Welcome to ALMA Community Day!

Erin Cox
Northwestern University

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University of Illinois

Atacama Large Millimeter/submillimeter Array
Karl G. Jansky Very Large Array
Very Long Baseline Array

Schedule:

09:00 – 09:10 – Welcome and Overview of Workshop
09:10 – 09:50 – ALMA Overview and Capabilities
09:50 – 10:05 – Cassie Science Talk
10:05 – 10:20 – Erin Science Talk
10:20 – 10:40 – Coffee Break
10:40 – 11:40 – Radio Interferometry Basics
11:40 – 12:15 – Proposal Preparation
12:15 – 13:15 – Lunch (provided for registered participants)
13:15 – 13:45 – The ALMA Observing Tool
13:45 – 14:30 – OT Hands-on Activity
14:30 – 15:30 – Introduction to CASA: Imaging and Simulations
15:30 – 15:45 – Coffee Break
15:45 – 16:50 – Imaging or Simulations Hands-on
16:50 – 17:00 – Concluding Remarks

WiFi Available:

1) eduroam

2) Guest wifi-network Guest-Northwestern

Software to download:

ALMA OT

https://almascience.nrao.edu/proposing/observing-tool

Download the webstart version (automatically download newest version)

CASA

https://casa.nrao.edu/casa_obtaining.shtml

Version 5.4.0 will work with *most* MAC os

NAASC Sources of Support

ALMA Helpdesk: Questions are usually answered within 48 hours (around the clock staffing in the week leading up to the proposal deadline)
https://help.almascience.org

Student Observing Support: Successful ALMA proposals will be invited to apply for up to $35k to support undergraduate or graduate student involvement
https://science.nrao.edu/opportunities/student-programs/sos

Page Charges: Upon request NRAO covers page charges for authors at US institutions when reporting results from ALMA/VLA
https://library.nrao.edu/pubsup.shtml

Face-to-face Visitor Support: NRAO will cover the travel expenses of up to 2 people from 2 teams per week to come to get support for data reduction, proposal preparation, etc at NAASC…also have long term visitor
https://science.nrao.edu/facilities/alma/visitors-shortterm

ALMA Ambassadors: You too can become an ALMA Ambassador
https://science.nrao.edu/facilities/alma/ambassadors-program

NRAO:
One Observatory, Three World Class Facilities

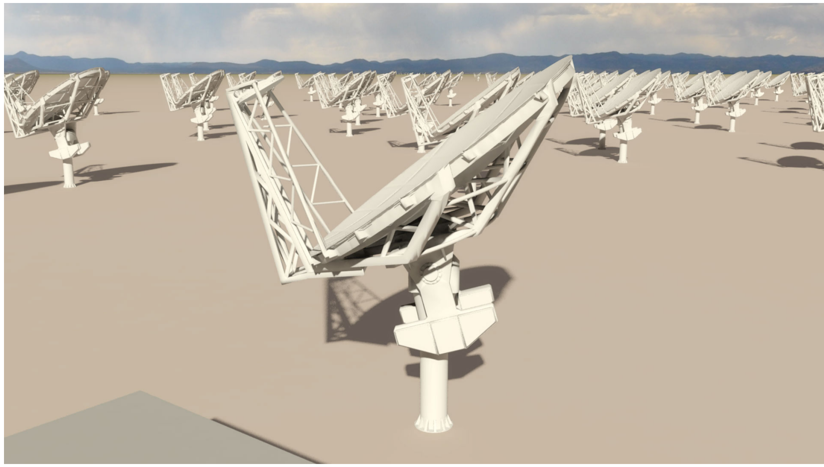
Other Affiliated Telescopes and Observatories include the Green Bank Observatory (http://greenbankobservatory.org/). The VLBA was incorporated back into NRAO last year.

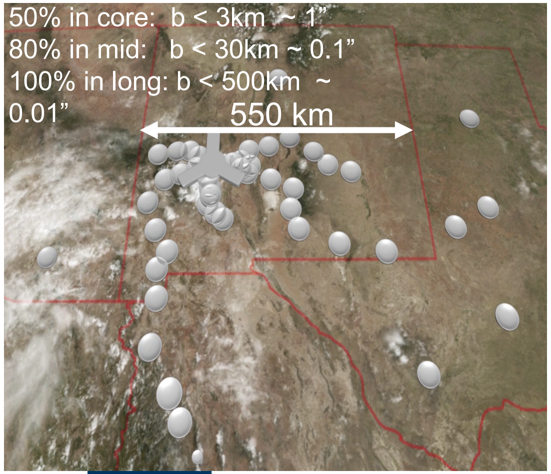
NRAO:
One Observatory, Three Facilities

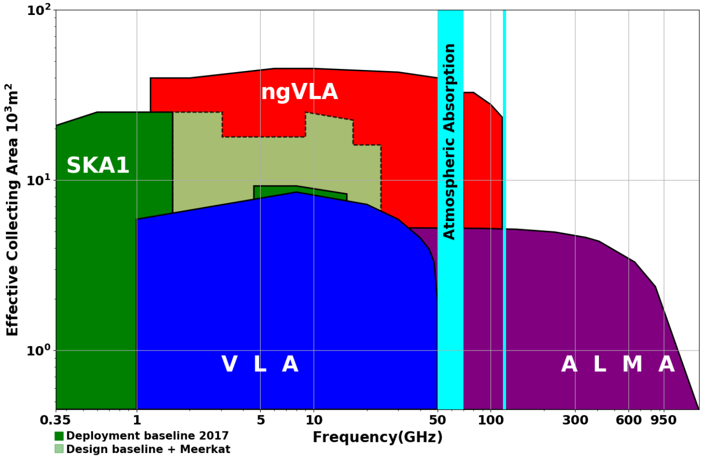
Atacama Large Millimeter/submillimeter Array:
a 66-antenna array in Chile

A next-generation Very Large Array (ngVLA)

- Scientific Frontier: ***Thermal imaging at milli-arcsec resolution***
- Sensitivity/Resolution Goal:
  - ***10x effective collecting area & resolution of JVLA/ALMA***
- Frequency range: ***1.2 –116 GHz***
- Located in Southwest U.S. (NM+TX) & MX, centered on VLA
- Baseline design under active development
- Low technical risk (reasonable step beyond state of the art)







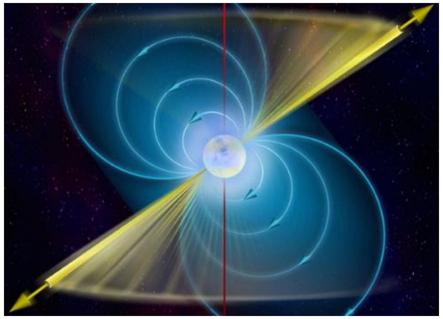
Complementary suite from meter to submm arrays for the mid-21st century

- **< 0.3cm:** ALMA 2030
- **0.3 to 3cm: ngVLA**
- **> 3cm:** SKA

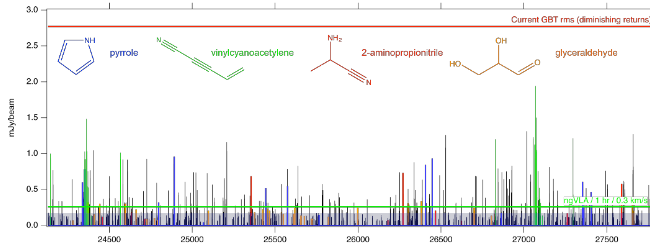
https://science.nrao.edu/futures/ngvla

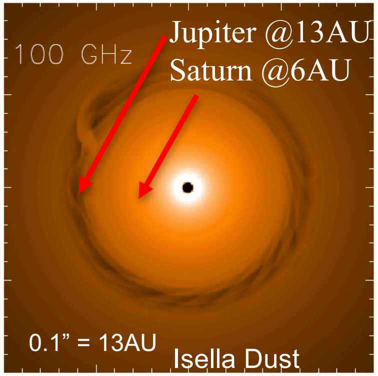
ngVLA Key Science Mission
(ngVLA memo #19)

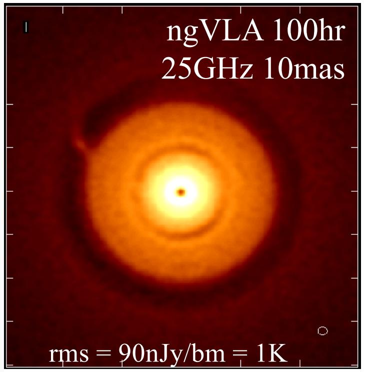
- *Unveiling the Formation of Solar System Analogues*
- *Probing the Initial Conditions for Planetary Systems and Life with Astrochemistry*
- *Charting the Assembly, Structure, and Evolution of Galaxies Over Cosmic Time*
- *Using Pulsars in the Galactic Center as Fundamental Tests of Gravity*
- *Understanding the Formation and Evolution of Stellar and Supermassive BH’s in the Era of Multi-Messenger Astronomy*

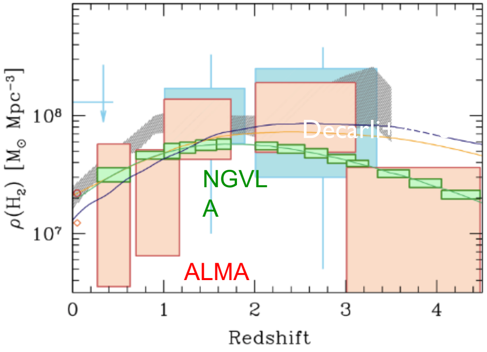


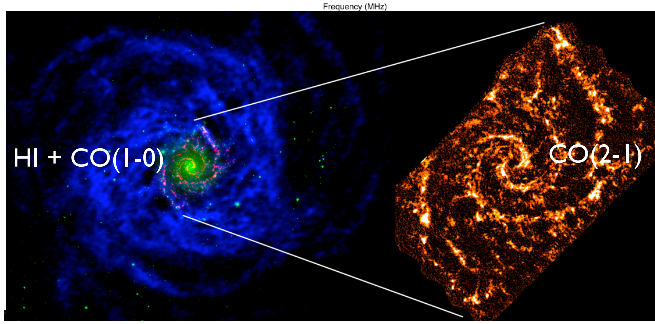
Highly synergistic with next-generation ground-based OIR and NASA missions.





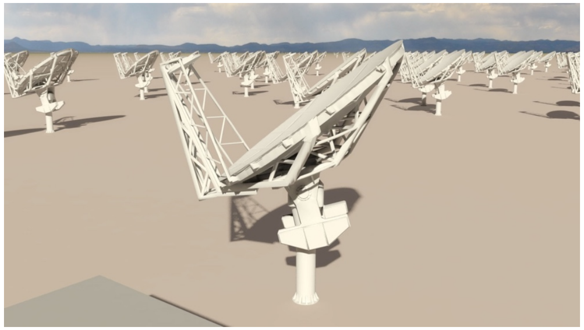






Current Reference Design Specifications

(ngVLA Memo #17)



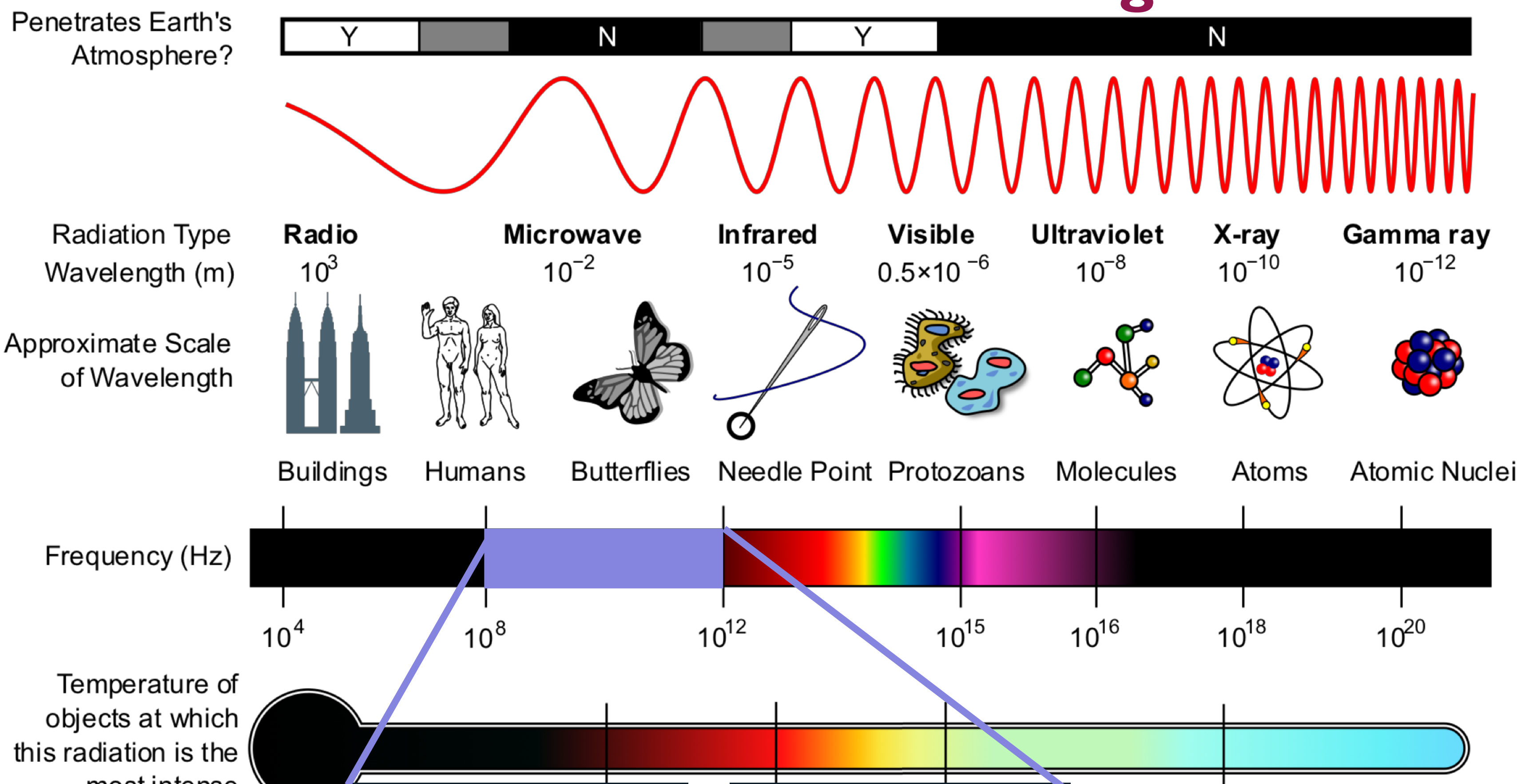
- 214 18m offset Gregorian (feed-low) Antennas
  - Supported by internal cost-performance analysis
- Fixed antenna locations across NM, TX, MX
  - ~1000 km baselines being explored
- 1.2 – 50.5 GHz; 70 – 116 GHz
  - Single-pixel feeds
  - 6 feeds / 2 dewar package
- 19 6m short spacing array + 4 18m in TP mode to fill in (*u, v*) hole

