

An Introduction to ALMA

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A large, dark, segmented radio telescope dish is shown against a clear blue sky. The dish is composed of many triangular panels. A complex metal support structure is visible on the right side, holding up the dish. The overall scene is a low-angle shot looking up at the telescope.

ALMA (the Atacama Large Millimeter/submillimeter Array) is the world's best millimetre/submillimetre telescope.

The telescope, located in Chile, is designed to observe at 0.32–9.5 mm (31–950 GHz).

The primary emission sources it detects are:

- Thermal (modified blackbody) dust continuum emission
- Molecular spectral line emission
- Free-free continuum emission.

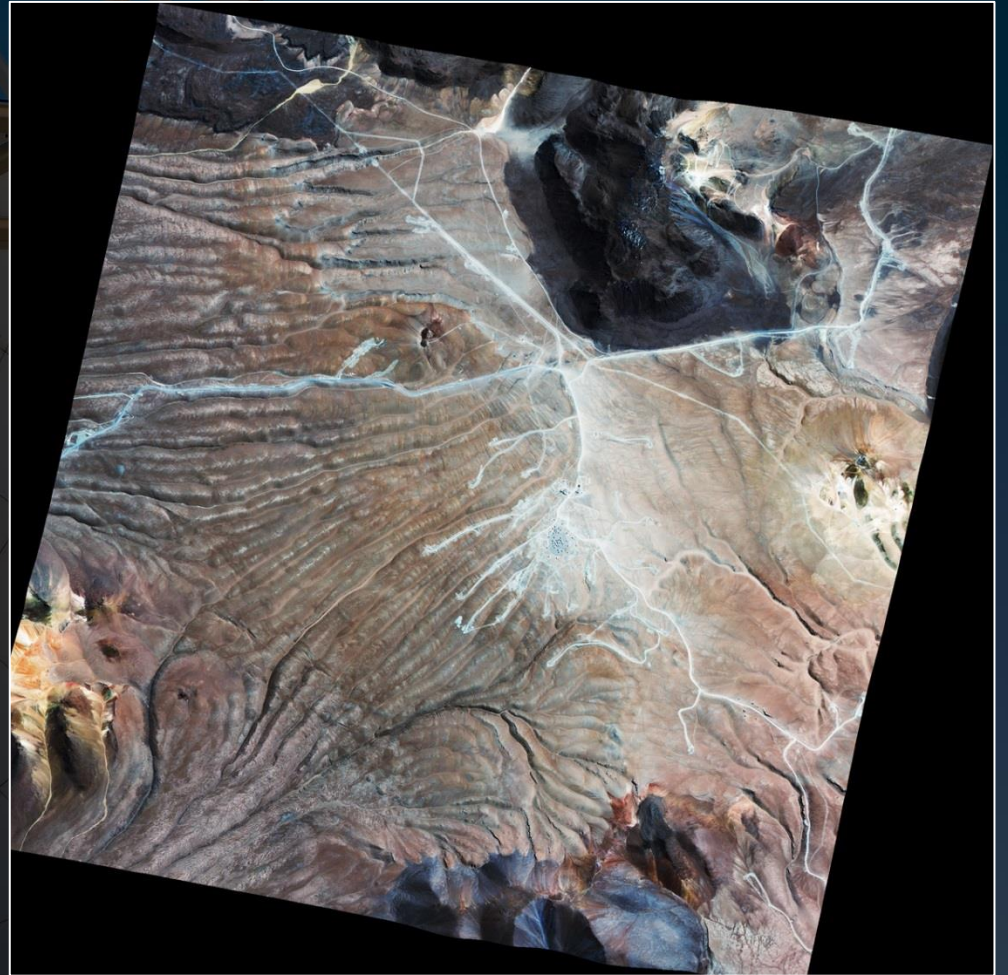


Some of the science performed with ALMA includes:

- Detecting dust emission from high-redshift galaxies (up to $z=10$)
- Using CO to measure redshifts for distant galaxies
- Imaging molecular gas and dust in nearby galaxies
- Examining the formation of protostellar objects in molecular clouds
- Identifying the chemical composition of molecular gas around protostellar objects
- Resolving protoplanetary disks
- Observing the formation of molecules and dust grains around evolved stars and supernovae
- Studying the physics of the Sun

ALMA is located in the Atacama Desert, a high-altitude desert in Chile.

Because the air is cold and dry, the site is ideal for observing in submillimetre and millimetre bands.



(Credit: Aerophotogrammetry Service, Chilean Air Force)

The Array Operations Site (AOS) is located at an elevation of 5000 m.

Access to the site is highly restricted, even for people working with the observatory.



(Credit: ALMA (ESO/NAOJ/NRAO)/A. Caproni (ESO))

The Array Operations Site (AOS) is located at an elevation of 5000 m.

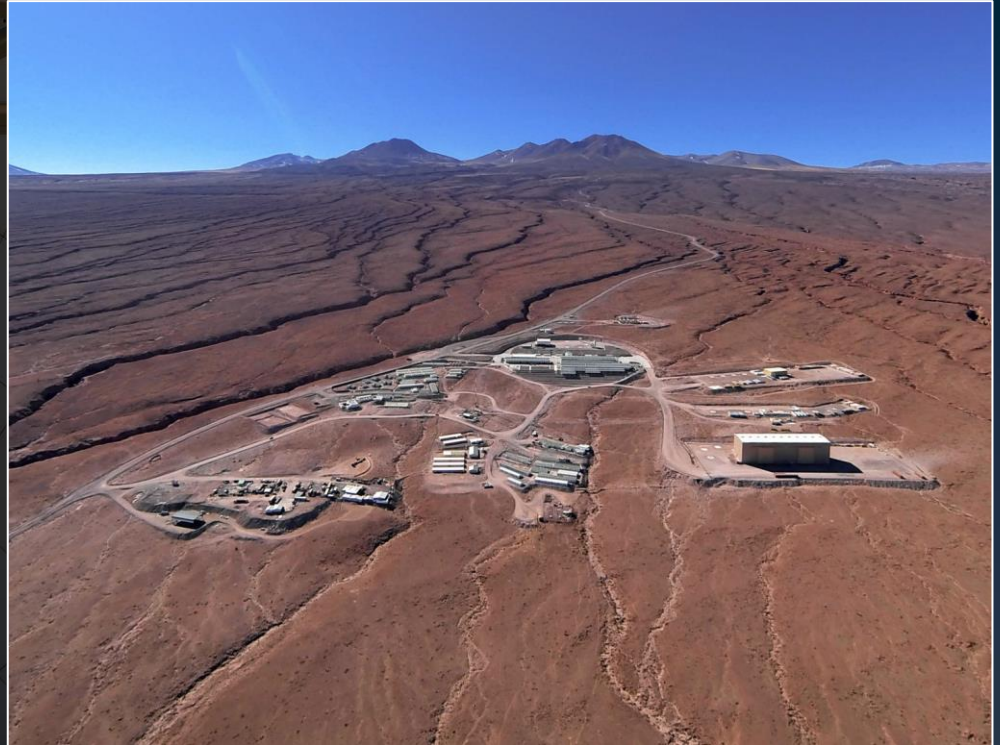
Access to the site is highly restricted, even for people working with the observatory.



(Credit: ESO/S. Fandango)

Workshops for the telescope are located at the Observation Support Facility (OSF) at an elevation of 2900 m.

Public tours of the site are available.



(Credit: ESO)

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(Credit: ALMA (ESO/NAOJ/NRAO), W. Garnier (ALMA). Acknowledgment: General Dynamics C4 Systems)

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(Credit: ESO)

ALMA operations are managed from the Joint ALMA Office on the European Southern Observatory campus in Santiago.

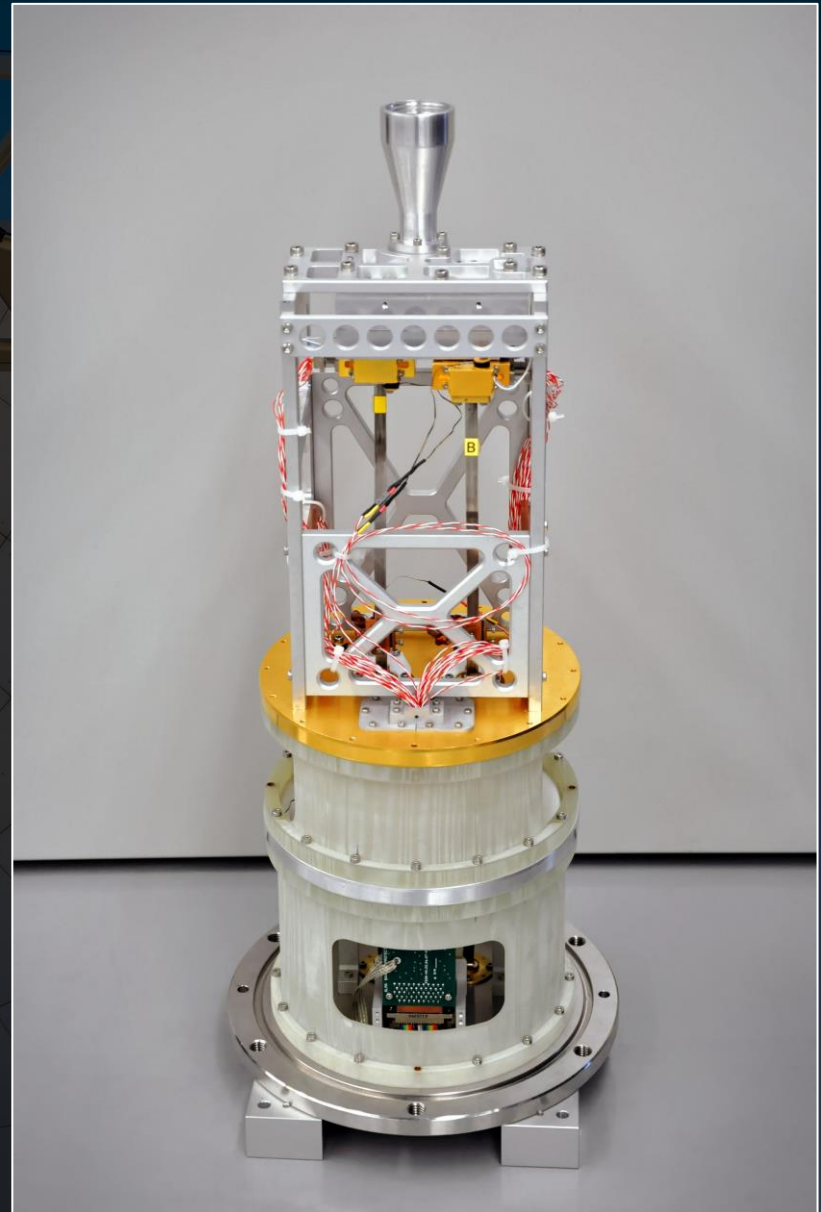


(Credit: ESO & ALMA (ESO/NAOJ/NRAO))

ALMA uses multiple sets of heterodyne receivers.

Currently, 8 bands are available.

The data are initially processed through a couple of large correlators located at the AOS.

