



NATIONAL RADIO ASTRONOMY OBSERVATORY



NRAO Town Hall

Tony Beasley



NRAO/GBO & Government Shutdown

- With NSF & careful cash management – we anticipate the AUI Observatories operating as usual through January (all scenarios) and even mid-February (most scenarios). VLBA, GBO – longer.
- External interactions (travel, committees, panels etc.) ... constraints on NRAO-hosted events and NRAO staff participation will kick in late January.
- If shutdown continues to ~mid February – ALMA (NAASC) and VLA operations will halt. ALMA Chilean operations will continue unchanged indefinitely. NRAO online services will be affected.
- Questions – later this evening or come by the NRAO booth tomorrow.

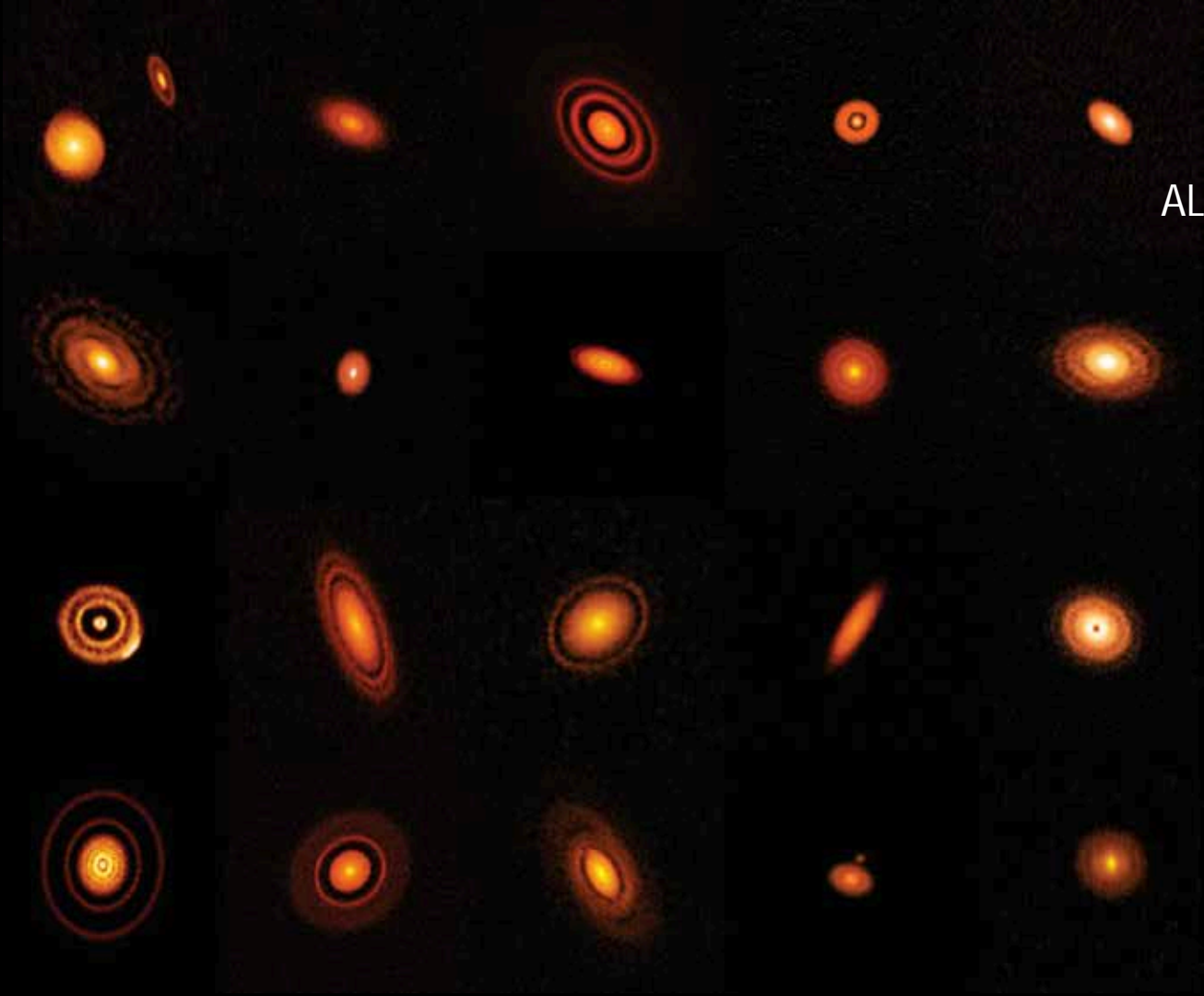


NRAO Instruments & Science - 2018

- Highlights
 - **USNO joint partnership, reintegration of Very Long Baseline Array into NRAO and new funding to fiber up the VLBA**
 - VLA – assist locating AGN source of High Energy neutrino
 - ALMA – DSHARP Large Program
 - ALMA – High-redshift Oxygen $z=9.1$
 - VLASS – Orphan GRB source detected
 - Superluminal BNS coalescence eject – VLBA

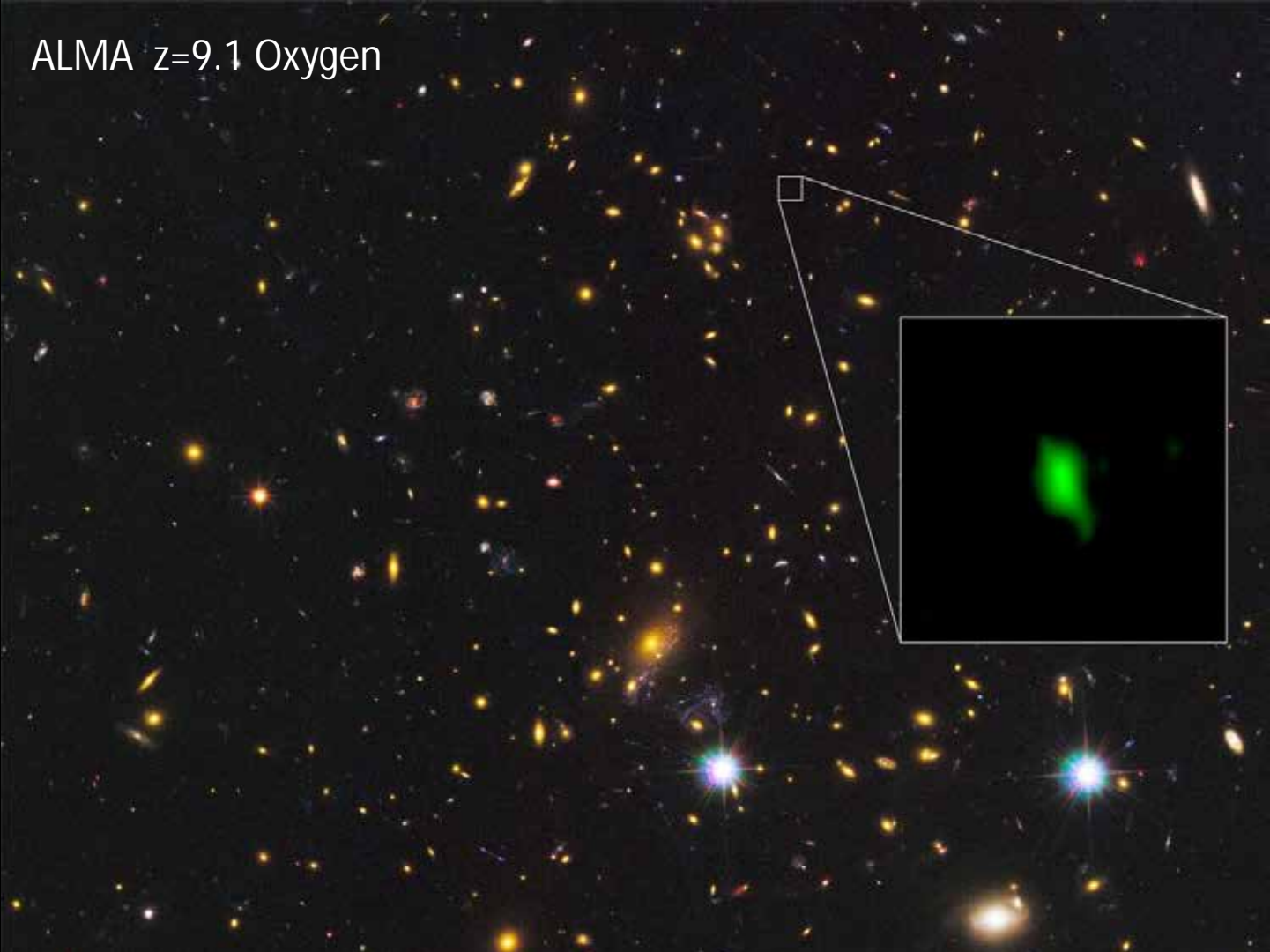
+ many others..