- Continuum Sensitivity: ~0.1uJy/bm @ 1cm, 10mas, 10hr => T_B ~ 1.75K
- Line sensitivity: ~21.5uJy/bm @ 1cm, 10 km/s, 1", 10hr => T_B ~ 35mK

Receiver Configuration

Band #	Dewar	f_L GHz	f_M GHz	f_H GHz	f_H: f_L	BW GHz
1	A	1.2	2.35	3.5	2.91	2.3
2	B	3.5	7.90	12.3	3.51	8.8
3	B	12.3	16.4	20.5	1.67	8.2
4	B	20.5	27.3	34.0	1.66	13.5
5	B	30.5	40.5	50.5	1.66	20.0
6	B	70.0	93.0	116	1.66	46.0

What are Radio Wavelengths?



https://en.wikipedia.org/wiki/Electromagnetic_spectrum#/media/File:EM_Spectrum_Properties_edit.svg

VLA
~1 - 50 GHz
~300 - 6 mm

ALMA
~84 - 950 GHz
~3 - 0.3 mm

What Can We Observe in the Radio?

- Sun – coronal mass ejections, magnetic field activity
- Solar system, KBOs – atmospheres, astrometry, composition
- Star-forming regions – dust and gas environment, kinematics (infall, outflows, jets), proto-planetary disks, cores, chemistry, feedback, and natal cloud / star interactions
- Exoplanets – direct imaging, gaps in disks, kinematics
- Pulsars – neutron star physics, pulse morphology, gravity, ISM probe
- Galactic structure – spiral arms, bars, global atomic and molecular gas properties
- Nearby galaxies – molecular / atomic gas content and kinematics, dynamics of galaxies at high resolution, star formation, obscured SF, gas flow
- Galaxy groups and clusters – atomic and molecular gas across systems, star formation efficiency, kinematics, dynamical mass measurements
- Black holes – mass measurements, kinematics
- High redshift galaxies – extragalactic background light, source counts, star formation history and efficiency, evolution of gas content (atomic and molecular)
- Cosmology – H_0 measurement, SZE

What is ALMA?

A global partnership between North America, Europe, and East Asia to deliver a revolutionary millimeter/submillimeter telescope array (in collaboration with Chile).

Provides unprecedented imaging* & spectroscopic capabilities at mm/submm λ

Array Operations Site is located at 5000m elevation in the Chilean Andes

ALMA by the numbers:

Number of Antennas = 66

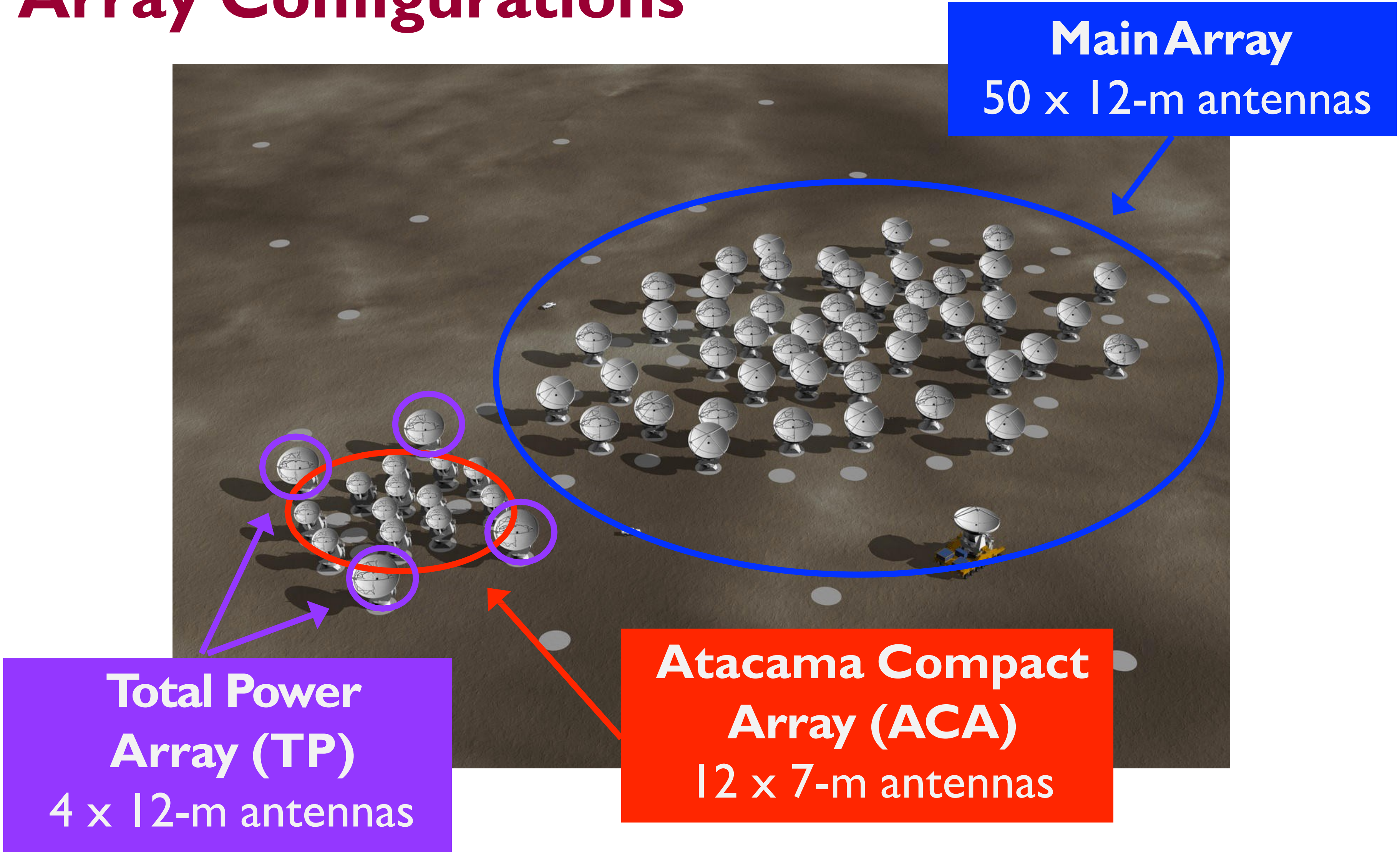
Baselines = 150 m to > 16 km

Best Resolution = 0.015” at 300 GHz

Wavelengths = 0.32 mm to 3.6 mm

Antenna Locations = 192

Array Configurations



Main Array
50 x 12-m antennas

Total Power Array (TP)
4 x 12-m antennas

Atacama Compact Array (ACA)
12 x 7-m antennas

**TP + ACA = Morita Array*

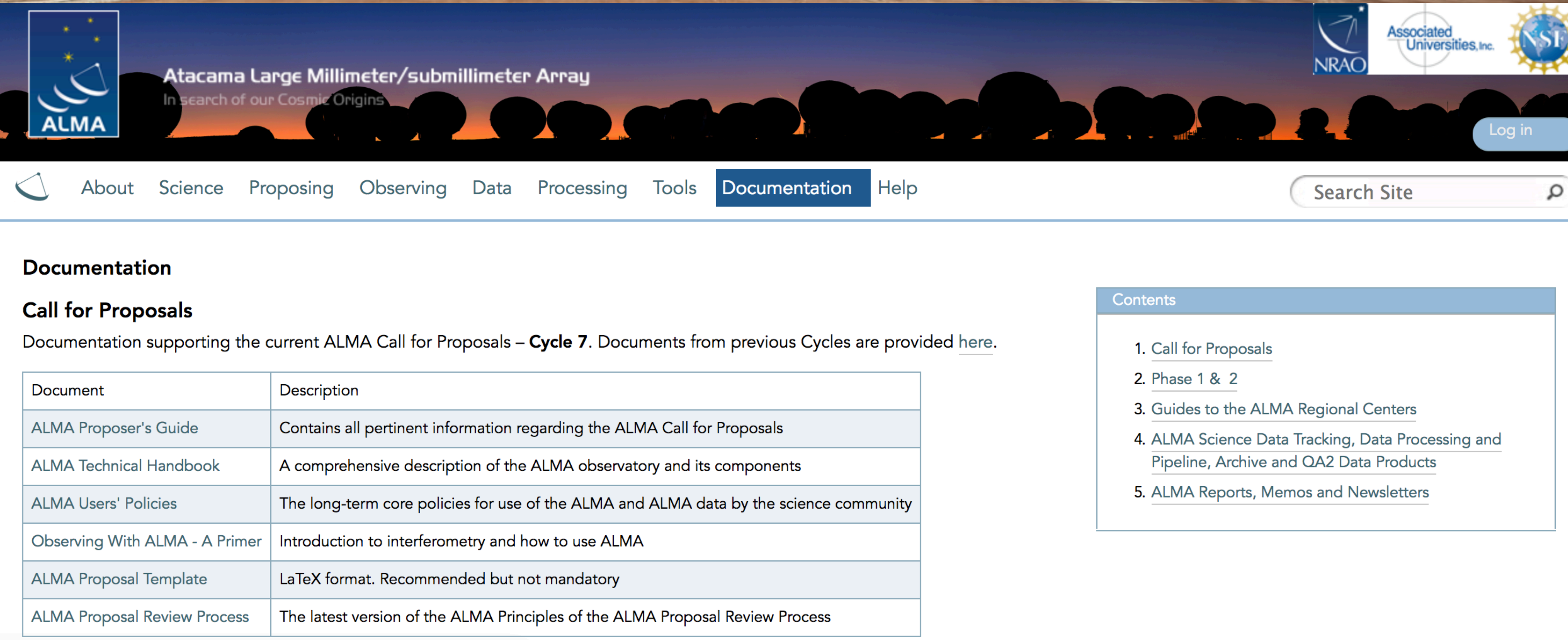
www.planet.com

What is ALMA?

Array configurations between 150 meters and >16 kilometers: 192 possible antenna locations:

http://youtu.be/YMISe-C8GUs

ALMA is a telescope for *all* astronomers



Documentation

Call for Proposals

Documentation supporting the current ALMA Call for Proposals – **Cycle 7**. Documents from previous Cycles are provided here.

Document	Description
ALMA Proposer's Guide	Contains all pertinent information regarding the ALMA Call for Proposals
ALMA Technical Handbook	A comprehensive description of the ALMA observatory and its components
ALMA Users' Policies	The long-term core policies for use of the ALMA and ALMA data by the science community
Observing With ALMA - A Primer	Introduction to interferometry and how to use ALMA
ALMA Proposal Template	LaTeX format. Recommended but not mandatory
ALMA Proposal Review Process	The latest version of the ALMA Principles of the ALMA Proposal Review Process

Contents

ALMA in a Nutshell…

- Angular resolution down to 0.015” (at 300 GHz)
- Sensitive, precision imaging 84 to 950 GHz (3 mm to 320 μm)
- State-of-the-art low-noise, wide-band receivers* (8 GHz bandwidth)
- Flexible correlator with high spectral resolution at wide bandwidth
- Full polarization capabilities including circular.
- Estimated 1 TB/day data rate
- All science data archived
- Pipeline processing

ALMA is10-100 times more sensitive and has 10-100 times better angular resolution than current mm interferometers*

*With 90 Degree Walsh Switching in Bands 9 and 10, this gives 16 GHz of instantaneous bandwidth.