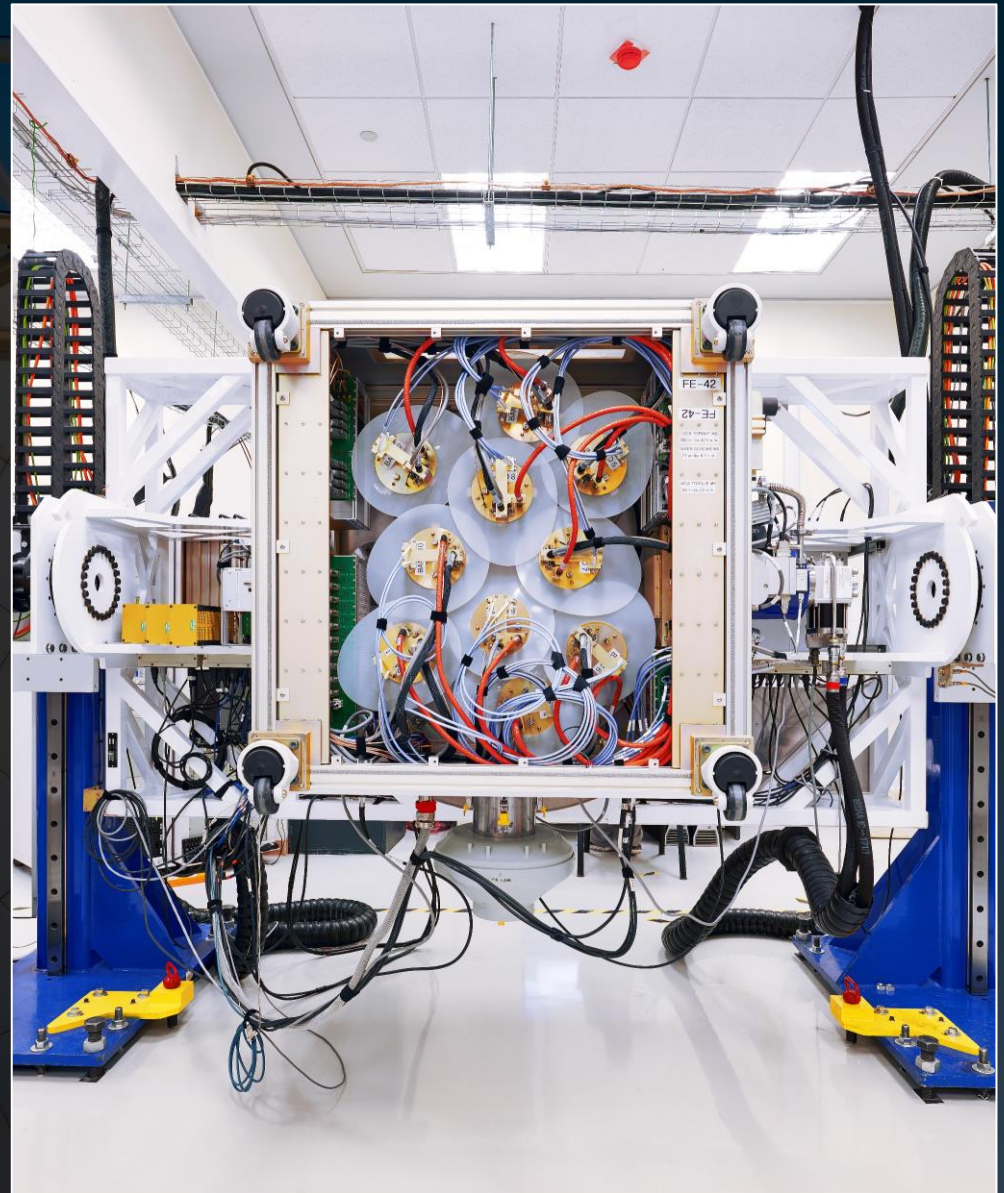


(Credit: ASIAA/NAOJ/ESO/S. Guisard (www.eso.org/~sguisard))

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(Credit: Enrico Sacchetti/ESO)

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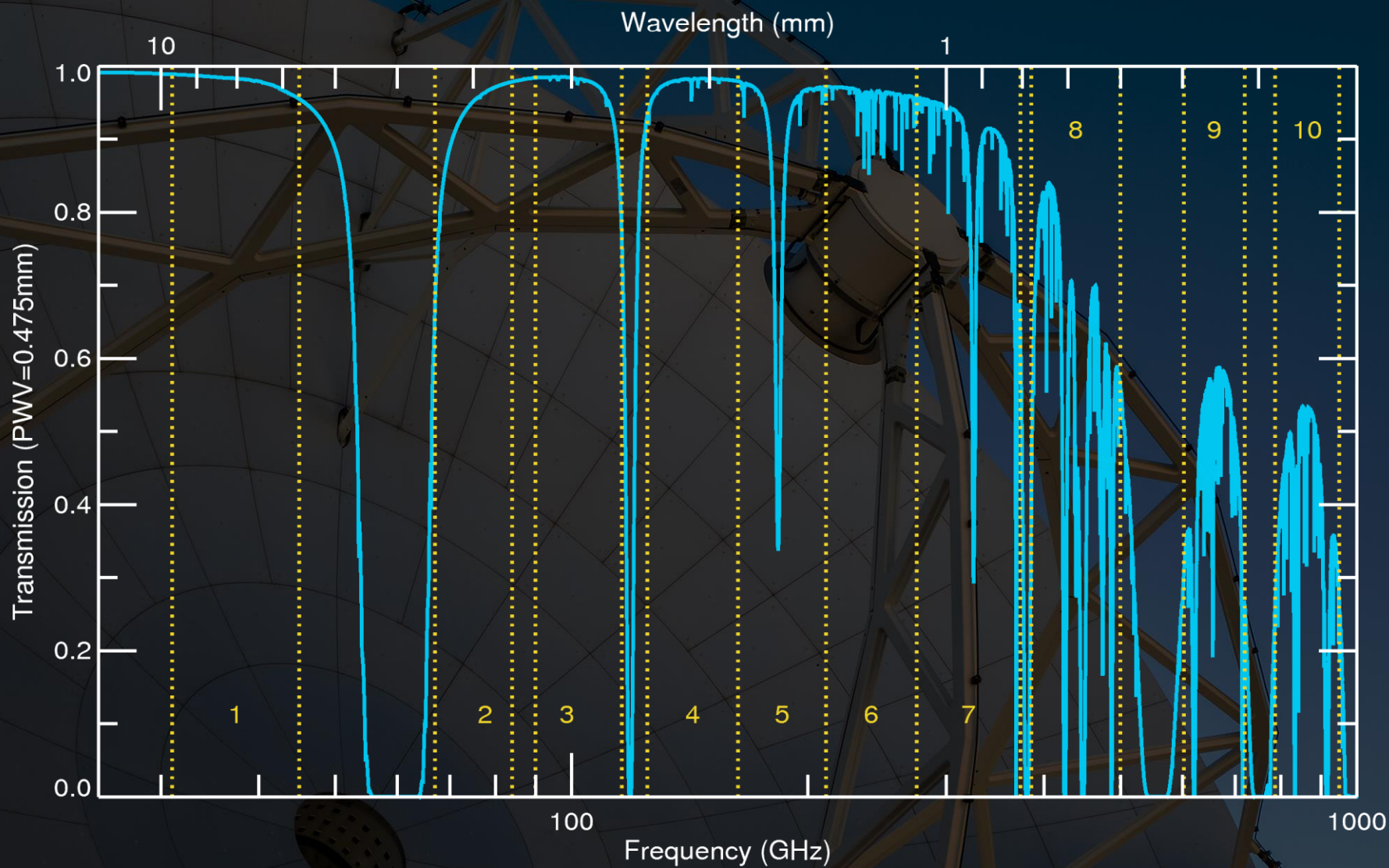
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(Credit: ESO/M. Alexander)

Band	Frequency (GHz)	Wavelength (mm)	Primary Beam (arcsec)	Angular Resolution (arcsec)	
				Compact Configuration	Extended Configuration
3	84-116	2.6-3.6	63	3.4	0.042
4	125-163	1.8-2.4	43	2.3	0.028
5	163-211	1.4-1.9	30	1.8	0.023
6	211-275	1.1-1.4	25	1.5	0.018
7	275-373	0.80-1.09	19	1.0	0.028
8	385-500	0.60-0.78	14	0.74	0.046
9	602-720	0.42-0.50	9.2	0.52	0.033
10	787-950	0.32-0.38	7.1	0.39	0.024



ALMA has three subarrays that observe different-sized structures:

- The main array (50 antennas with 12m diameters)
- The Atacama Compact Array (12 antennas with 7m diameters)
- The total power antennas (4 antennas with 12m diameters)



(Credit: ESO)

The main (12m) array can be reconfigured in different ways to achieve different angular resolutions.

- Short baseline configurations image extended emission.
- Long baseline configurations resolve small structures.



(Credit: ESO/P.Martinez)

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(Credit: ESO)

The ACA is used to image large-scale structures that are usually resolved out by the 12m array. It can also be used as a stand-alone array when resolving structure is unimportant.

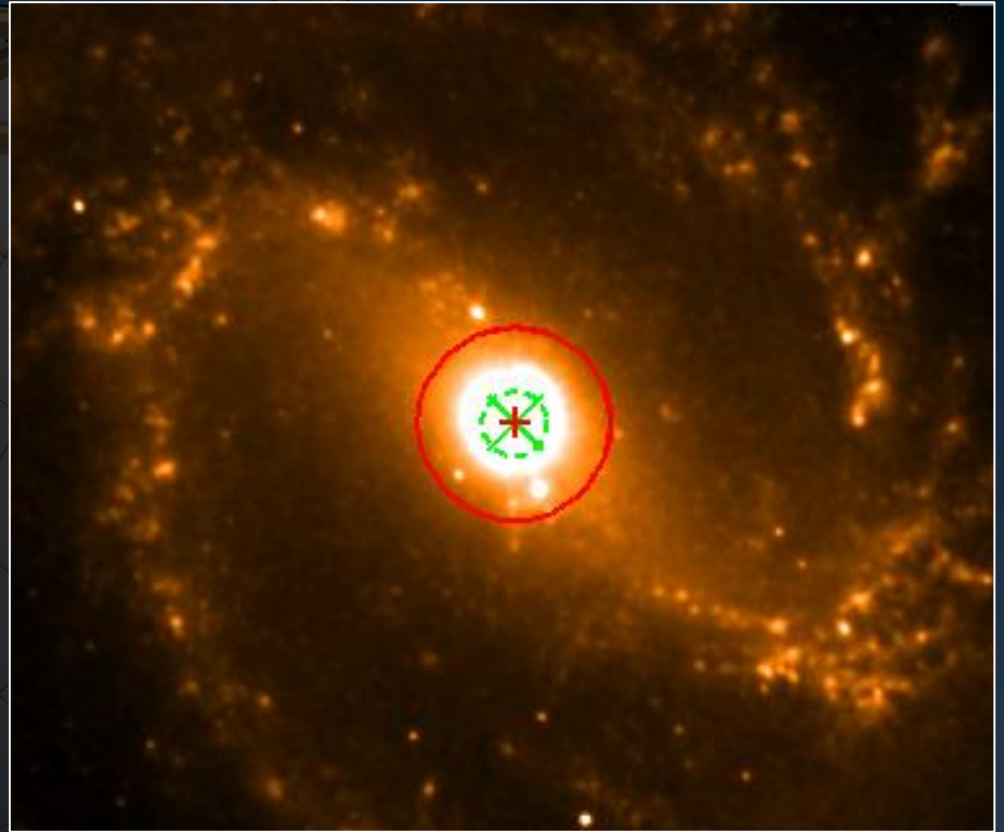


The total power antennas are used to detect large-scale line emission resolved out by both the 12m and ACA arrays. (Continuum-imaging capabilities may be added in the future.)