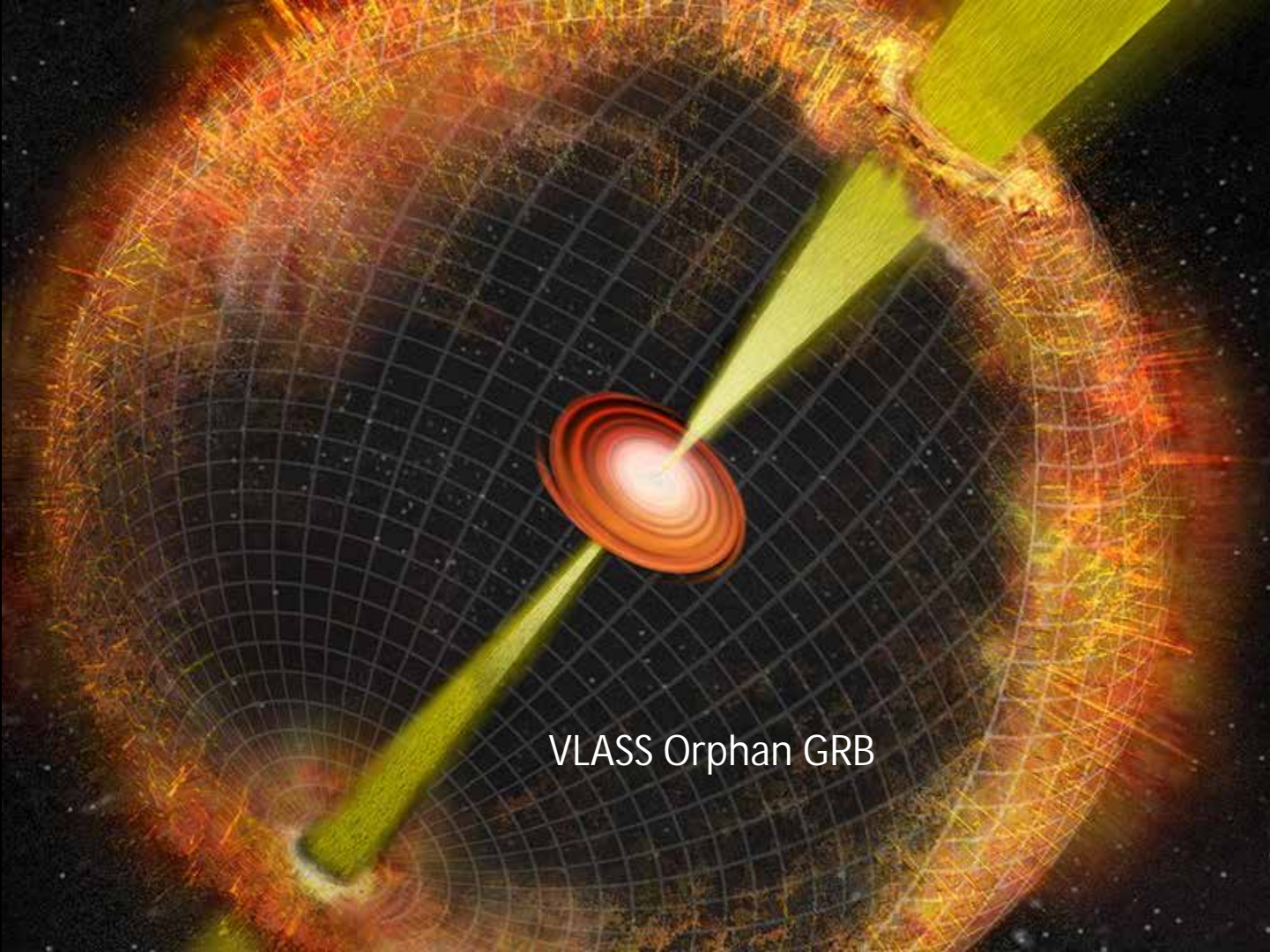




ALMA DSHARP

ALMA $z=9.1$ Oxygen





VLASS Orphan GRB

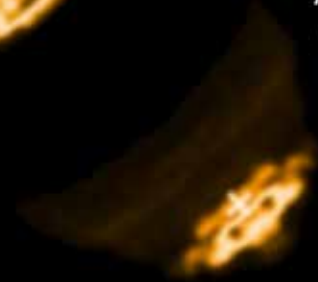
VLBA – BNS Superluminal ejecta



October 2017
(75 days)



April 2018
(230 days)



2 light years


4 light years

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Star 08 Oct 08 1998
January 7, 2018 at 10:27 am / News Feature
 Using data from ALMA, a team of astronomers studied the growth and evolution of bubbles of hot plasma produced by intense stellar outbursts. The results will contribute to understanding in greater depth the complex interplay between the hot plasma and the star's outflow.






Image Release: ALMA Discs Passing Current to Classroom
December 20, 2017 at 8:00 am / News Release
 An entire ALMA observatory passed Earth on December 2, astronomer using ALMA with a remarkably good look at its intercalibration.



Fragmenting Star Discs Birth in Shiny Star "Old" Clouds
December 16, 2017 at 10:00 am / News Release
 ALMA has detected a star in a young system that may have formed from a planet.

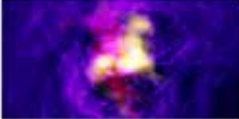


The Search of Planet Formation, From Starving
December 12, 2017 at 10:00 am / News Release
 ALMA has conducted a survey of protoplanetary disks, the planet-forming dust disks around young stars.


NRAO – 39 press releases and announcements

Showing news items 11 - 20 of 39

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Galaxy Zoo: Fountain Seen in Full Glory
November 6, 2018 at 10:00 am / News Release
 A billion light-years from Earth lies one of the universe's most massive structures, a giant surrounded by a sprawling...



VISA Returning to NRAO, Getting Technical Upgrade
October 24, 2018 at 10:00 am / News Release
 After two years as an independent facility, the VISA once again is part of the NRAO, and will get a significant technical upgrade.


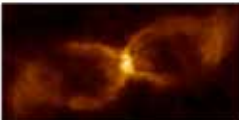



Image Release: ALMA Maps Europe's Temperature
October 23, 2018 at 10:00 am / News Release
 New ALMA images show never-before-seen surface details on Europa, including an enigmatic "cold spot"