In either case, this is using the Time Division Mode (TDM) modes.

What is ALMA?

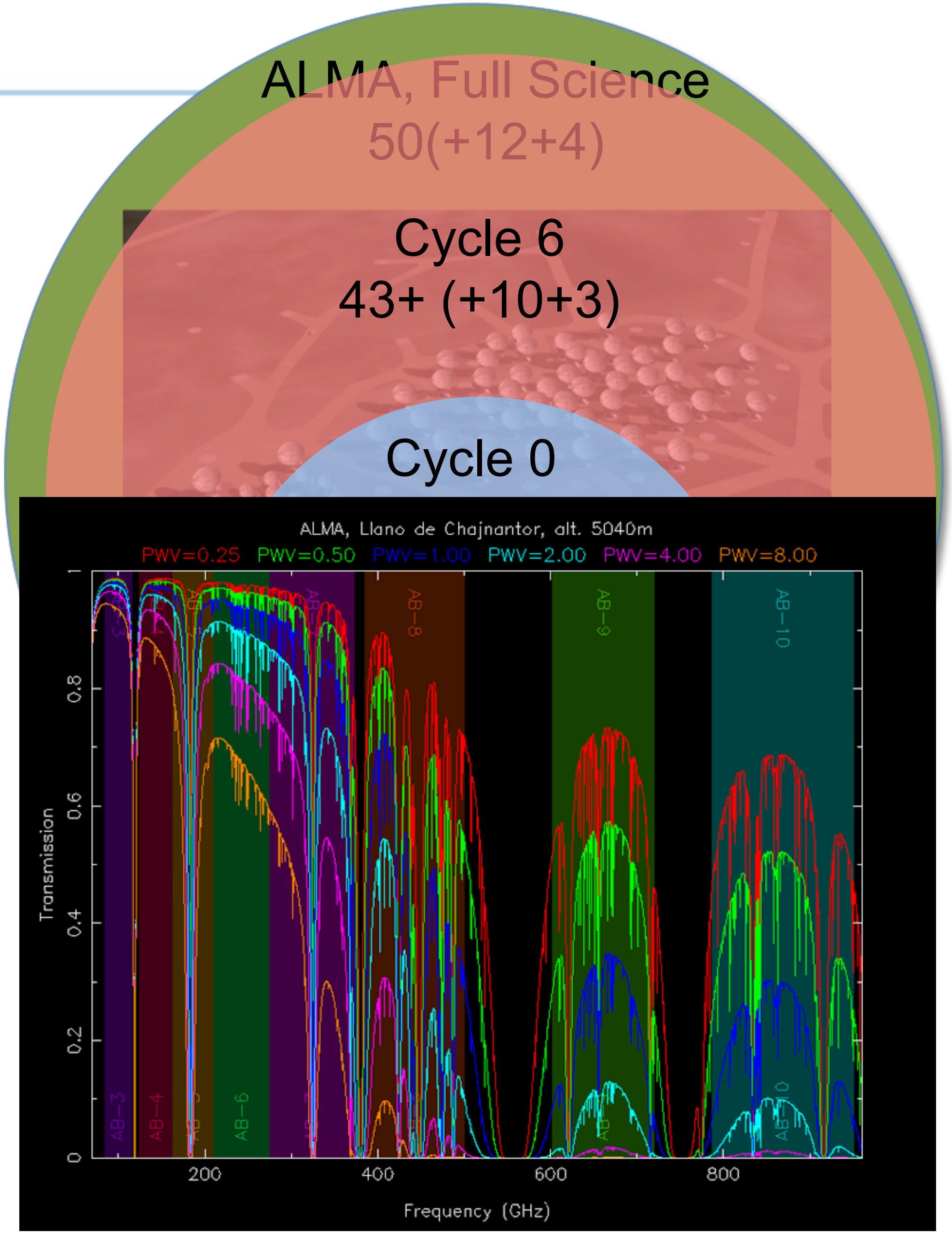
Collecting Area

Not only sensitivity but the collecting area (1.6 acres or 6600+ m2) + huge number of baselines provides excellent image fidelity

Spectral Coverage - Covers

ten atmospheric windows with 50% or more transmission above 35 GHz

https://almascience.nrao.edu/proposing/about-alma/atmosphere-model



ALMA, Full Science
50(+12+4)

Cycle 6
43+ (+10+3)

Cycle 0

ALMA Current Status

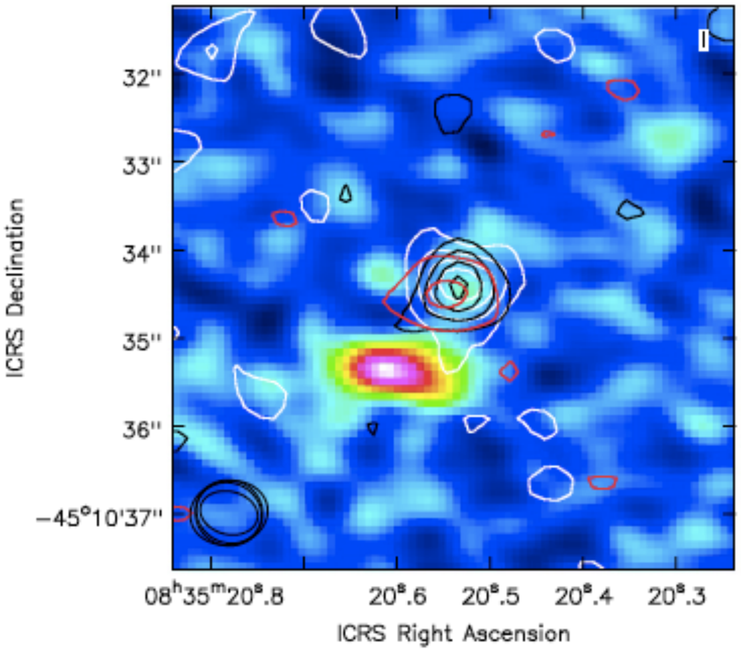
- Construction Project ended in September 2014
- Routine science observing has been out to **greater than 16 km baselines (C43-10)** thanks to the highly successful Long Baseline Campaigns in 2014 and 2015
- **All 66 antennas accepted**
  - Currently all 66 antennas are at the high site (AOS), of which ~47 on average (up to max ~66) are being used for Cycle 6 observations
  - Some construction and verification items remain to be finished (e.g., wide-field polarization; various observing modes)
- The ACA (Atacama Compact Array) or Morita Array – up to 12x7m antennas and 4x12m antennas for TP observations – is currently being used for Cycle 6 observations
- More on Capabilities later… however, first on to science!

ALMA Science Highlights

Science Highlight (2)

ALMA Images Vela Pulsar

- ALMA Development Study results on pulsar observations will appear soon.
  - Successful measurement of pulsar profiles were achieved on Vela
- Detections in non-time resolved mode were made on Vela, SgrA* magnetar, and Crab pulsar.
  - Vela pulsar was detected in ALMA Bands 3, 4, 6 and 7 (see B7 image)
  - Extended structure seen in B7 may be a counter-jet protruding from the pulsar

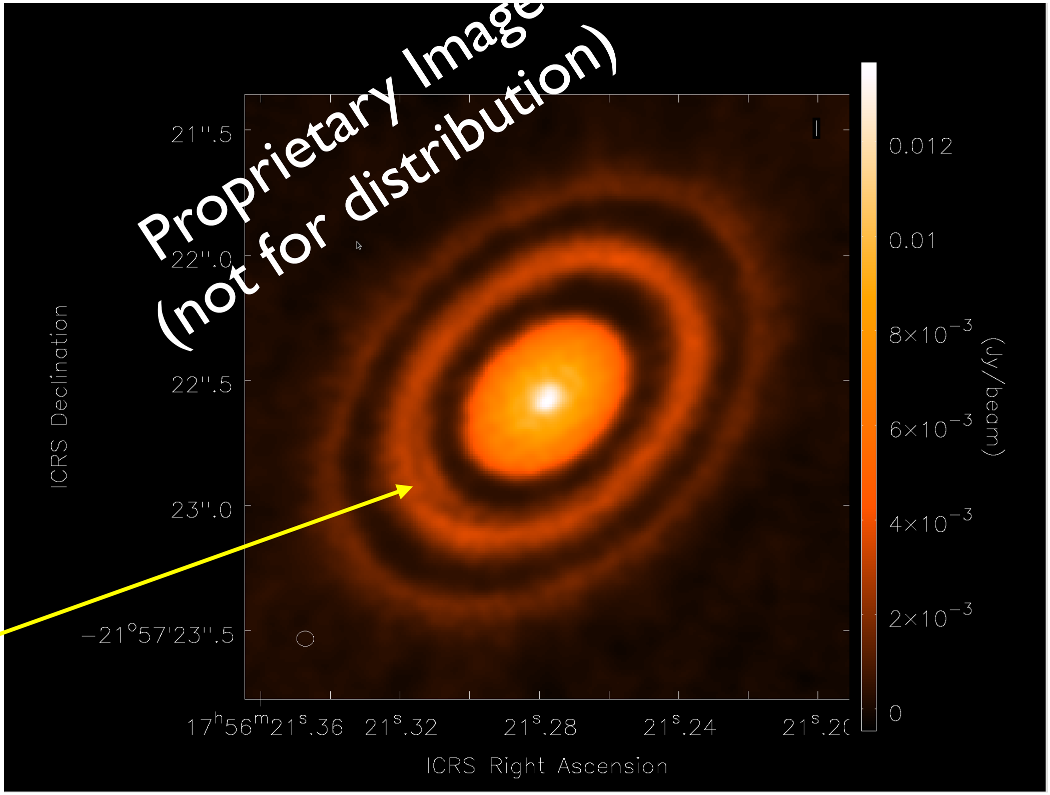


Science Highlight

ALMA Images Proto-Planetary Disks

This is a proprietary result of a proto-planetary disk, currently under analysis by the PIs.

The image displayed is an example of **pipeline-processed data,** for which there was *no manual intervention* by the data-analysts

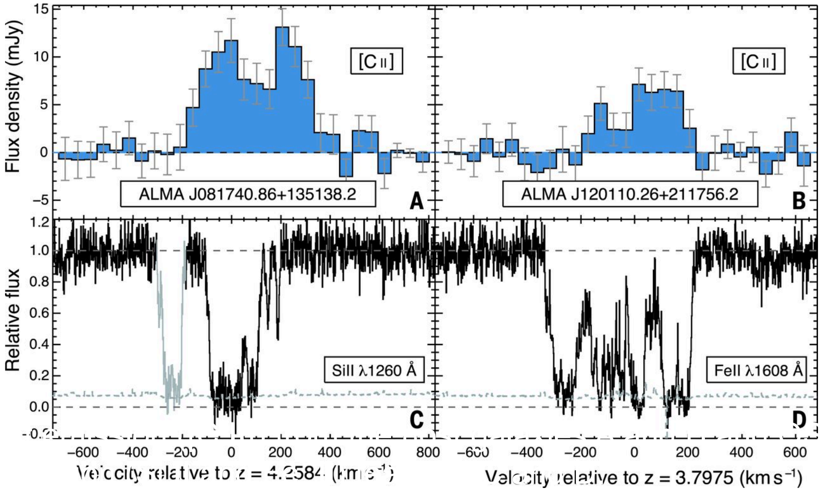


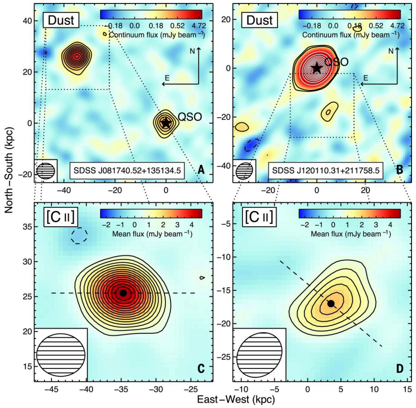
Note the separation in second major ring – not seen before!

Science Highlight (VI)

ALMA: SuperHaloes Surround Early Milky-Way-like Galaxies

- With ALMA, US astronomers observed young Milky-Way like galaxies at z~4 and probed their haloes by measuring even more distant QSOs through them.
- QSO-galaxy offsets probe the galaxy halo far beyond the ~5kpc extent of [C II] emission
  - The host galaxy has enriched its inner gaseous halo
  - The halo is bound to the host, will eventually be accreted and enrich star-forming gas.