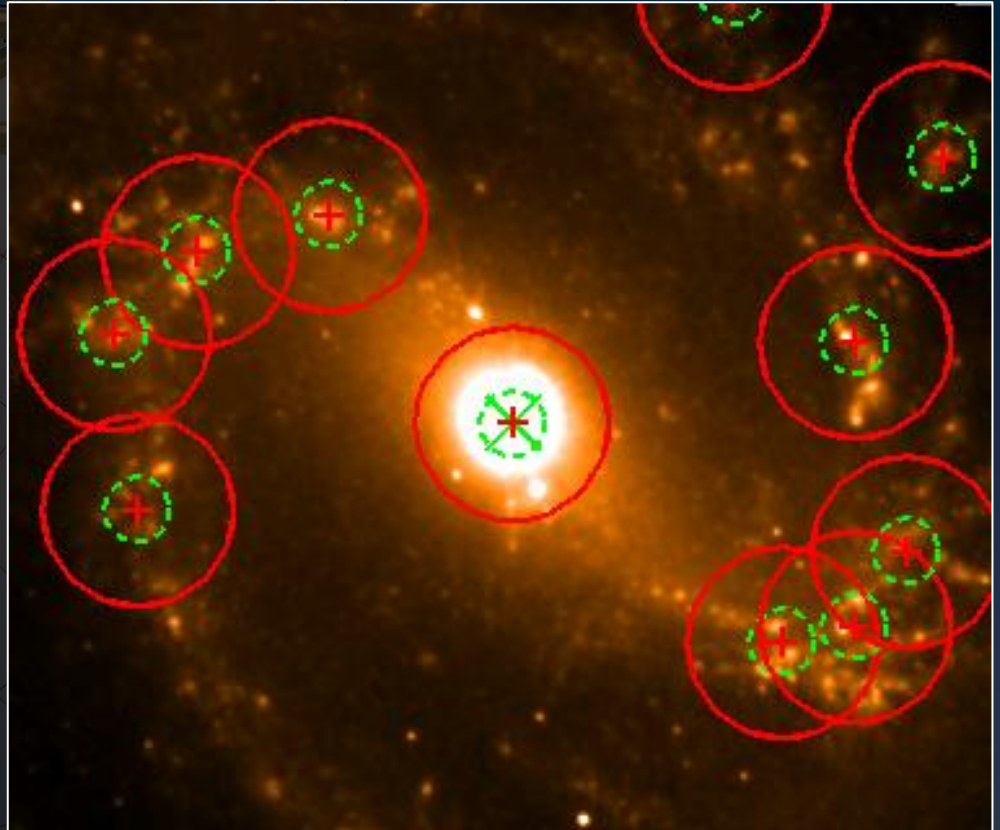
The most basic field that can be imaged by ALMA is a single pointing.

However, ALMA can also image multiple pointings as part of one set of observations or mosaic a rectangular field.



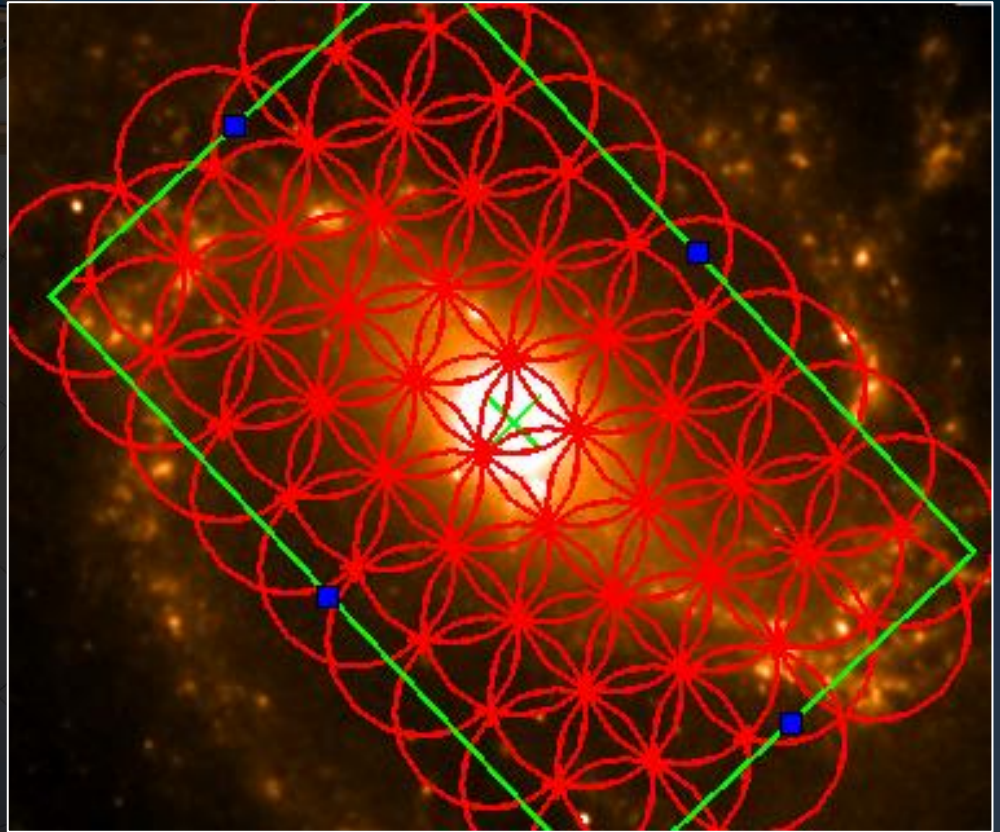
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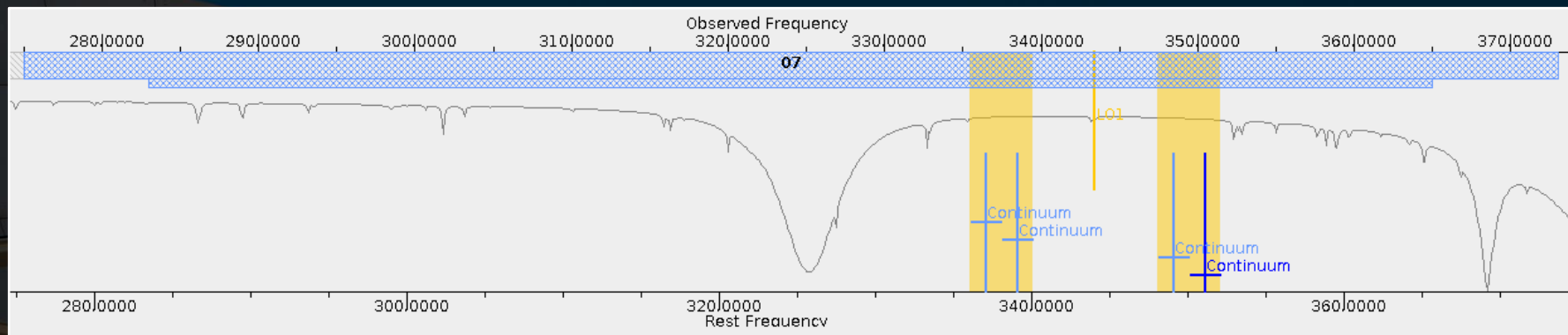
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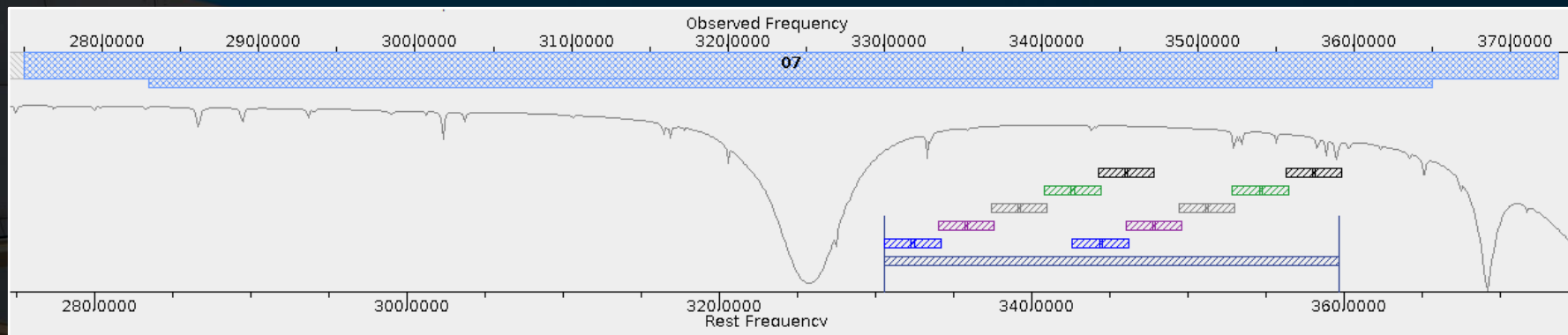


ALMA currently offers three types of spectral set-ups.

- Spectral line imaging mode
- Continuum mode
- Spectral scan mode

In all three modes, each observation is normally performed with 4 or more spectral windows (spws), with two spws on each side of a local oscillator signal (except for bands 9 and 10, where all the spws are on one side of a local oscillator).

Each spw can contain up to 3840 channels (or 4096 for the ACA).



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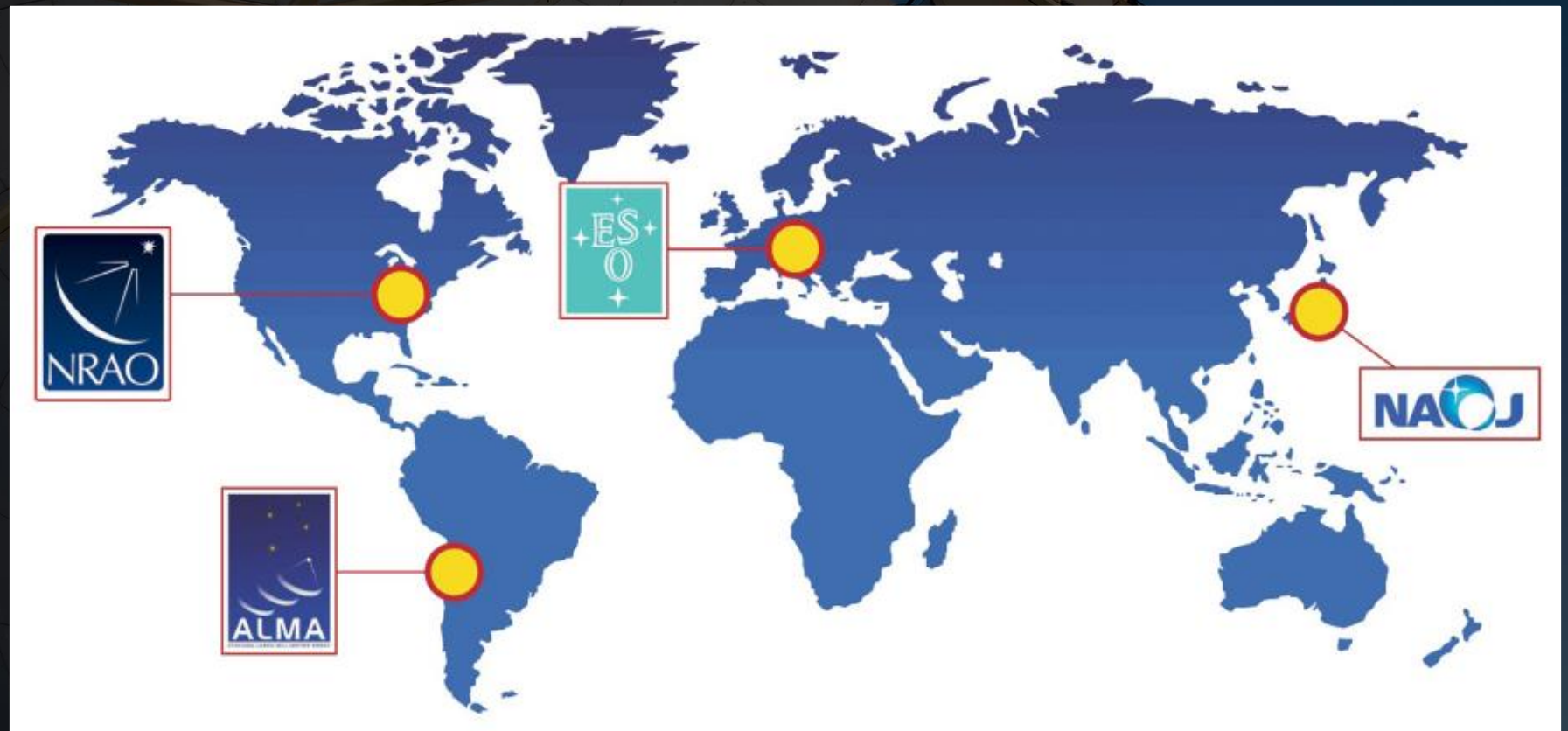
A low-angle, close-up photograph of an ALMA (Atacama Large Millimeter/submillimeter Array) telescope dish. The dish is a large, white, parabolic structure made of many smaller panels, supported by a complex metal framework. The background is a clear, deep blue sky. The lighting is bright, suggesting daytime.