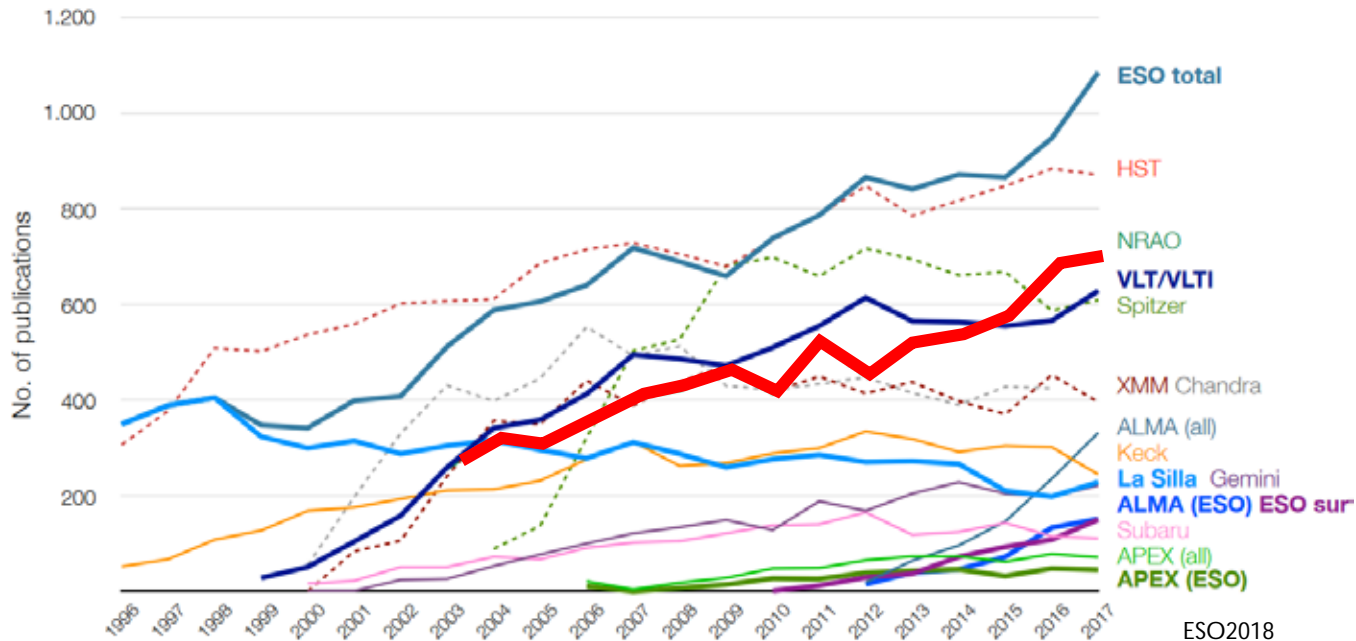
When is a Nova Not a "Nova" When a White Dwarf and a Brown Dwarf Collide
October 8, 2018 at 12:00 am / News Release
 Using ALMA, an international team of astronomers found evidence that a white dwarf and a brown dwarf collided in a short-lived blaze of glory.



VLA Sky Survey Reveals First "Orphan" Gamma Ray Burst
October 4, 2018 at 10:00 am / News Release
 Comparing data from new, ongoing sky survey to data from previous observations reveals probable gamma ray burst that directed no gamma rays toward Earth.



Publications of major observatories by year



ESO2018

NRAO Telescope Citations

573,635



NRAO Strategic Initiatives

- Rebuild physical infrastructure – VLA
 - VLA Sky Survey
 - Science-ready Data Products
 - Central Development Laboratory
 - Broadening participation
 - Next generation VLA (ngVLA)
 - SKA engagement
-
- Scientific, technical, global environment evolving...
 - Decadal Survey approaches...

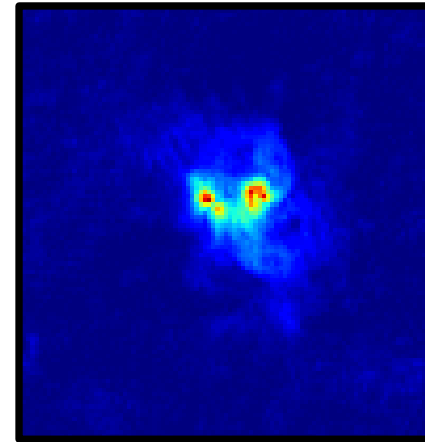
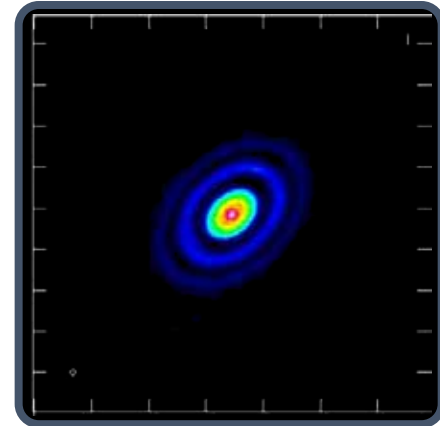


Science Ready Data Products

- Maximizing NRAO's Scientific Impact

The goal of the SRDP project is to increase the scientific impact of NRAO's telescopes by