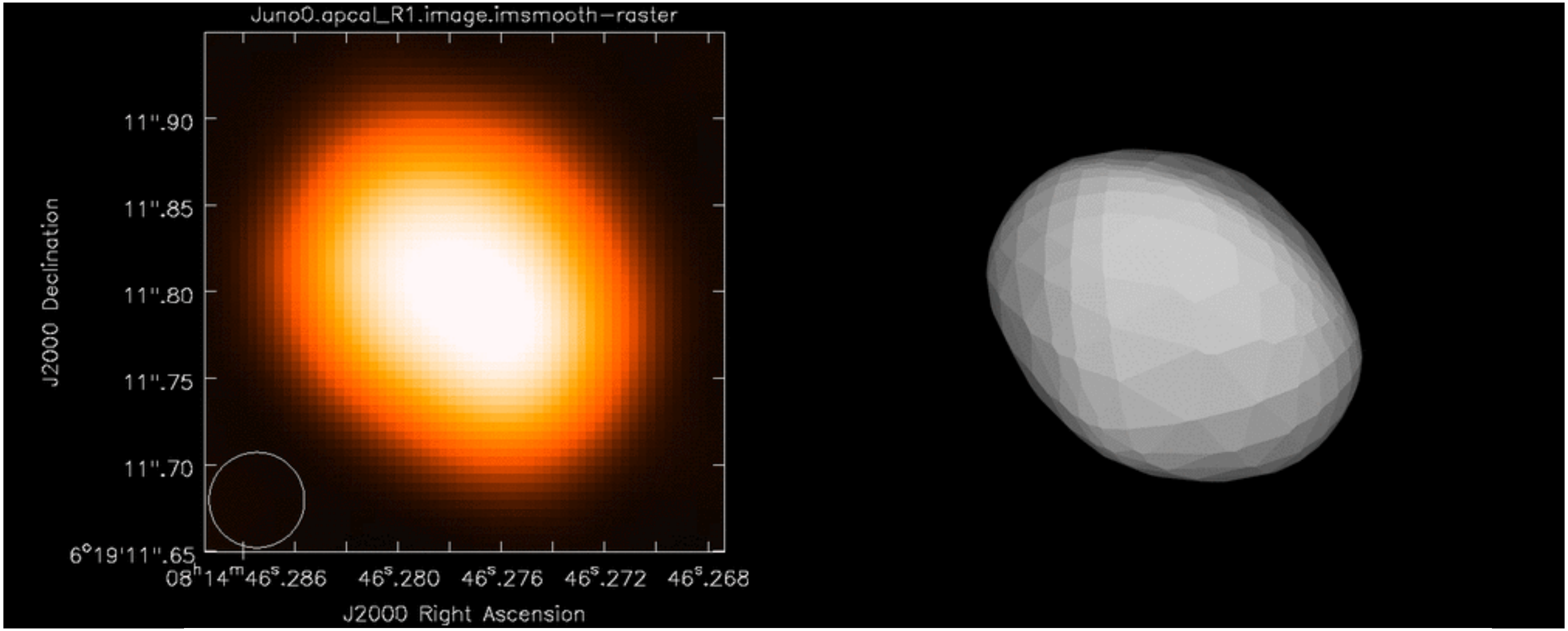
Above: The ≈400-GHz continuum emission near two QSOs (black stars). xes give the relative physical (proper) distance at the DLA. Below: Mean flux density over the full [C] 158-μm line profile displayed above. The dashed line is the measured major axis of the galaxy.

Band 6 ALMA image of Juno

233 GHz (1.3 mm) Science verification Band 6 Observations of Juno

Five consecutive executions over 4.4 hours

Beamsize ~ 0.04”x0.03” (~60x45 km)



(ALMA Partnership, Hunter et al. 2015, model from Durech et al. 2010, Database of Asteroid Models from Inversion Techniques)

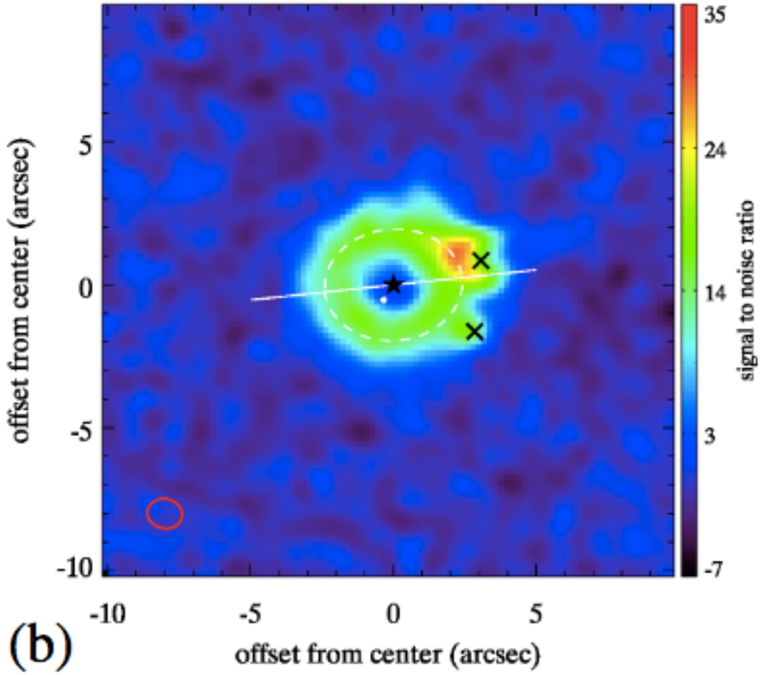
Kuiper Belt Analogue Around Sun-like Star

HD 95086 is a 1.6 M_{sun} A star about 17 Myr years old, 83.8 pc from the Sun

HD 95086 hosts a directly-imaged ~4M_{Jup} planet about 57 AU from the star

ALMA has imaged a debris disk outside the planetary orbit

- The disk is inclined 30°
- The disk extends from an inner radius ~100 AU to an outer radius ~320 AU.
- A bright source near the edge of the ring is almost certainly a background galaxy.
- A second planet may shepherd the inner edge of the cold disk, could be 0.2-1.5 M_{jup}



ALMA detects organics on Pluto

CO(3-2) and HCN (4-3) in atmosphere of Pluto

Lines probe abundances and temperatures

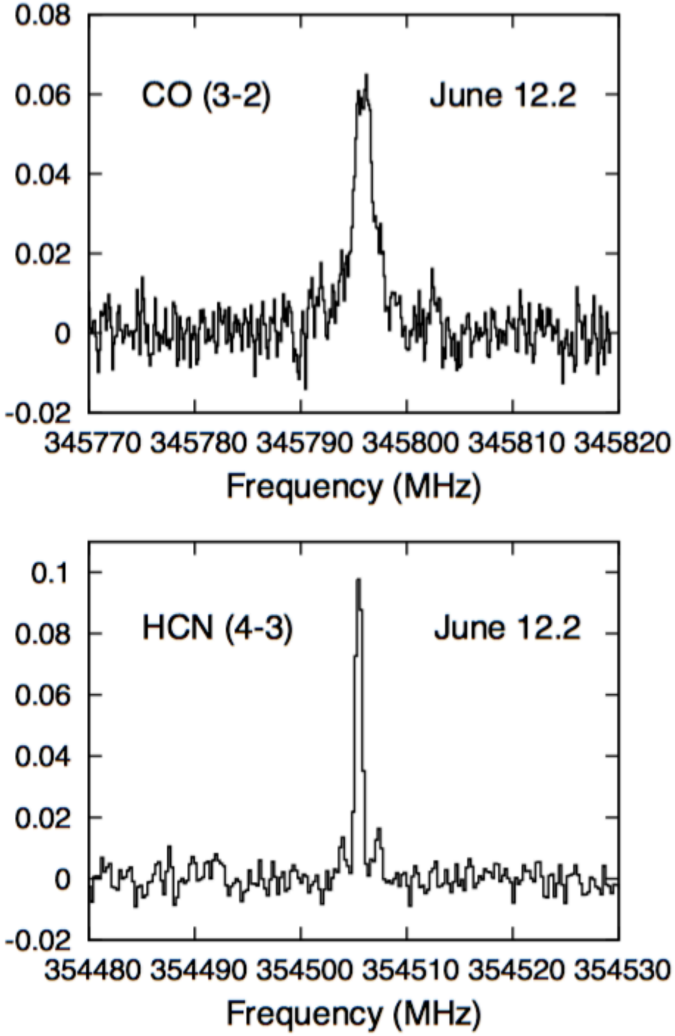
Dayside temperature profile shows a well-marked temperature decrease (i.e., mesosphere)

Above the 30-50 km stratopause, with T= 70 K at 300 km

In agreement with New Horizons solar occultation data.

The HCN line shape implies a high abundance in the upper atmosphere

Suggests a warm (>92 K) upper atmosphere (450 – 800 km)



(Lellouche et al. 2016)

TransNeptunian Object DeeDee

ALMA imaged 2014 UZ_{224} (or DeeDee*) at 1.3 mm

Measured thermal properties

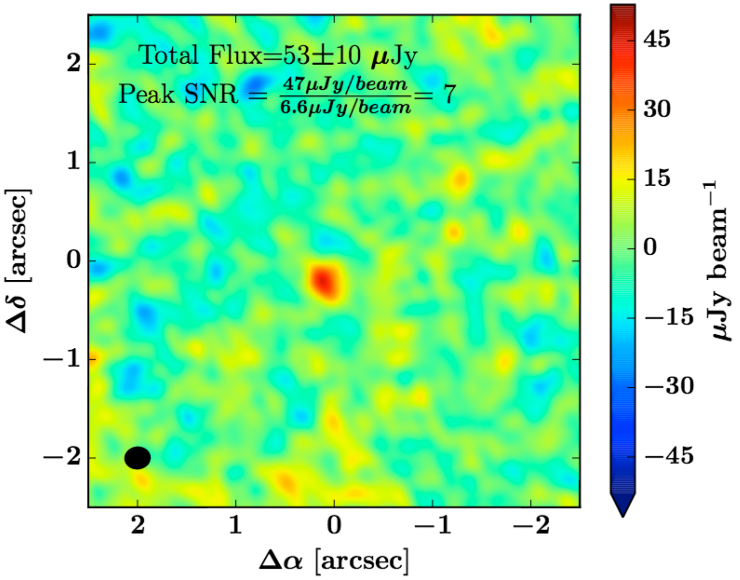
DeeDee is at 92 au, about twice the distance of Pluto

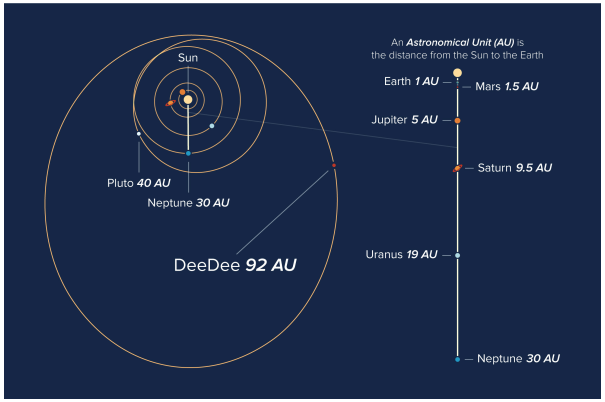
2nd most distant confirmed Solar System object with a surface at 30K

Data suggest a diameter of 635km, 2/3 that of Ceres

Very dark, its albedo is only 13%.

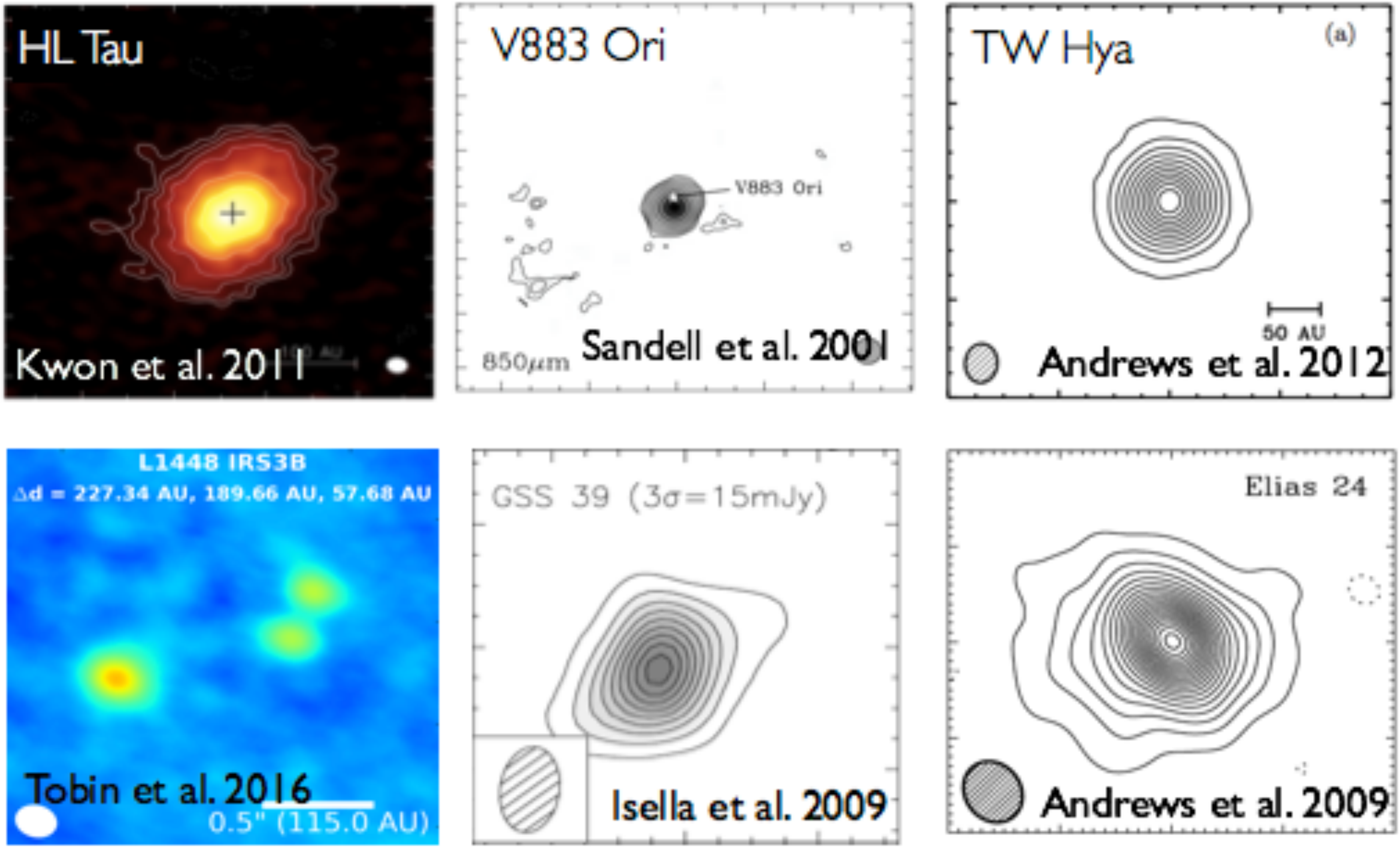
Gerdes et al., 2017 *ApJL*, **839**, L15.