ALMA has a series of other capabilities, including:

- Polarization observing modes
- VLBI observing modes (involving other telescopes)
- Solar observing modes
- Pulsar observing modes

ALMA is operated by a collaboration between North America, Europe, and East Asia. Regional activities are coordinated by ALMA Regional Centres (ARCs).

The JAO in Chile coordinates all activities.



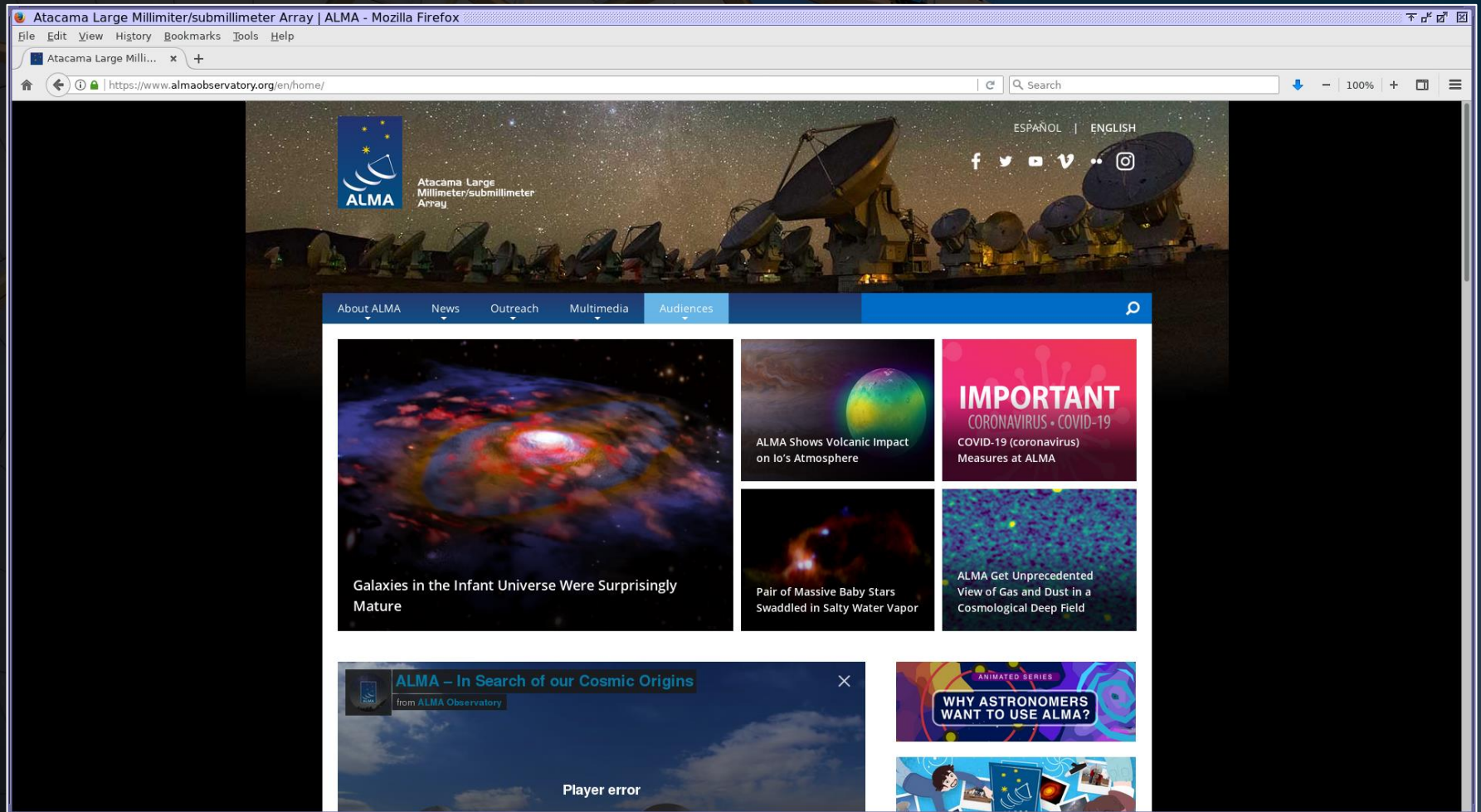
The European Southern Observatory coordinates ALMA activities in Europe.

Multiple ARC Nodes provide local user support. Staff at these nodes also participate in other support activities.

The University of Manchester hosts the ARC Node for the United Kingdom.



The ALMA website for the general public is at <http://almaobservatory.org/>.



Each ARC has a professional astronomer page. The ESO ARC webpage is at <https://almascience.eso.org/>.

ALMA Science Portal at ESO - Mozilla Firefox

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ALMA Science Portal ... x +

https://almascience.eso.org

Search

ALMA Atacama Large Millimeter/submillimeter Array in search of our Cosmic Origins

Search Site

Due to the COVID-19 outbreak, ALMA Science Operations have been suspended and the Cycle 8 Call for Proposals has been delayed until 2021 March. The start of ALMA Cycle 8 will now be 2021 October. ALMA continues to carefully monitor the evolving global situation regarding the COVID-19 pandemic and will post ALMA-related updates as News Items to the Science Portal. Apr 24, 2020 09:50 PM

About Science Proposing Observing Data Processing Tools Documentation Help

Observatory News

The First 60000 ARI-L Images are Now Available in the ALMA Science Archive
Oct 13, 2020

ALMA starts the process of recovering the telescope array
Oct 01, 2020

Release of Full Polarization ALMA Test Data
Oct 01, 2020

EU ARC News

Research Associate at the UK ARC Node
Jun 15, 2020

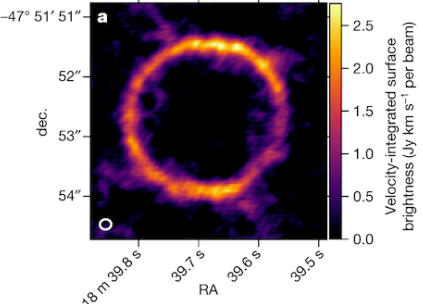
Postdoctoral Positions at the ALMA ARC node at Leiden Observatory (closed)
Dec 17, 2019

Requesting calibrated data in Europe
Apr 13, 2019

Status

Refereed publications: 2012
Last observed source: HerBS-152
Current configuration: C43-4

Science Highlight: A dynamically cold disk galaxy in the early Universe



In a recent paper, Rizzo and collaborators present an image reconstruction of a dynamically cold, highly star-forming, rotating disk in galaxy SPT-S J041839-4751.9, at redshift $z = 4.2$, which is strongly gravitationally lensed by a foreground galaxy at $z = 0.263$.

The top panel shows the emission of the 158- μm fine-structure line of ionized carbon [C II] integrated across a velocity range of 721 km s^{-1} (zeroth-moment map), as observed with ALMA. The beam size, shown as a white ellipse on the lower left corner, is $0.19'' \times 0.17''$ at a position angle of -85.22° .

The reconstructed image of the $z=4.2$ galaxy is shown in the bottom panel: it is a typical dusty starburst, with global star-forming and dust properties that are in agreement with current numerical simulations and observations. The authors also derived a rotation curve with the typical shape of nearby massive spiral galaxies, which demonstrates that at least some young galaxies are dynamically akin to those observed in the local Universe, and are not necessarily affected by extreme environments.

Site Map Accessibility Contact Privacy Statement

Region: EA EU NA

The UK ARC Node has a website at <http://www.alma.ac.uk/> that provides news and information for UK ALMA users.

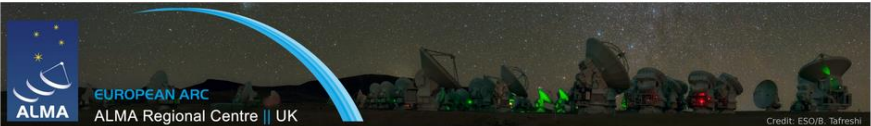
UK ALMA Regional Centre Node Homepage - Mozilla Firefox

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www.alma.ac.uk

UK ALMA Regional Centre



ALMA EUROPEAN ARC
ALMA Regional Centre || UK

Credit: ESO/B. Tafreshi

Search ...

Local Information

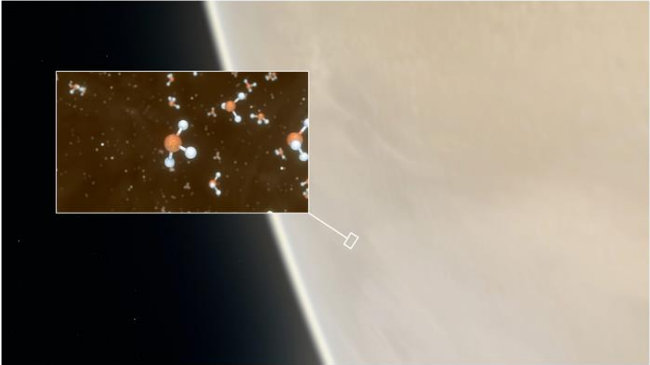
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- Publications
- Public Outreach
- Software and Tools

External Links

- ALMA Regional Centres
- ALMA Observatory
- ESO
- NAOJ
- NRAO
- Documentation
- Proposer's Guide
- Technical Handbook



