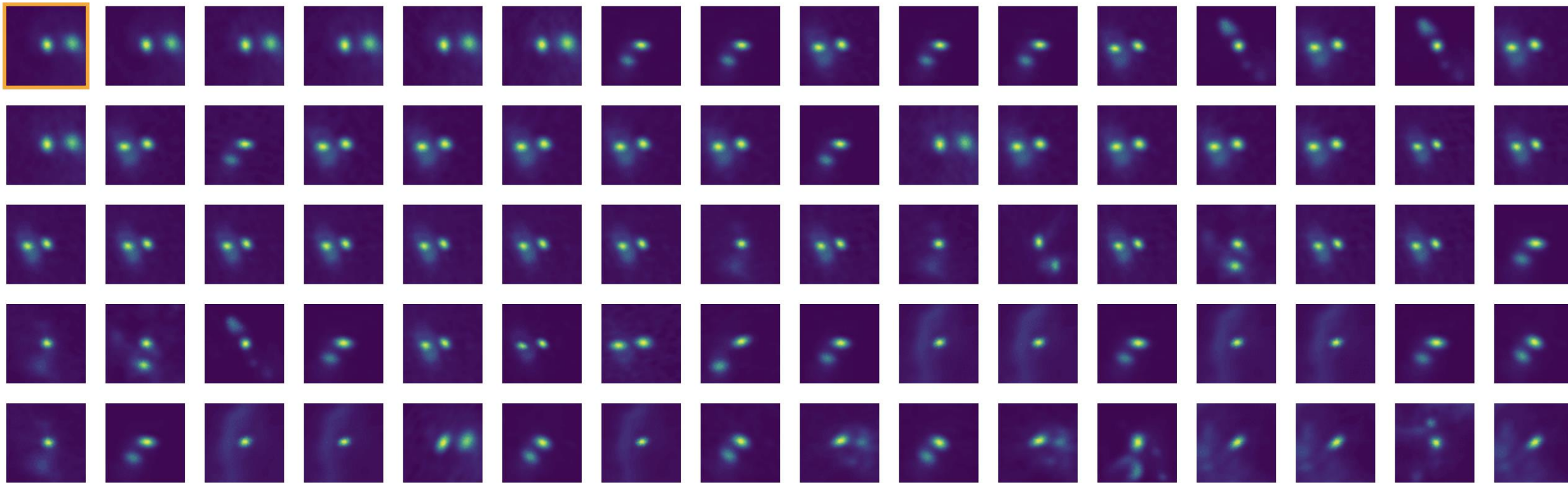
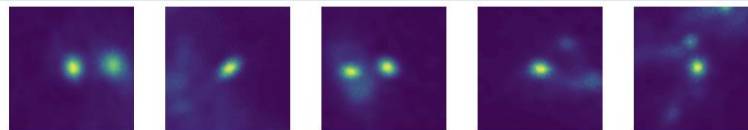


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- Find your favorite source or randomly pick one
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ex. [XXXX.cont.l.pbcor.fits](#)
- Explore the Similarity
- Can you find some similar target?

Thanks for your attention