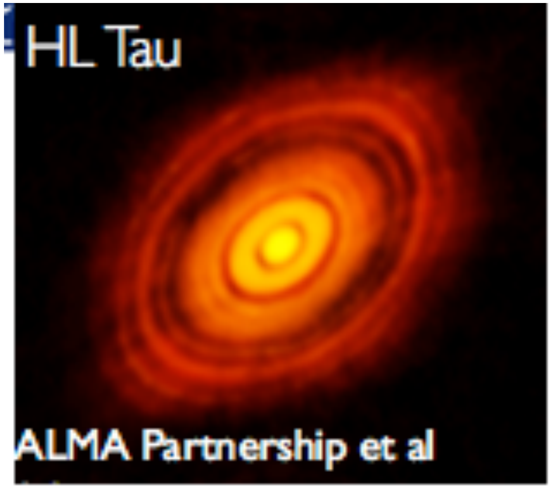
*short for "Distant Dwarf

Protoplanetary Disks: Pre- ALMA



Composite image courtesy J. Carpenter / A. Wootten (ALMA / NRAO)

Protoplanetary Disks: With ALMA


HL Tau

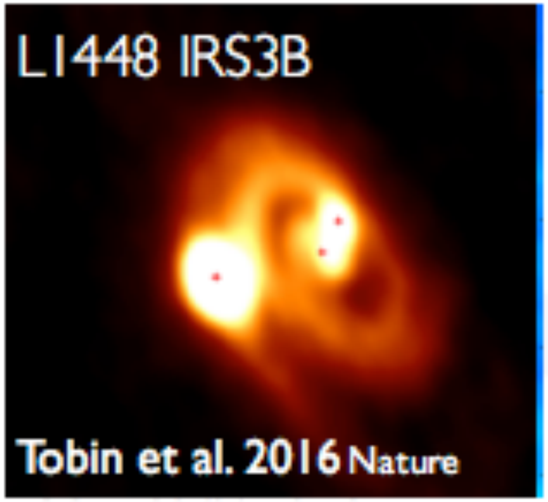
ALMA Partnership et al


V883 Ori

Cieza et al. 2016, Nature


TW Hya

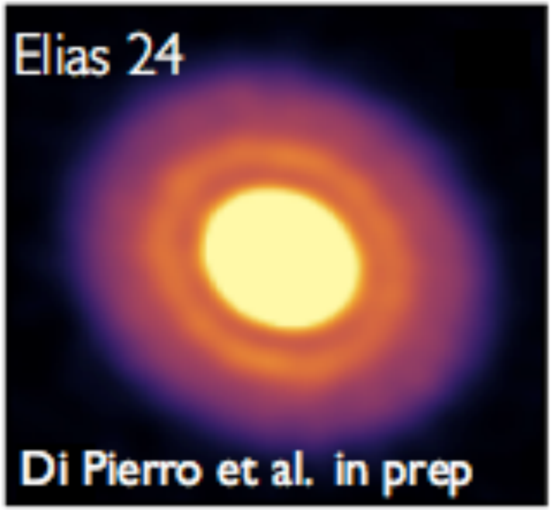
Andrews et al. 2016


L1448 IRS3B

Tobin et al. 2016 Nature


Elias 2-27

Pérez et al. 2016 Science


Elias 24

Di Pierro et al. in prep

Composite image courtesy J. Carpenter / A. Wootten (ALMA / NRAO)

TW Hya with ALMA

Band 7 (870 μm) image

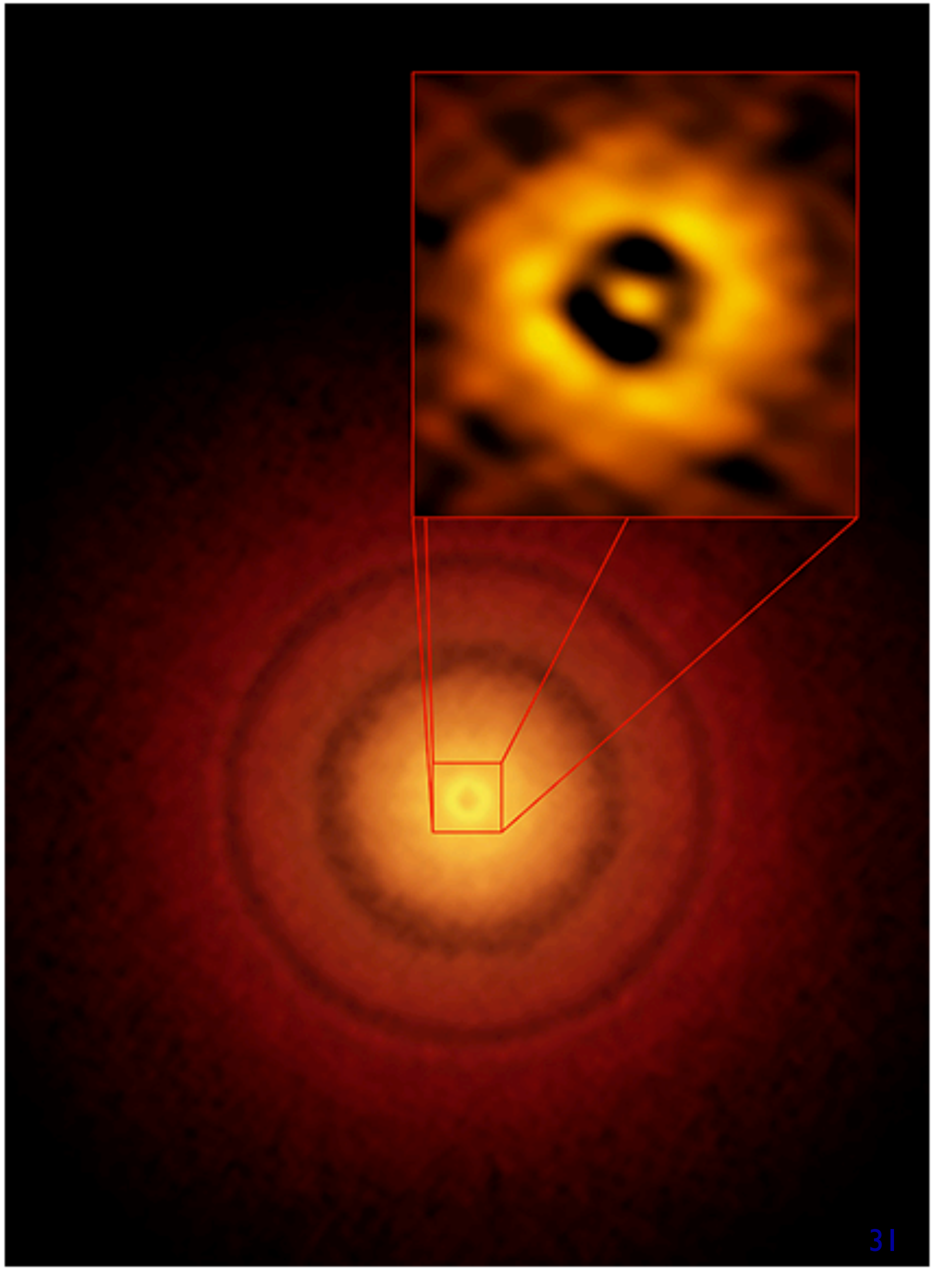
Young (10 Myr) system at 175 light years

Series of concentric rings

- Substructure indicates concentration of solids around pressure max

Narrow dark annulus at 1 au

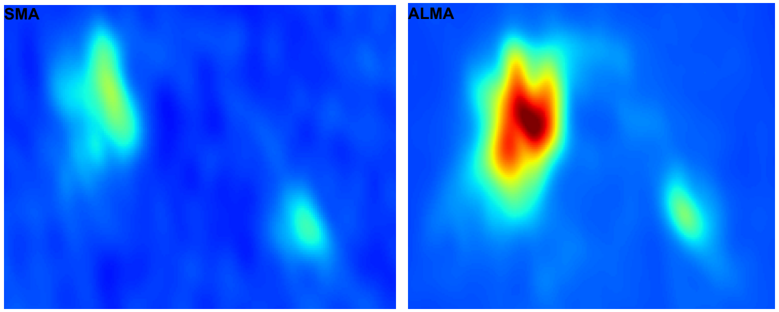
- Possibly indicating interactions between disk and young planets



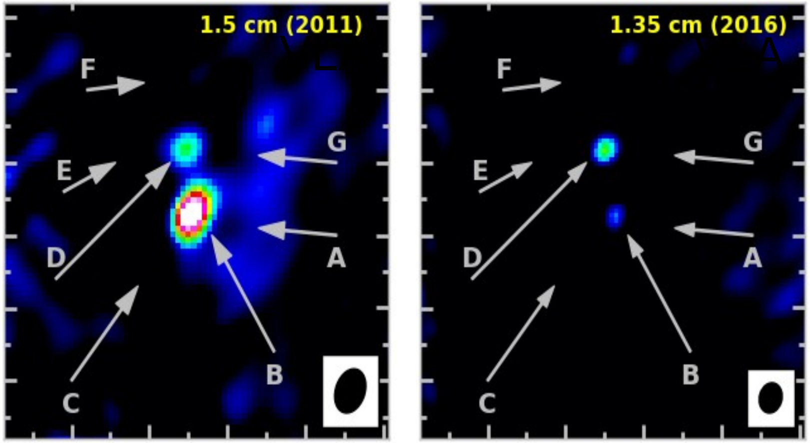
ALMA Catches Massive Star Outburst

NGC 6334I-MM1 dust continuum outburst

Hunter et al. 2017 ApJ 837, L29



Pre-outburst Post-outburst



Dimming of the HCHII region by a factor of 4

- Suppression of UV photons

Candidate compact disk/outflow system

- Disk traced by hot SO$_2$
- Outflow traced by C^{34}S and 6 cm jet direction, and maser flare

Consistent with a a B4 ZAMS star

- Accreting >= 0.1M$_\odot$ in a short period

ALMA Science Highlights: Protoplanetary Disks

Protoplanetary Disks: With ALMA

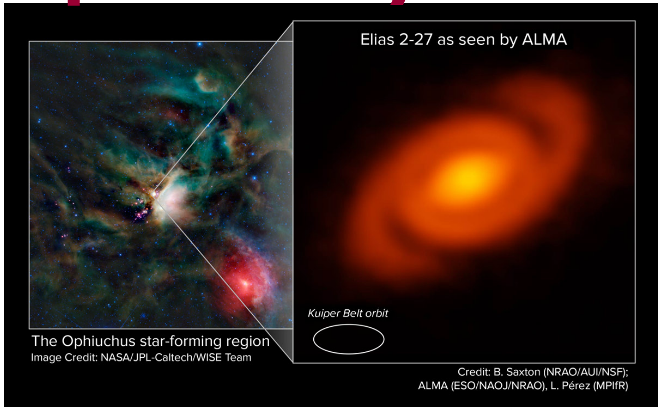


Image Credit: NASA/JPL-Caltech/WISE Team

Credit: B. Saxton (NRAO/AUI/NSF); ALMA (ESO/NAOJ/NRAO), L. Pérez (MPIfR)

A Spiral Density Wave Observed in a Protoplanetary Disk

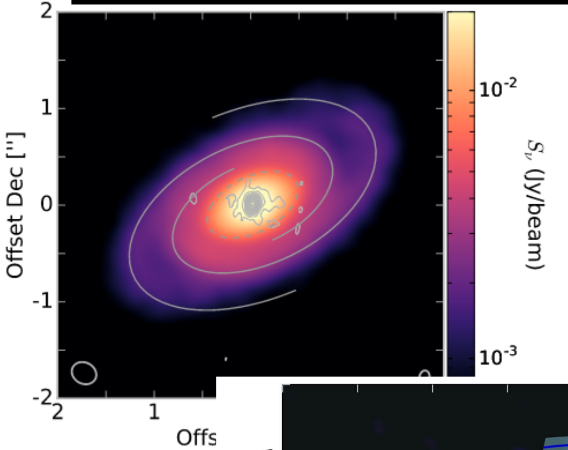
Perez et al. Science 353, 1519 (2016)

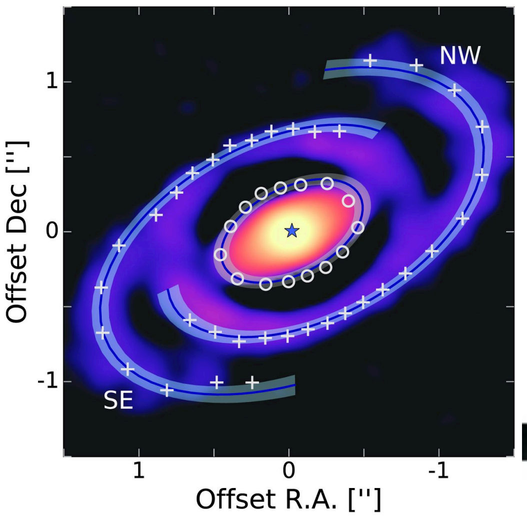
Gravitational instabilities in protoplanetary disks might be excited by e.g. planet-disk interactions or gravitational instabilities

Disk mid-plane structure provides a sensitive probe for the instabilities; optical observations probe the disk surface but radio wavelength observations probe the disk densi structure.