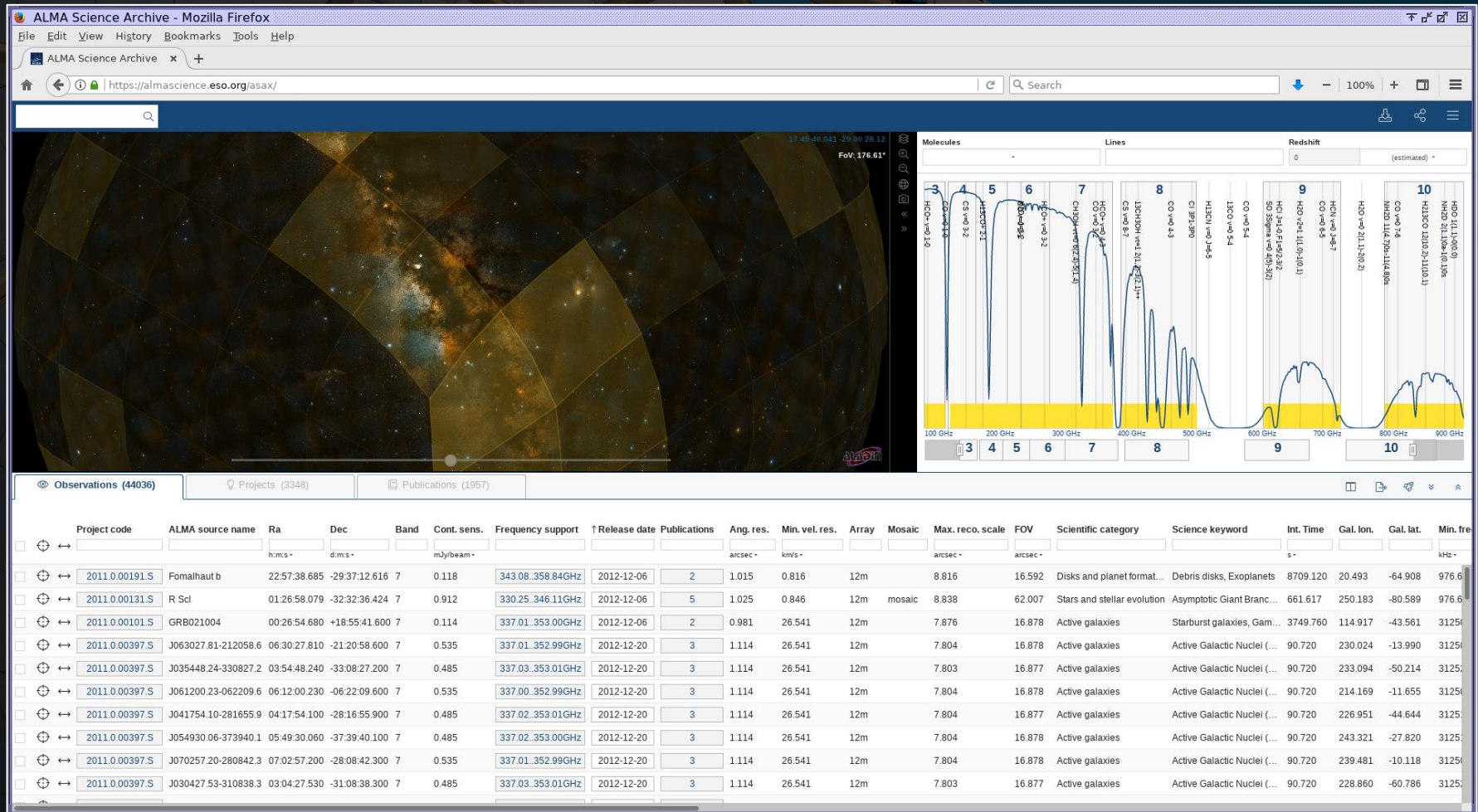
An artistic impression of the edge of Venus with an inset image showing phosphine molecules. Credit: ESO/M. Kornmesser/L. Calçada & NASA/JPL/Caltech.

ALMA starts the process of recovering the telescope array

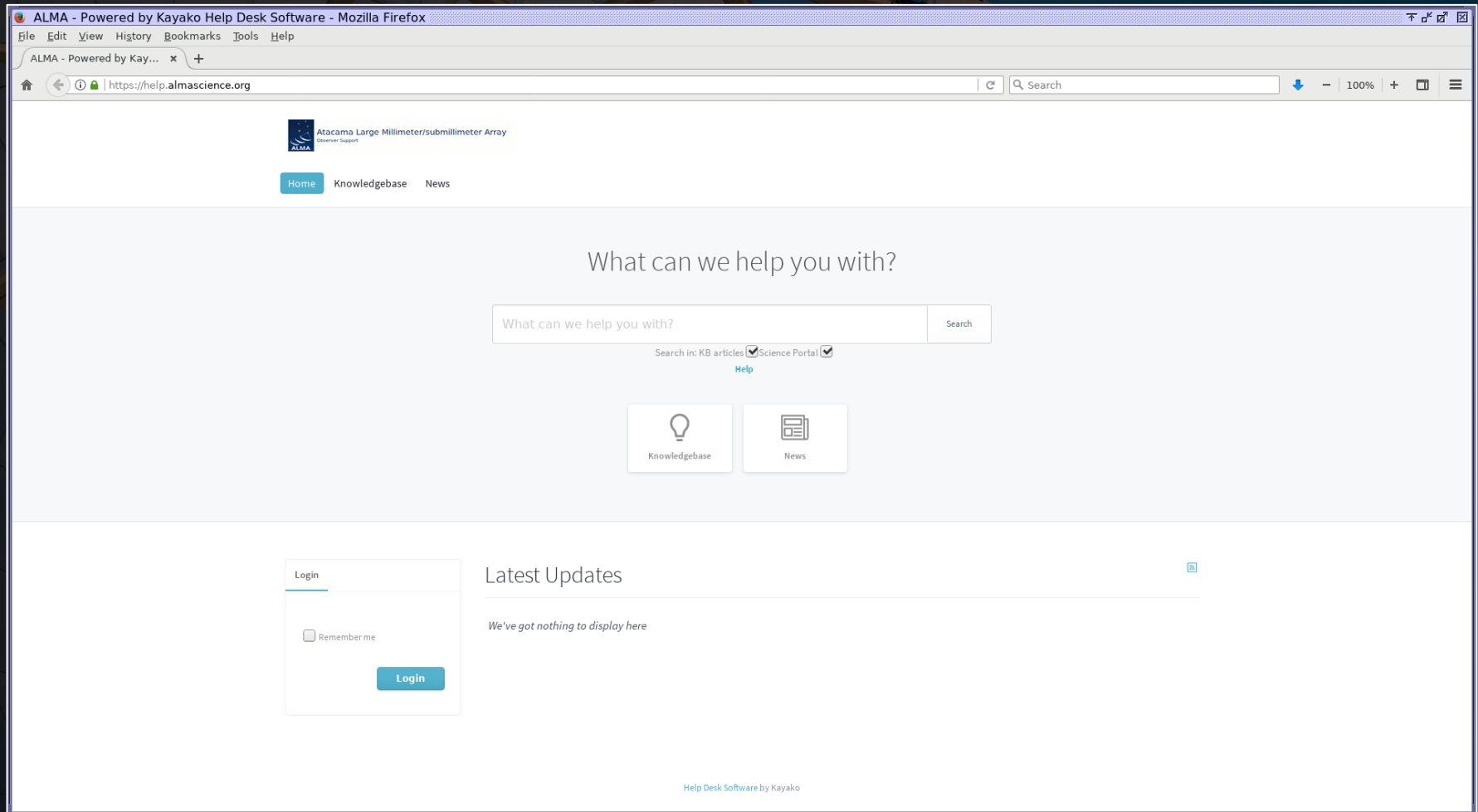
On the 1st of October, the Joint ALMA Observatory (JAO) announced that ALMA is now scheduled to begin the process of recovering the telescope array. This will begin with preparations of the ALMA Observations Support Facility (OSF, located at an elevation of 2900 m) for the return of staff and contractors. Once the OSF is operational again, the plan is to restart work at the Array Operations Site (AOS, located at an elevation of 5000 m).

The restart plan will take 80 days to reach the point where the antennas are powered up again. This means that the earliest point in time at which enough receivers are functional for science observations will be January. However, the JAO has emphasized that the exact timeline for these activities is highly uncertain and may be affected by various factors that are out of the control of JAO staff. Also, the JAO anticipates that science observations will be suspended in February for annual maintenance activities during the Altiplano winter.

Data can be downloaded from the ALMA Science Archive at <https://almascience.eso.org/asax>.



Questions related to ALMA (including about CASA) can be sent via the ALMA Helpdesk at <https://help.almascience.org/>.



The documentation website (<https://almascience.eso.org/documents-and-tools>) has three documents that are very useful references:

- Observing with ALMA – A Primer
- ALMA Proposer's Guide
- ALMA Technical Handbook

Observing with ALMA – A Primer (Cycle 8)



www.almascience.org

ALMA, an international astronomy facility, is a partnership of ESO (representing its member states), NSF (USA) and NINS (Japan), together with NRC (Canada), MOST 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.

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ALMA Cycle 8 Proposer's Guide



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Doc 8.3, ver. 1.0 | 13 Jan, 2020