ALMA imaging (dust and CO, 33 AU resolution) reveals tw symmetric spiral arms (r~150AU) emanating from an elliptical emission ring (r~71AU) in the disk Elias 2-27, the nearby ρ Oph cloud

A spiral density wave fits the observations well. Fragmentation of such spirals remains the only plausible formation mechanism for planets and companions at large disk radii, where core-accretion becomes inefficient.



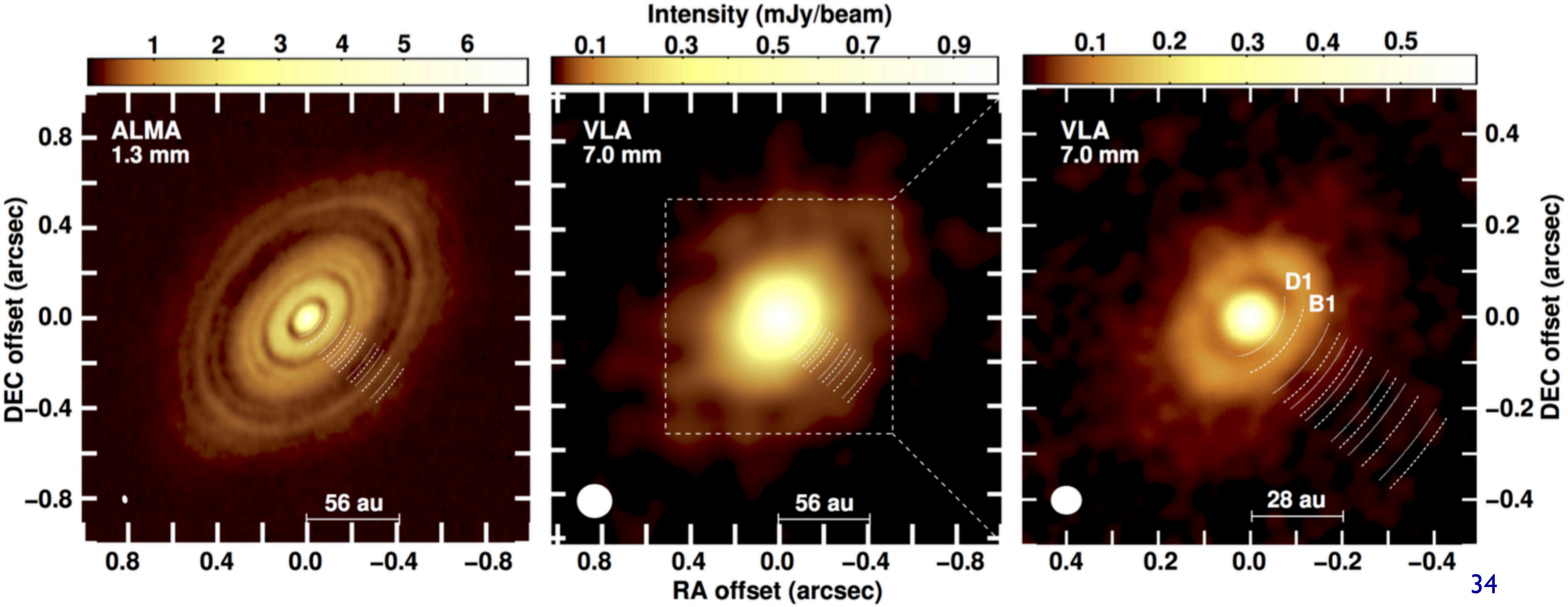


ALMA Science Highlights: Protoplanetary Disks

Protoplanetary Disks: With ALMA and VLA

- Emission from inner regions of HL Tau still optically thick at ALMA wavelengths
- VLA can image the disk at comparable resolution to ALMA at 7mm where emission is optically thin
- Combination of ALMA+VLA helps differentiate between formation theories with info on grain growth, fragmentation, and formation of dense clumps: suggest HL Tau disk is in very early stage of planet formation with planets not yet in the gaps but set for future formation in the bright rings

Carrasco-González et al. 2016



ALMA Science Highlights: Star Formation Peak

Scoville et al. (2016 ApJ 820 83)

"ISM Masses and the star formation law at z = 1 to 6: ALMA observations of dust continuum in 145 galaxies in the COSMOS survey field"

ALMA Cycle 2 observations of long-wavelength dust emission were used to probe the evolution of the star-forming interstellar medium (ISM). Sample size: 145 galaxies

Found a single high-z star formation law -- an approximately linear dependence on the ISM mass and an increased star formation efficiency per unit gas mass at higher redshift.

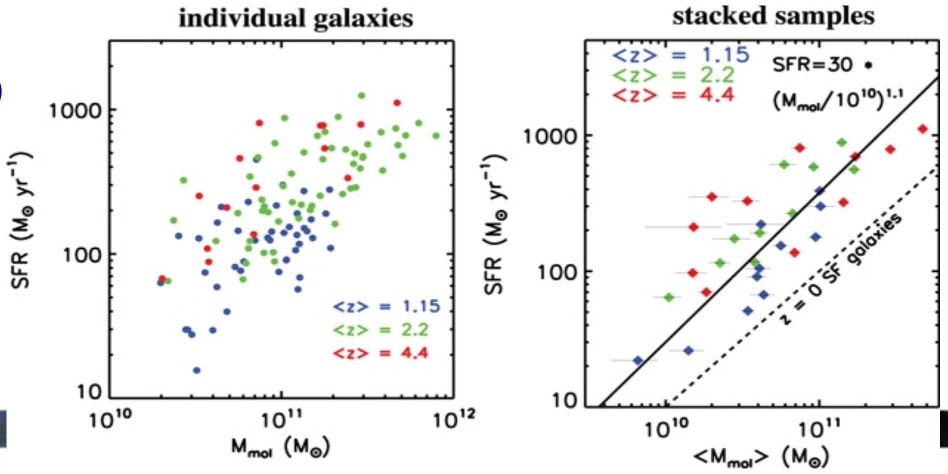
Several notable conclusions from the survey – among them:

At z > 1, the entire population of star-forming galaxies has ~2–5 times shorter gas depletion times than low-z galaxies.

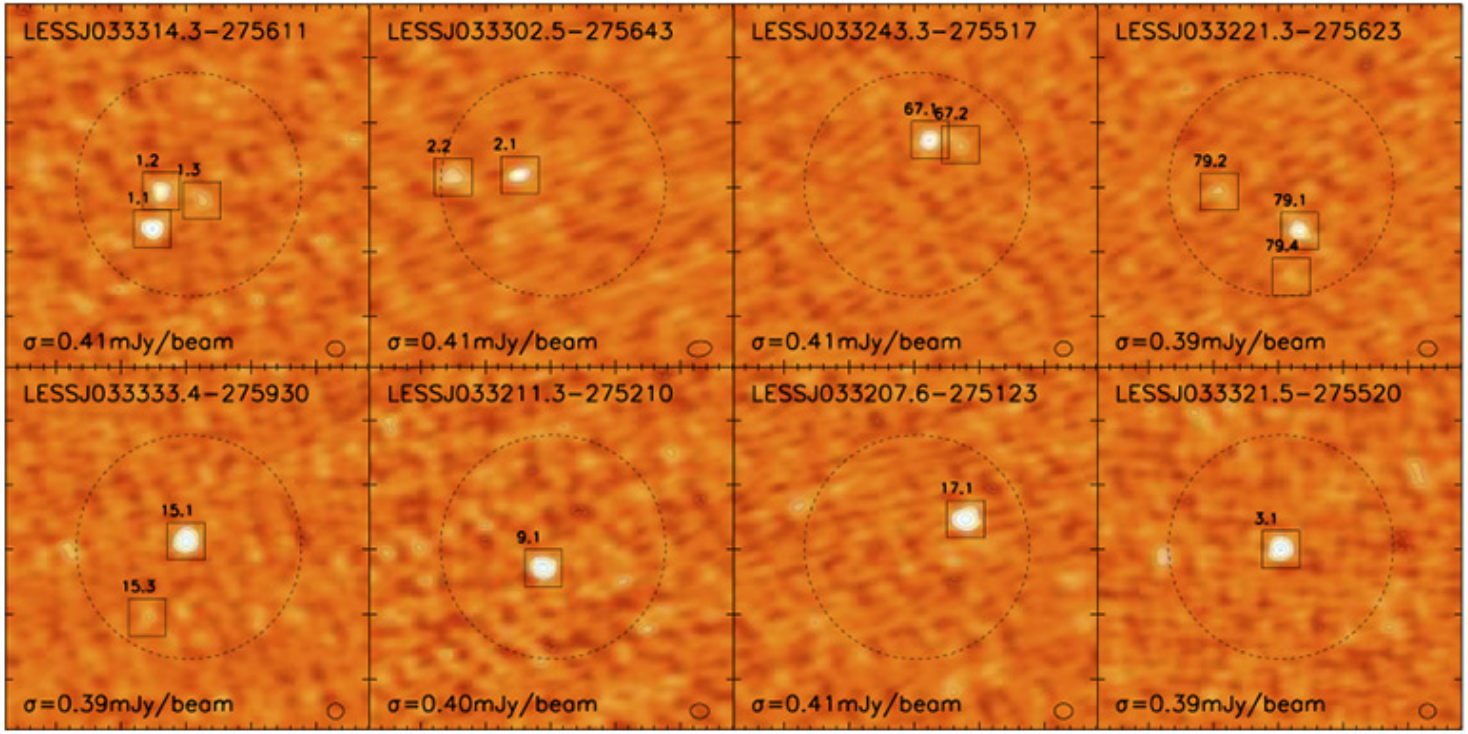
=> **different mode of star formation in the early universe**

most likely dynamically driven by compressive, high-dispersion gas motions—a natural consequence of the high gas accretion rates.

36 citations to date (power of well-designed surveys)



Resolving High-z Submm Galaxies with ALMA



Hodge et al. (2013)

126 submillimeter sources observed with ALMA at 870 μm

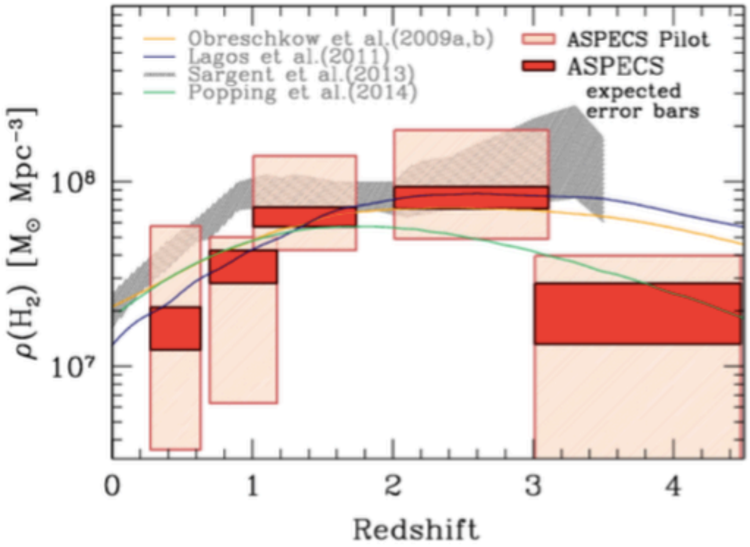
2x deeper, 10x higher angular resolution than previous surveys

99 sources detected in 88 fields, integration time ~120 sec (!!)

Significant multiplicity (35-50%) found at 0.2” resolution

ALMA Deep Fields

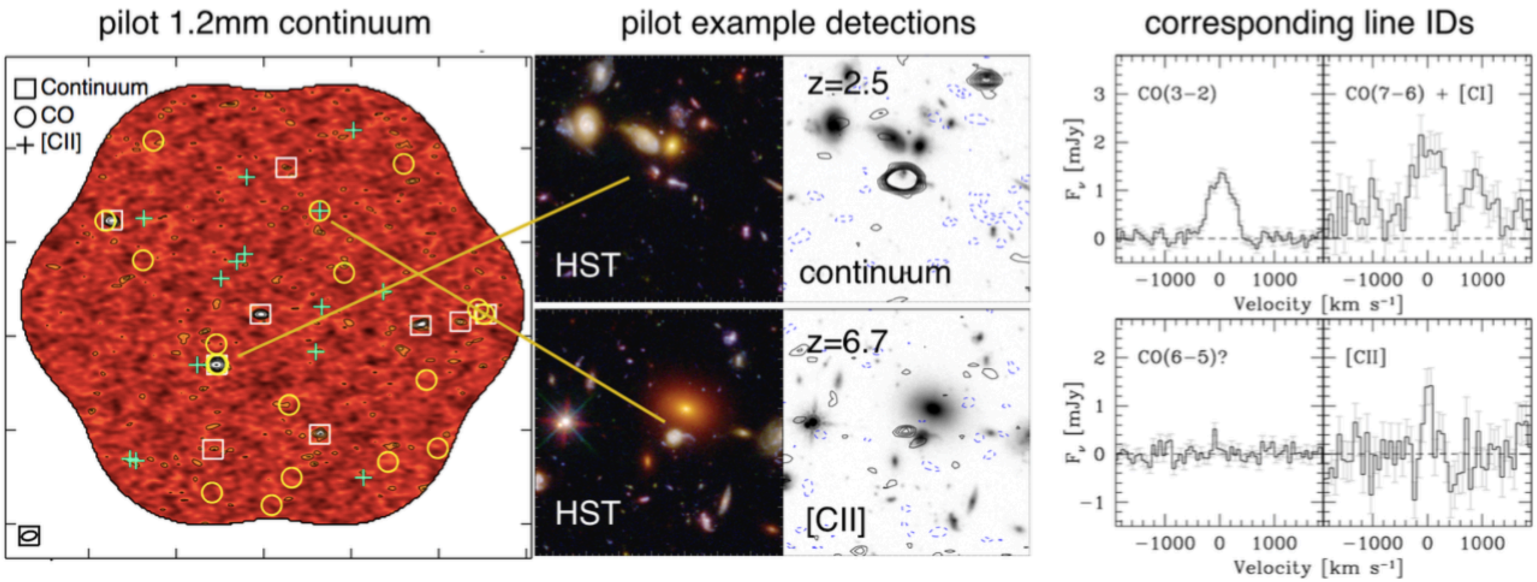
Large volume surveys for cold gas (SF) throughout the universe



ASPECS is the first line deep field, involving full frequency scans of Band 3 and 6 in the Hubble UDF

- 21 candidate line galaxies
- CO emission from galaxies z =1 to 5
- [CII] at z > 9
- 9 dust continuum sources at 1.2 mm

see papers by: Walter, Decarli, Aravena

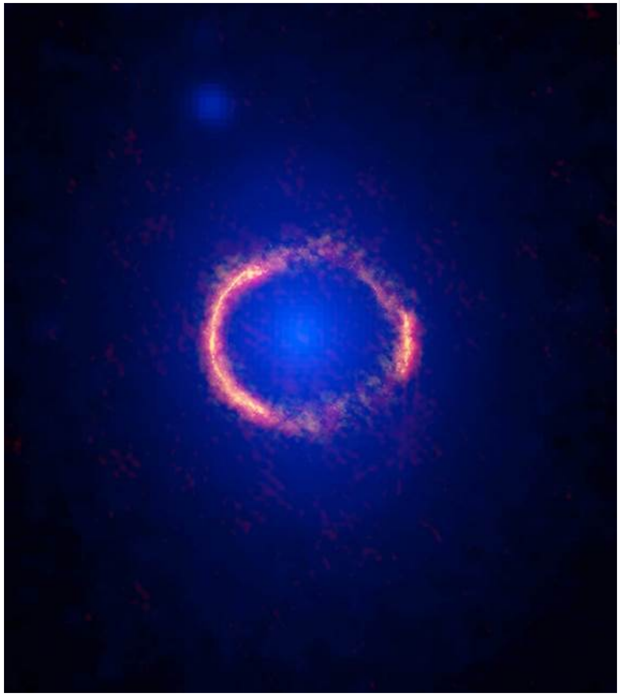


Observing the Distant Universe with ALMA

Hezaveh et al (2016) show ALMA's potential to advance understanding of dark matter substructures

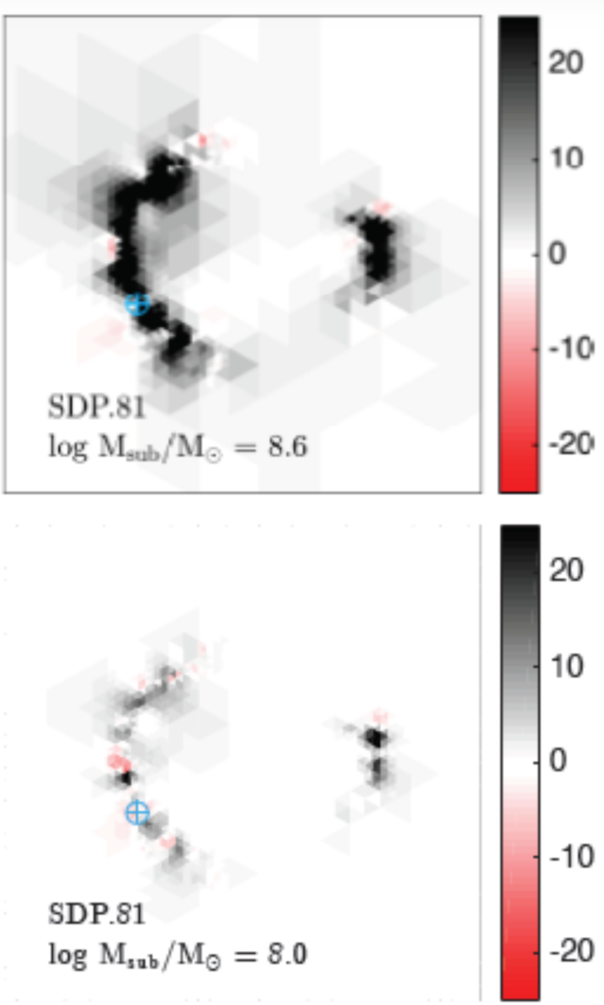
SDP.81 observations at Bands 4, 6 and 7 shown to detect subhalo with mass $10^{8.96\pm0.12}$ M_{sun}

Consistent with theoretical expectations



Blue: HST/WFC3 F160W data shows lensing elliptical at z~0.3

Red: ALMA Bands 4/6/7 combined emission.



ALMA Cycle 7 Capabilities

ALMA Capabilities

The Cycle 7 capabilities are fully described in Appendix A of the ALMA Proposers Guide available at:

https://almascience.nrao.edu/documents-and-tools

Number of antennas

12-m Array	7-m Array	12-m TP
43 (50)	10 (12)	3(4)

Receiver bands and 12-m Array Configurations

Band:	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Wavelength (mm):	3.1	2.1	1.6	1.3	0.87	0.74	0.44	0.32
Frequency (GHz):	100	150	183	230	345	460	650	870
Max Baseline (km):	16	16	16	16	**16**	3.6	3.6	3.6
Max Resolution (”):	0.042.	0.028	0.021	0.018	**0.012**	0.048	0.032	0.024

Files containing representative antenna configurations for the 12-m and 7-m arrays suitable for Common Astronomy Software Applications (CASA) simulations are available from the ALMA Science portal (http://almascience.org/documents-and-tools/cycle5/alma-configuration-files)

ALMA Capabilities

Available Observing Time:

	12-m Array	7-m Array	12-m TP
Time (hours):	4300*	3750**	3750

* includes DDT, Cycle 6 Carryover and resubmissions

**~750 Hours of ACA time will be available through the Supplemental Call in mid-Cycle 7.

Spectral line, continuum, and mosaic observations

- **Spectral line and continuum:**12-m Array and the 7-m Array, all bands
- **Single pointing:** 12-m Array and 7-m Array, all bands
- **Mosaics:** 12-m array and 7-m Array, Bands 3 to 9
- **Single-dish (TP) spectral line, no continuum:** Bands 3 to 8

Polarization

- Single pointing, on axis, full (including circular) polarization for both continuum and full-spectral-resolution observations in Band 3, 4, 5, 6, and 7 are offered on the 12-m Array.
- Minimum detectable degree of circular polarization = 1.8%
- Circular polarization will be offered only for sources that are on-axis with an angular size less than 10% of the FWHM primary beam (no Zeeman observations!!).

Cycle 7 capabilities

Long baseline (up to 16km) in B7

- Band 7 available for first time out to 16 km.
- Standard mode if calibrator found within 5 deg, nonstandard if not
- **NOTE: There will be NO C43-9 or C43-10 in Cycle 8! If you want/need those longest baselines, request them for Cycle 7 or wait until Cycle 9**

Improved Spectral Scan Mode

- Spectral Scan observing mode 25% faster and offered as standard mode

Band 7 Solar Observations

- Band 7 continuum observations will be available for Solar observing. This will also include the full continuum single-dish map of the sun (always available for Solar).

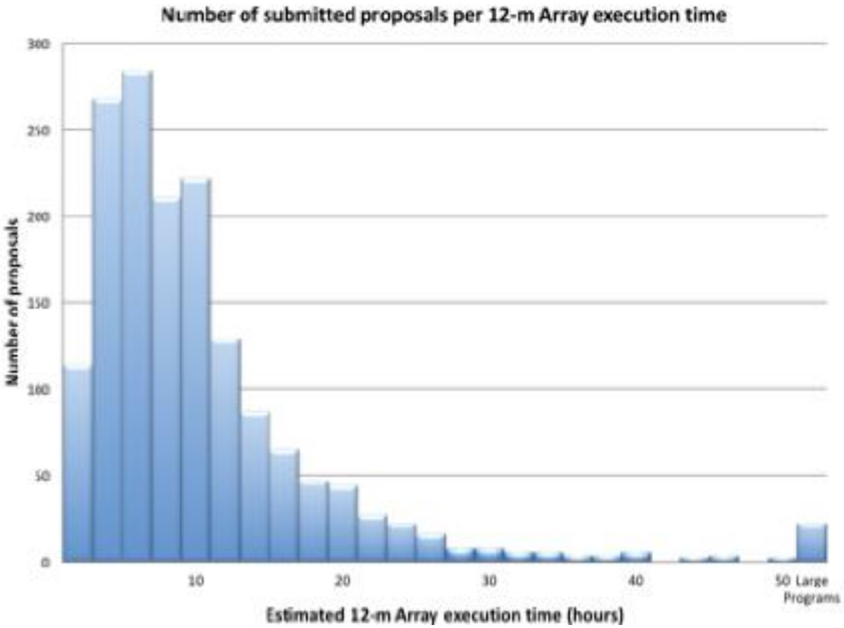
Relaxed restrictions on data rates

- Previous restrictions on observing modes set from the ALMA data rate have been removed. Users should no longer be limited by data rate restrictions or warnings when proposing.

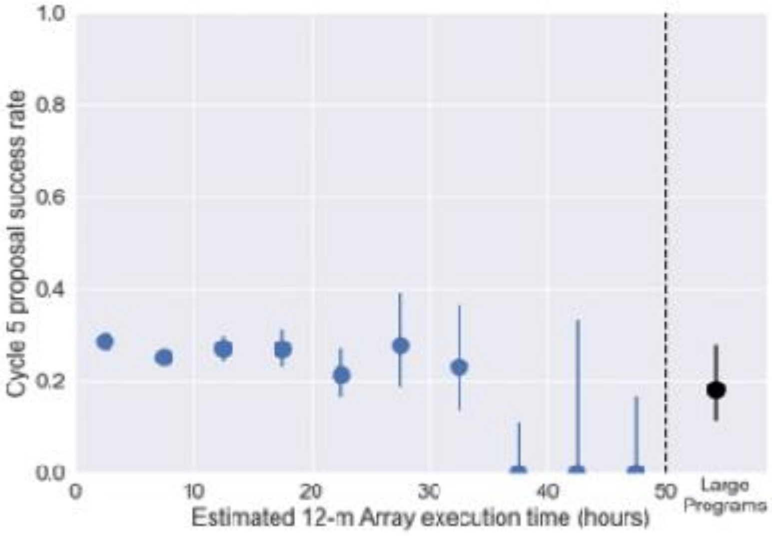
Proposal Length

Acceptance rate does not depend on proposal length

- **Strongly encourage** ACA only observations
- Also encourage “medium size” proposals of about 10-30 hours



Number of submitted proposals per 12-m Array execution time



Standard vs Non-Standard modes

What is non-standard?