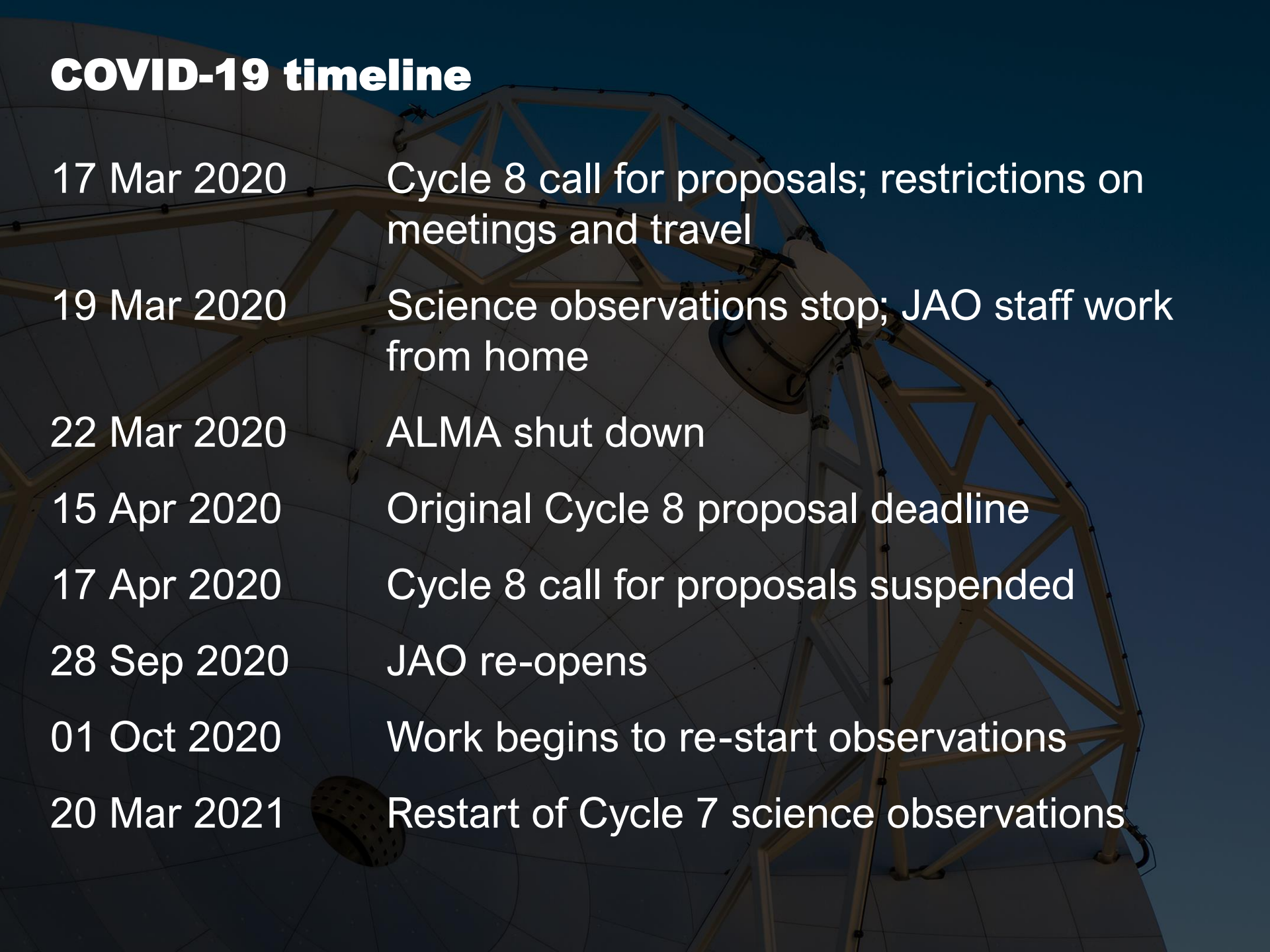
ALMA Cycle 8 Technical Handbook



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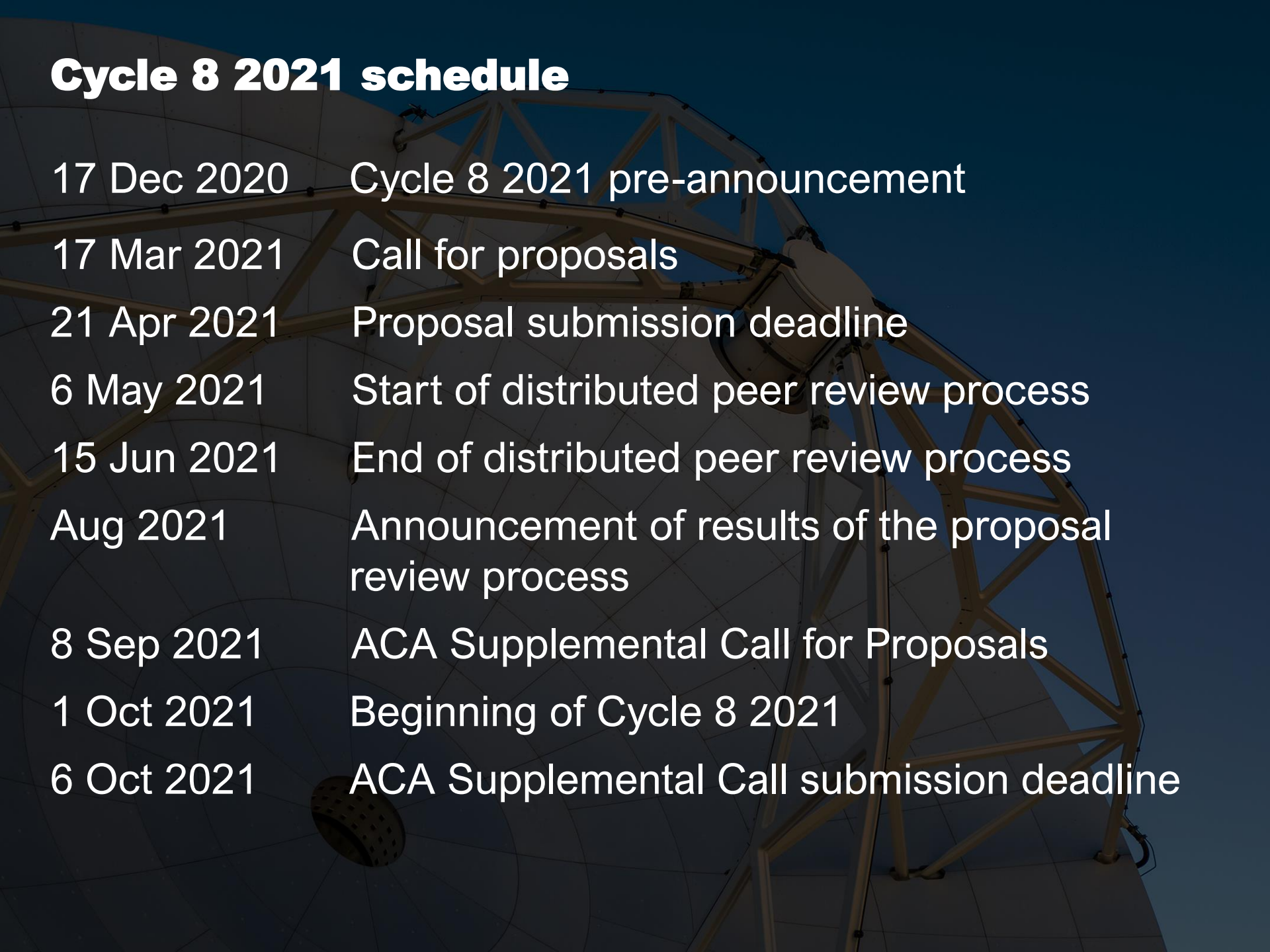
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COVID-19 timeline

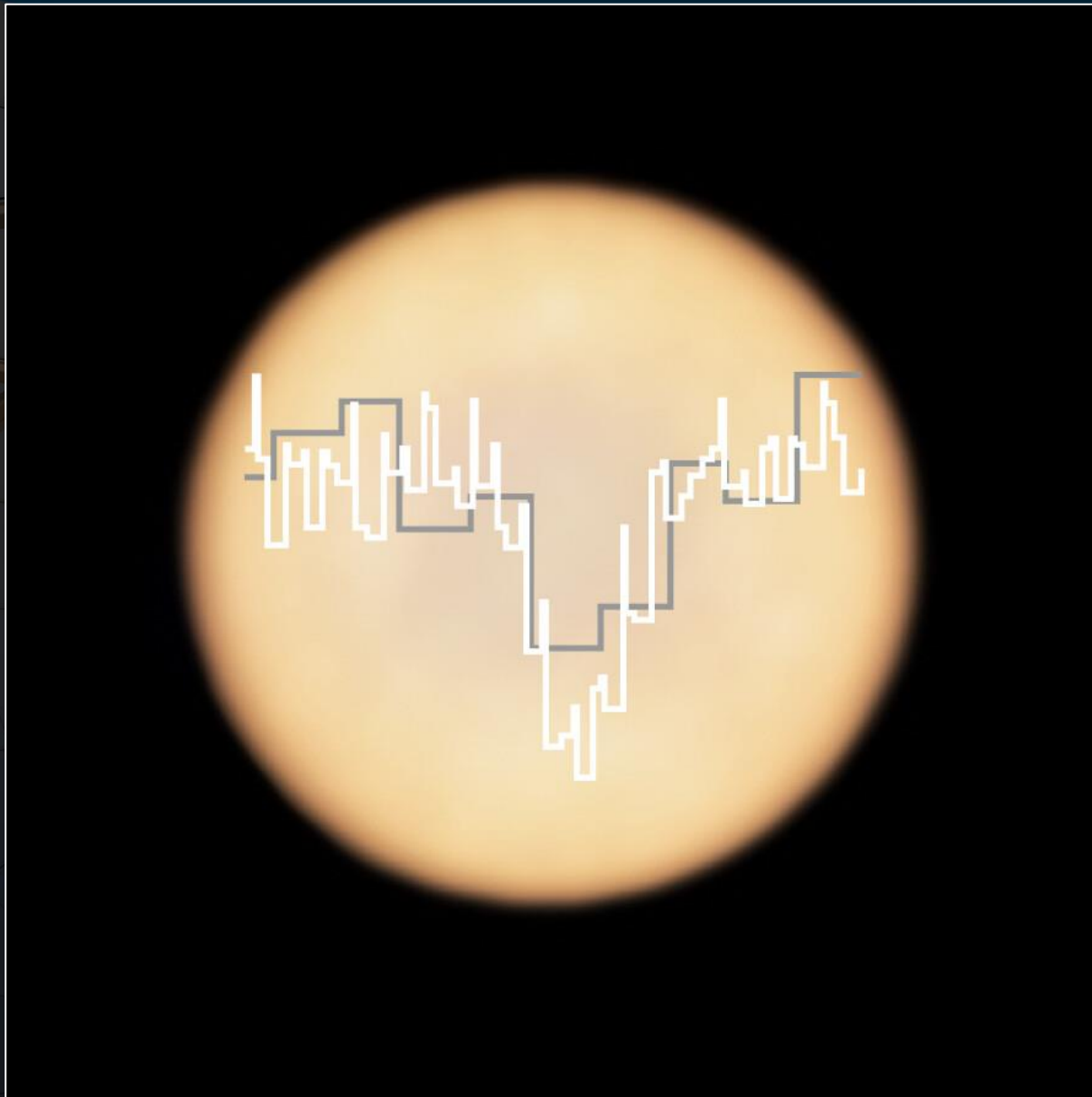


17 Mar 2020	Cycle 8 call for proposals; restrictions on meetings and travel
19 Mar 2020	Science observations stop; JAO staff work from home
22 Mar 2020	ALMA shut down
15 Apr 2020	Original Cycle 8 proposal deadline
17 Apr 2020	Cycle 8 call for proposals suspended
28 Sep 2020	JAO re-opens
01 Oct 2020	Work begins to re-start observations
20 Mar 2021	Restart of Cycle 7 science observations

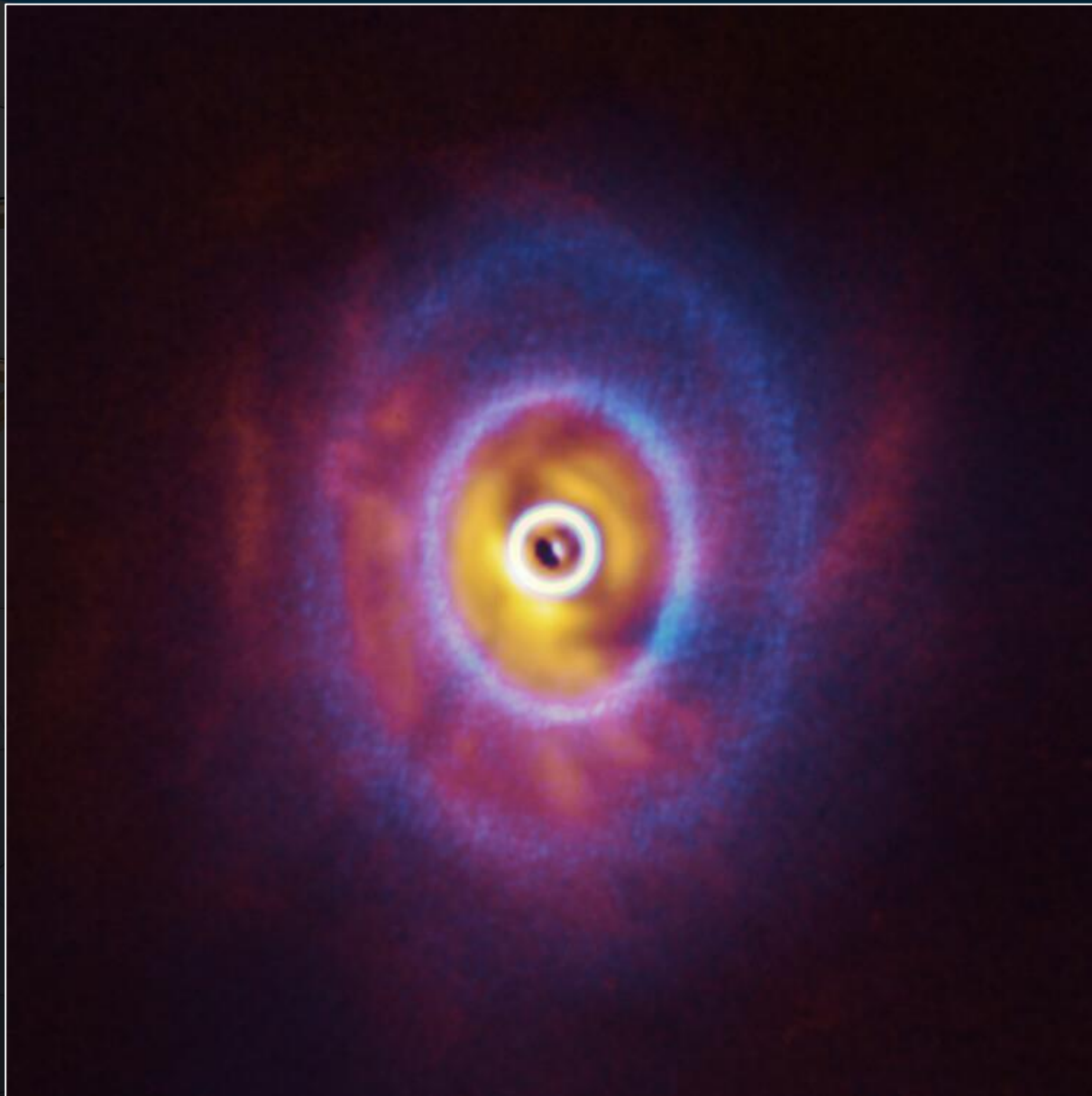
Cycle 8 2021 schedule



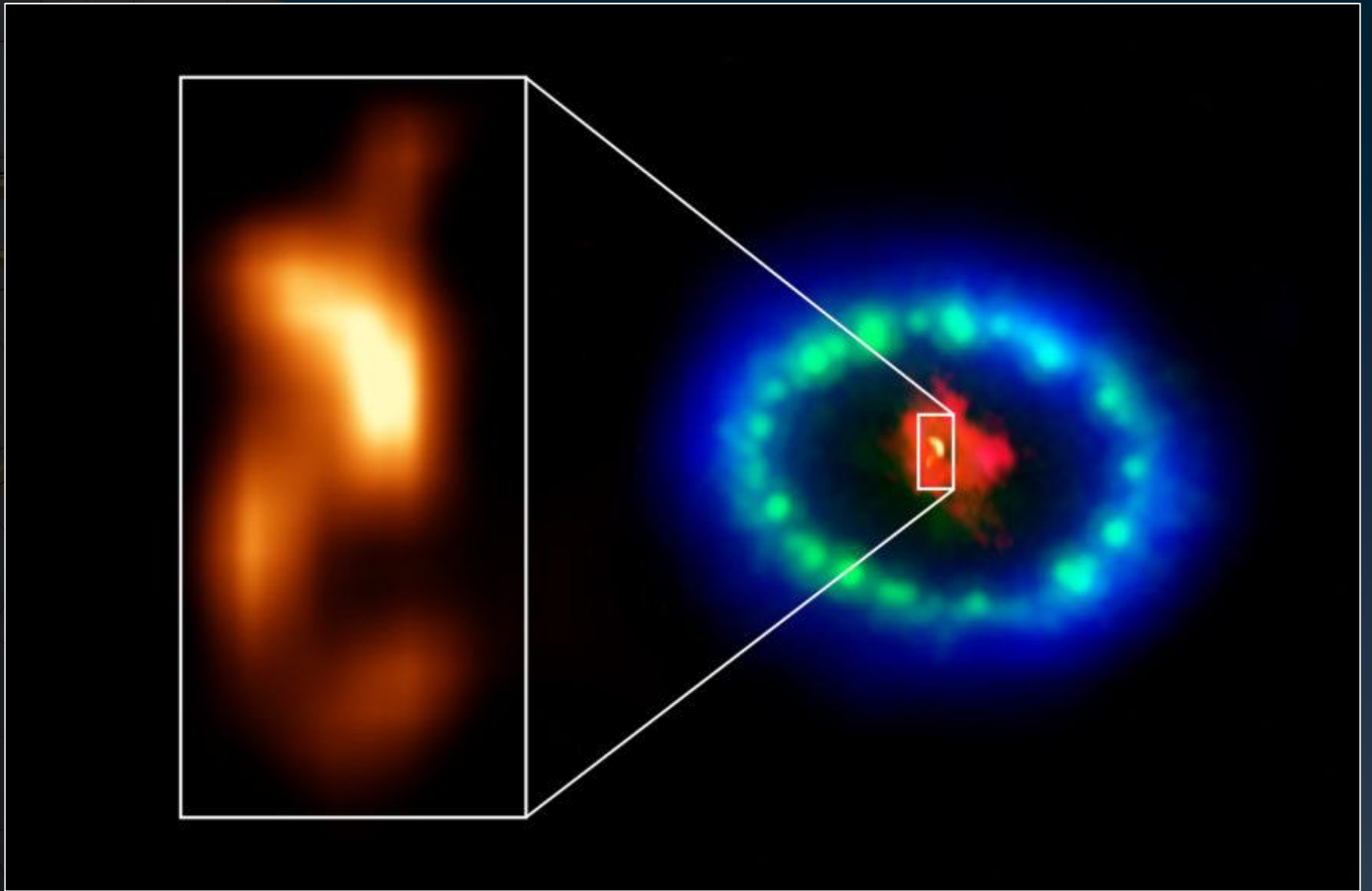
17 Dec 2020	Cycle 8 2021 pre-announcement
17 Mar 2021	Call for proposals
21 Apr 2021	Proposal submission deadline
6 May 2021	Start of distributed peer review process
15 Jun 2021	End of distributed peer review process
Aug 2021	Announcement of results of the proposal review process
8 Sep 2021	ACA Supplemental Call for Proposals
1 Oct 2021	Beginning of Cycle 8 2021
6 Oct 2021	ACA Supplemental Call submission deadline



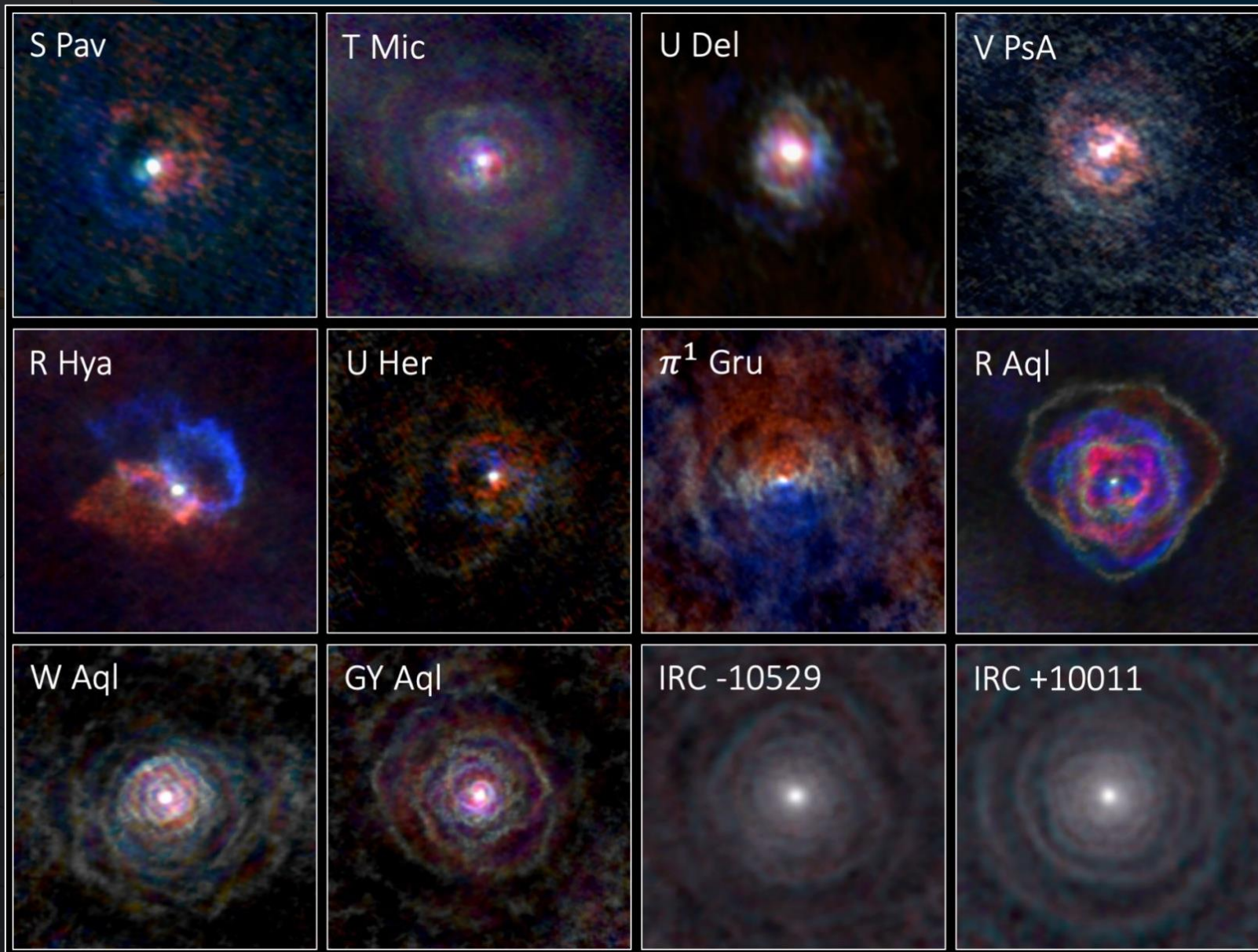
(Credit: ALMA (ESO/NAOJ/NRAO), Greaves et al. & JCMT (East Asian Observatory))



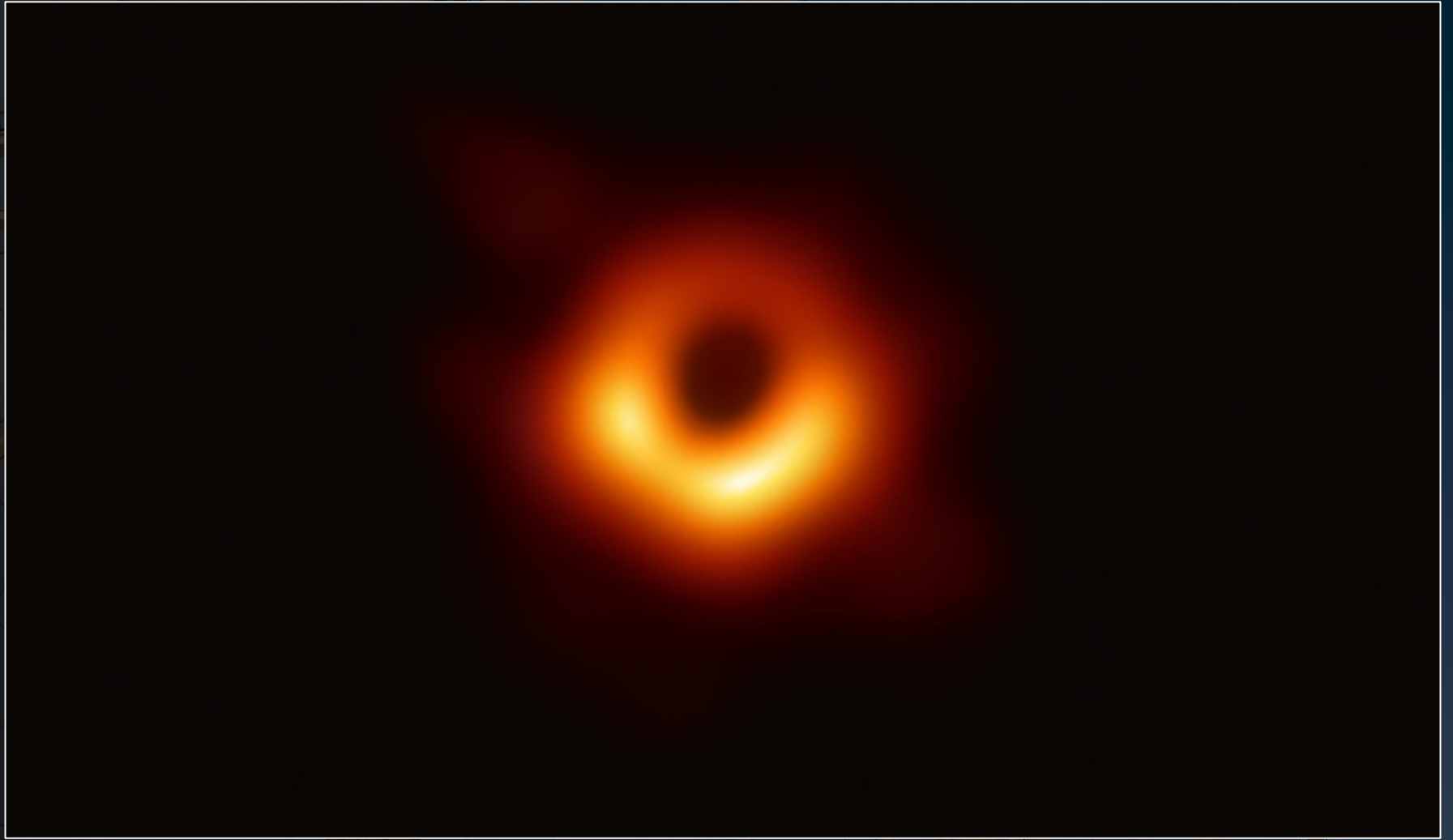
(Credit: ALMA (ESO/NAOJ/NRAO), ESO/Exeter/Kraus et al.)