Observations take additional observatory resources to calibrate, image, and deliver data (no guarantee it can be run through the standard pipeline)

About 20% of time will go to non-standard observations*

The fraction of time available for testing of new capabilities in Cycle 7 is ~10%

Non-Standard Observing Modes include:

- Band 7 observations with long baselines (> 16 km) with no phase calibrator within 5 degrees of science target. OT will asses availability of calibrator.
- Bands 9 and 10 observations
- All polarization observations
- Bandwidth switching projects (having less than 1 GHz aggregate bandwidths over all spectral windows)
- Solar observations
- VLBI observations
- Non-standard calibrations (user-defined calibrations selected in the OT)
- Astrometric Observations

ACA Supplemental Call

- In Cycle 7, ALMA will offer a stand-alone ACA Supplemental Call for Proposals.
- Supplemental Call will be issued on **3 September 2019** with a proposal deadline on **1 October 2019**.
- Minimum **750 h** of observing time on the ACA will be allocated through the Supplemental Call for observations between January 2020 and September 2020.
- Proposals may be submitted that use the 7-m Array only or the 7-m Array plus the Total Power array and with the same technical capabilities offered for the ACA in the Main Call.
- ACA prioritization:
  - Main Call: proposals which require ACA time (in combination with the 12-m Array or stand-alone ACA observations only) will only be eligible for "A" or "B
  - Supplemental Call: in the Supplemental Call, stand-alone ACA proposals accepted to the scheduling queue will be all given priority "C".
- **Proposals submitted to the Supplemental Call will be peer reviewed through a distributed system.**

More information about the supplemental call can be found at: https://almascience.nrao.edu/proposing/7m-array-supplemental-call

ALMA Capabilities

Full ALMA Operations (All Cycle 7 Capabilities plus):

Receiver bands:

- Include Bands 1 and 2

Baselines:

- All bands out to 16 km. Same may never be considered a standard mode

Standard vs Non-Standard modes:

- Fraction of non-standard modes should decrease to about 10%

Observing Time:

- Up to 4500 hours+ for successful proposals of PI programs expected on the 12m Array (includes DDT, Cycle 7+ Carryover and resubmissions)

Observing Modes:

- Wide field polarization capabilities (12m + 7m arrays)
- Full operations include full Stoke plus circular polarization at all observing bands including mosaics and Total Power

ALMA Cycle 7Timelines and Milestones

Date	Milestone
19 March 2019 (15:00UT)	Release of Cycle 7 Call for Proposals, Observing Tool & supporting documents and Opening of the Archive for proposal submission
17 April 2019 (15:00 UT)	**Proposal submission deadline**
End of July 2019	Announcement of the outcome of the Proposal Review Process
05 September 2019	Deadline for Submission of Phase 2 by PIs
October 2019	Start of ALMA Cycle 7 Science Observations
September 2020	End of ALMA Cycle 7

ALMA Cycle 7 Supplemental Call Timelines

Date	Milestone
03 September 2019	Call for Proposals and Supplemental Call submission server opened
01 October 2019	**Deadline to submit Supplemental Call proposals**
15 October 2019	Proposals released to reviewers
22 October 2019	Deadline for reviewer to report conflicts of interest on proposal review assignments
12 November 2019	Deadline to submit reviews and ranks
Early December 2020	Notification emails sent to PIs
January 2020	Successful Supplemental Call proposals enter the observing queue

ALMA Array Configuration Schedule (Cycle 7)

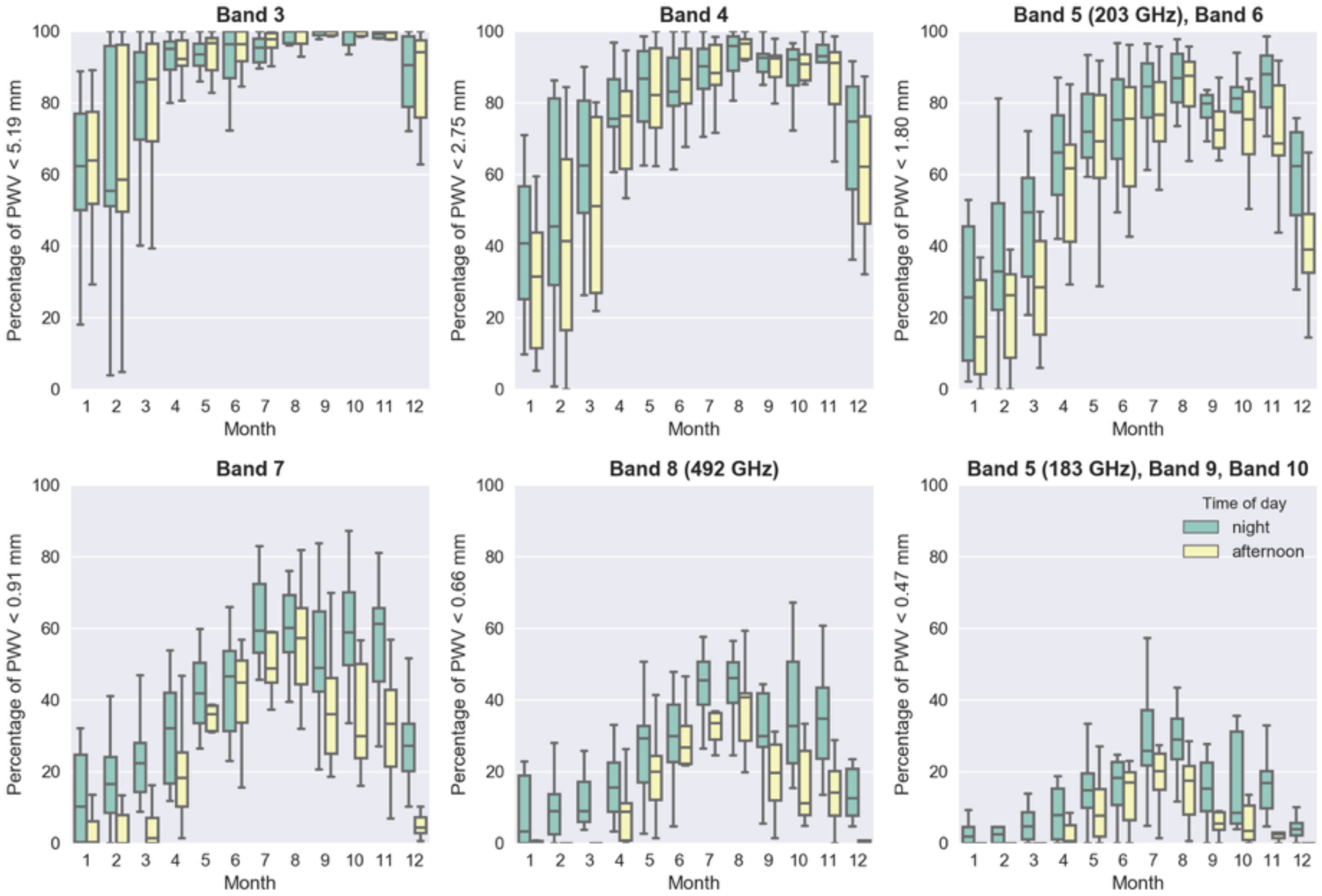
The array configuration schedule will cycle every couple years to accommodate the range of LST.

Cycle 7 expected to have longest baseline array configurations in winter (best weather) for higher frequency bands.

NOTE: No PI observing takes place in Feb!

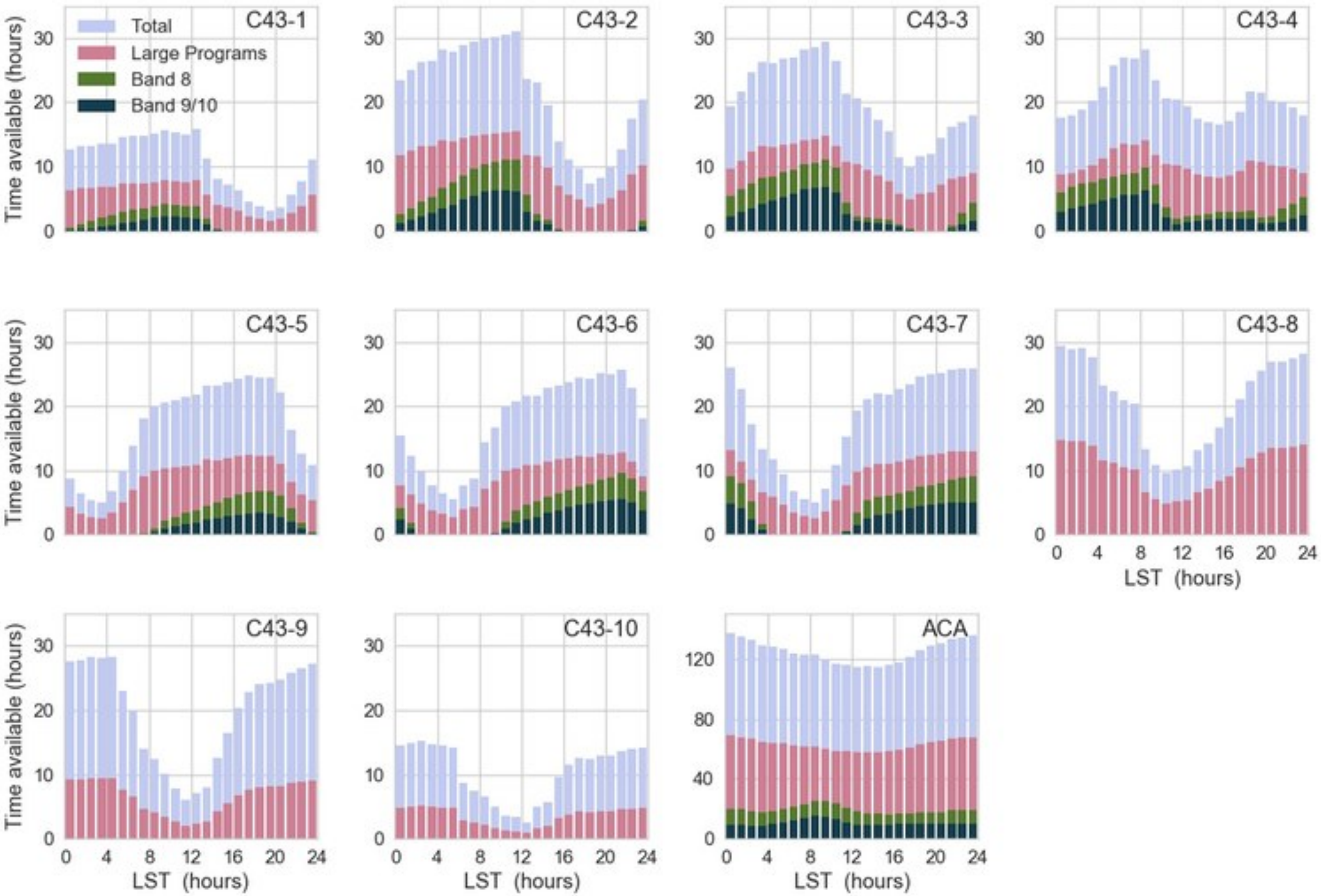
Start date	Configuration	Longest baseline	LST for best observing conditions
2019 October 1	C43-4	0.78 km	~ 22h – 10h
2019 October 20	C43-3	0.50 km	~ 23h – 11h
2019 November 10	C43-2	0.31 km	~ 1h – 13h
2019 November 30	C43-1	0.16 km	~ 2h – 14h
2019 December 20	C43-2	0.31 km	~ 4h – 15h
2020 January 10	C43-3	0.50 km	~ 5h – 17h
2020 February 1-28	No observations due to February Maintenance		
2020 March 1	C43-4	0.78 km	~ 8h – 21h
2020 March 20	C43-5	1.4 km	~ 9h – 23h
2020 April 20	C43-6	2.5 km	~ 11h – 1h
2020 May 20	C43-7	3.6 km	~ 13h – 3h
2020 June 20	C43-8	8.5 km	~ 15h – 5h
2020 July 11	C43-9	13.9 km	~ 16h – 6h
2020 July 30	C43-10	16.2 km	~ 17h – 7h
2020 August 20	C43-9	13.9 km	~ 19h – 8h
2020 September 10	C43-8	8.5 km	~ 20h – 9h

ALMA Weather Conditions



Best time to observe is June - August

Available Observing Time



Less time is available in Bands 8, 9, and 10

NAASC Sources of Support

- **ALMA Helpdesk:** User support is a priority so questions are usually answered within 48 hours (with around the clock staffing in the week leading up to the proposal deadline) - https://help.almascience.org
- **Student Observing Support:** Successful ALMA proposals will be invited to apply for up to $35k to support undergraduate or graduate student involvement - https://science.nrao.edu/opportunities/student-programs/sos
- **Page Charges:** Upon request NRAO covers page charges for authors at US institutions when reporting results from ALMA/VLA - https://library.nrao.edu/pubsup.shtml
- **Face-to-face Visitor Support:** Upon request NRAO will cover the travel expenses of up to 2 people from 2 teams per week to come to the NAASC to get support for data reduction, proposal preparation, etc… We also have long term visitor support as well - https://science.nrao.edu/facilities/alma/visitors-shortterm
- **ALMA Ambassadors:** You too can become an ALMA Ambassador. For program eligibility visit - https://science.nrao.edu/facilities/alma/ambassadors-program

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