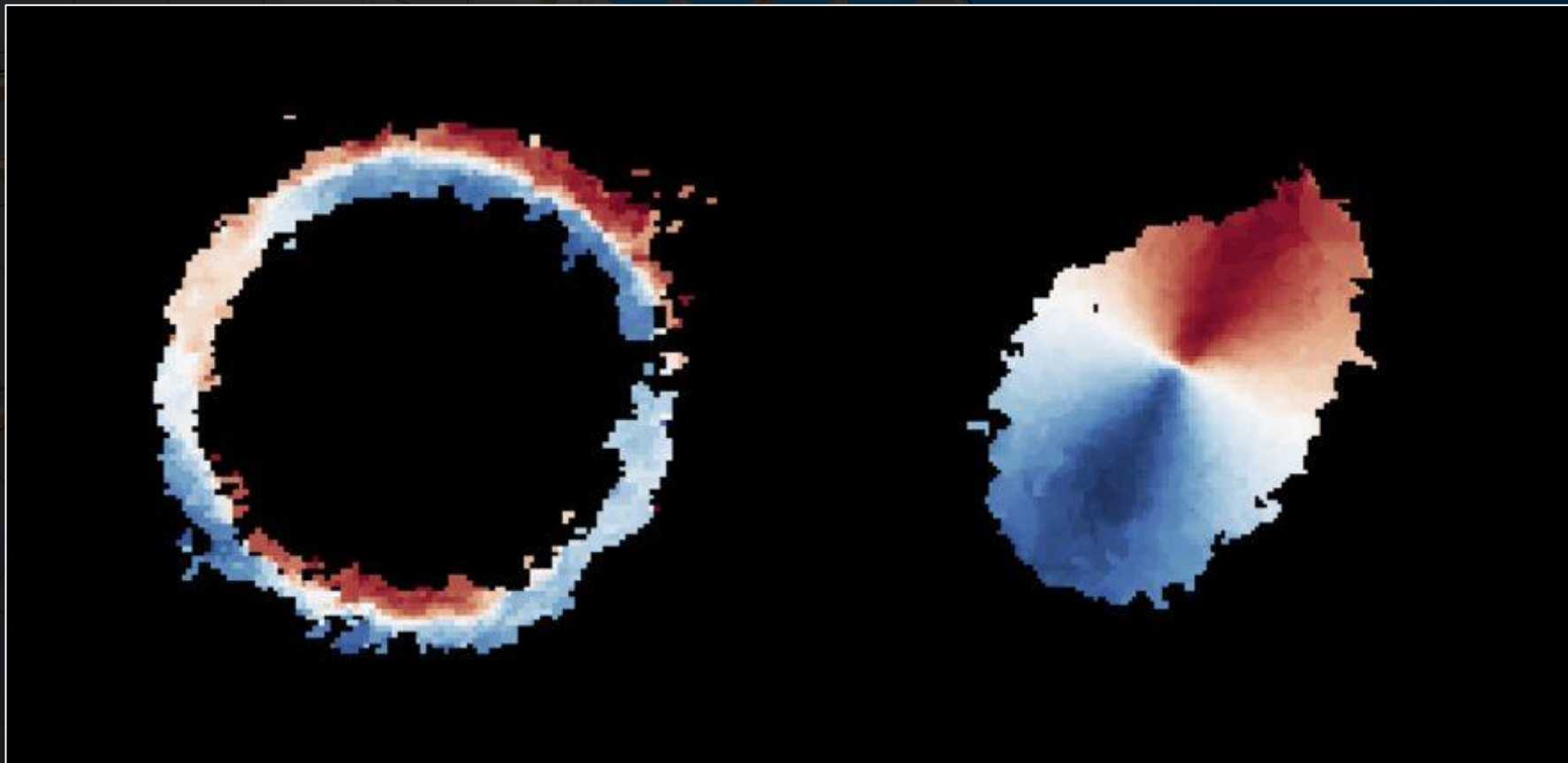
(Credit: ALMA (ESO/NAOJ/NRAO), P. Cigan and R. Indebetouw; NRAO/AUI/NSF, B. Saxton; NASA/ESA)



(Credit: L. Decin – ESO – ALMA)



(Credit: EHT Collaboration)

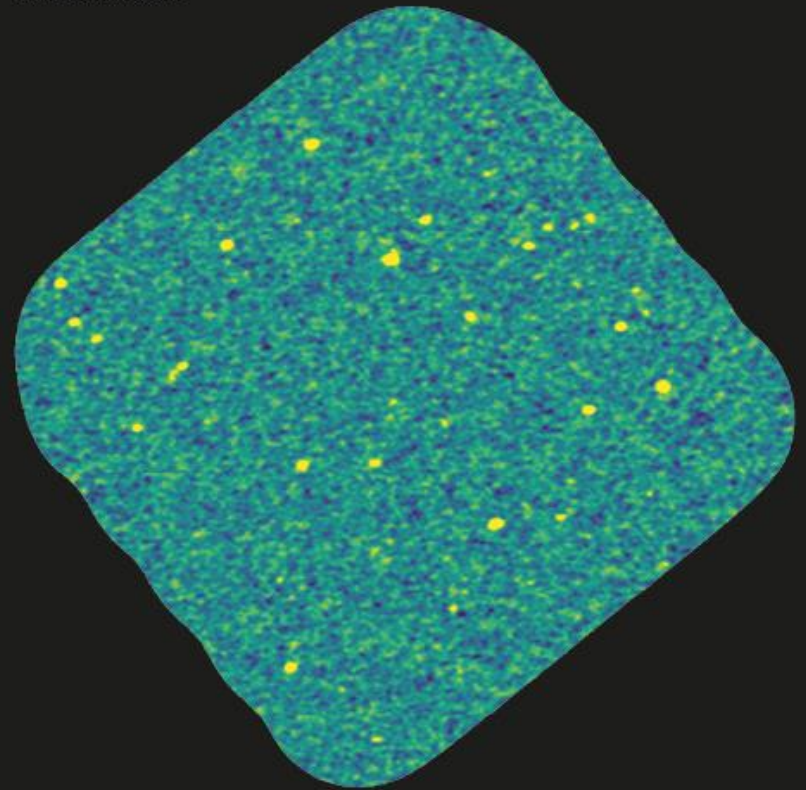


(Credit: ALMA (ESO/NAOJ/NRAO), Rizzo et al.)

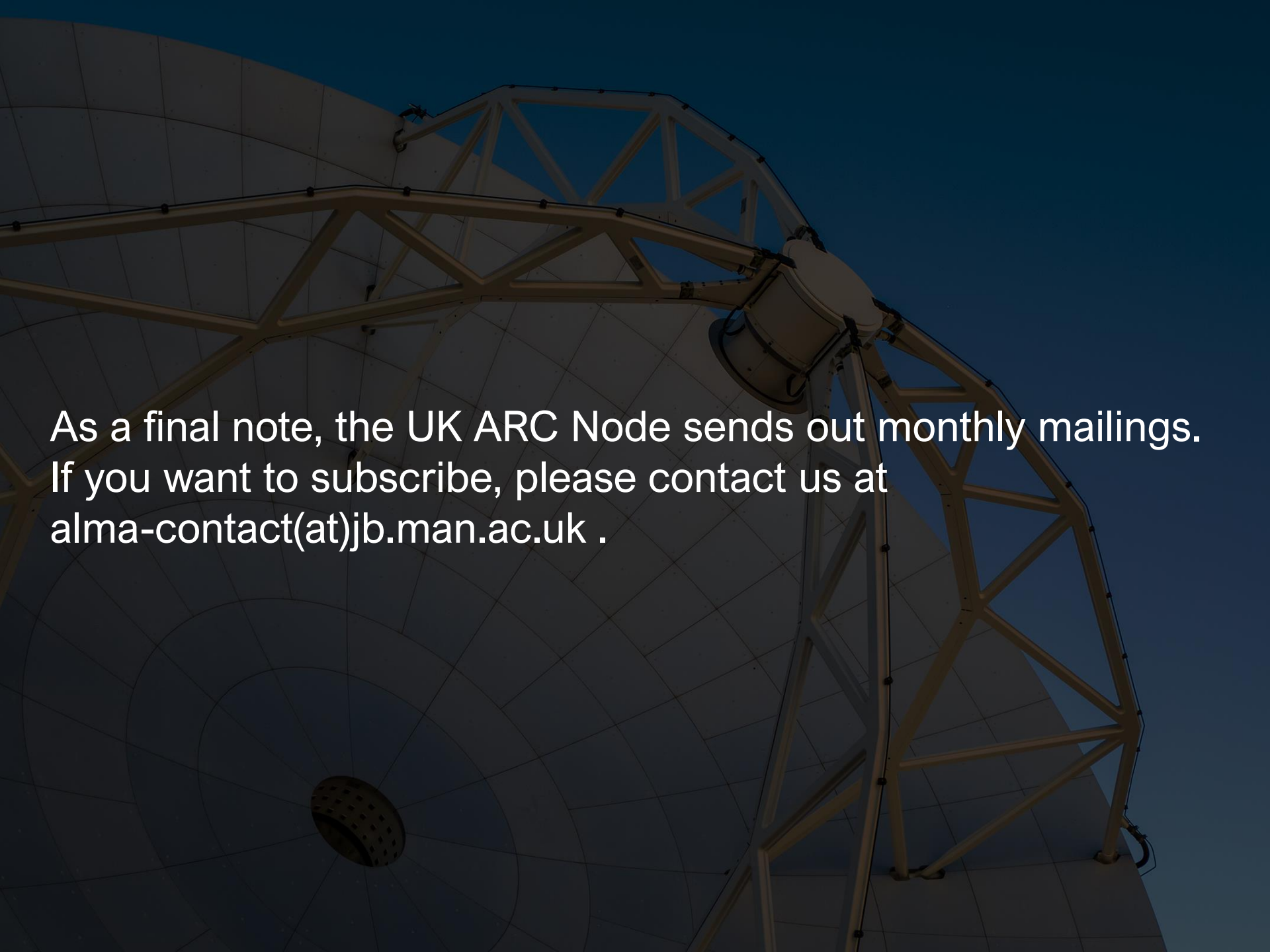
**HST stellar
emission**



**ALMA dust
emission**



(Credit: STScI, Gonzalez-Lopez et al, ALMA (ESO/NAOJ/NRAO))

A large radio telescope dish, likely part of the ALMA observatory, is shown from a low angle looking up. The dish is composed of many white panels and is supported by a complex network of yellow metal beams. The background is a clear blue sky.

As a final note, the UK ARC Node sends out monthly mailings.
If you want to subscribe, please contact us at
alma-contact@jb.man.ac.uk .