- Allowing users to focus more on science and less on data reduction
- Broaden our user community by decreasing the barriers to using NRAO's interferometers – ALMA success!
- Curating a rich archive of images for archival study



CASA - Global Software Infrastructure for Radio Astronomy



National Astronomy Consortium

The NAC Undergrad Experience



2018 NAC Program – All Sites



Tiffany Christian

STScl
Lou Strolger



Allison Erena

UW-Madison
Eric Wilcots



Lina Florez

Princeton
Michael Strauss



Angelina Gallego

STScl
Lou Strolger



Samantha Garza

UW-Madison
Bob Benjamin



Maryam Hami

NRAO
Dana Balser



Kaimi
Kahihikolo

Princeton
Josh Winn



Sophie
Lebowitz

NRAO
Bjorn Emonts



Cecilia Molina

NRAO
Aaron Evans



Kelly Sanderson

NRAO
Tony Beasley



Antoine
Washington

Princeton
Jenny Greene



Brett McGuire



The Laboratory Astrophysics Division (LAD) of the American Astronomical Society (AAS) has named Dr. Brett McGuire of the National Radio Astronomy Observatory (NRAO) the recipient of its 2019 Early Career Award.

Given to an individual who has made important contributions to laboratory astrophysics within 10 years of receiving their PhD, the award recognizes McGuire for significant laboratory and observational advancements in our knowledge of the inventory and evolution of complex molecules in the interstellar medium.

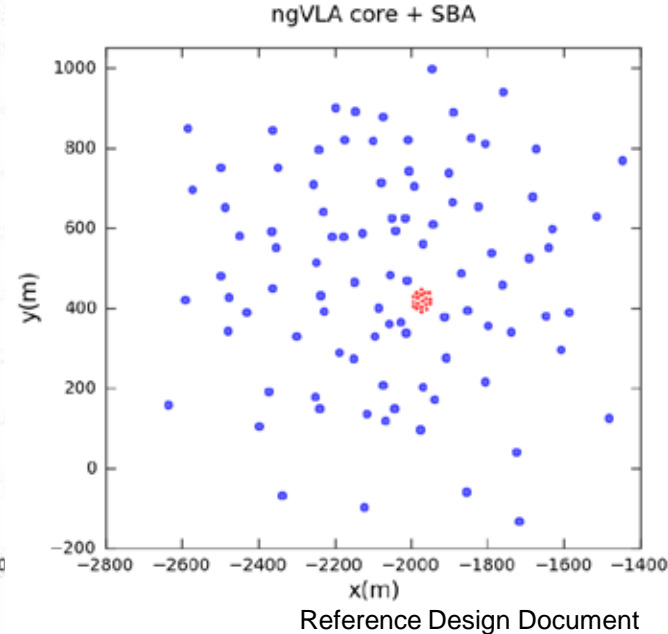
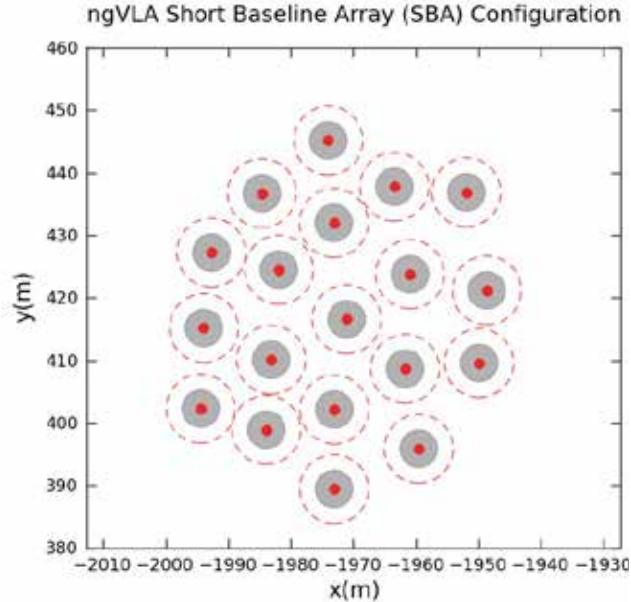


Next-Generation Very Large Array



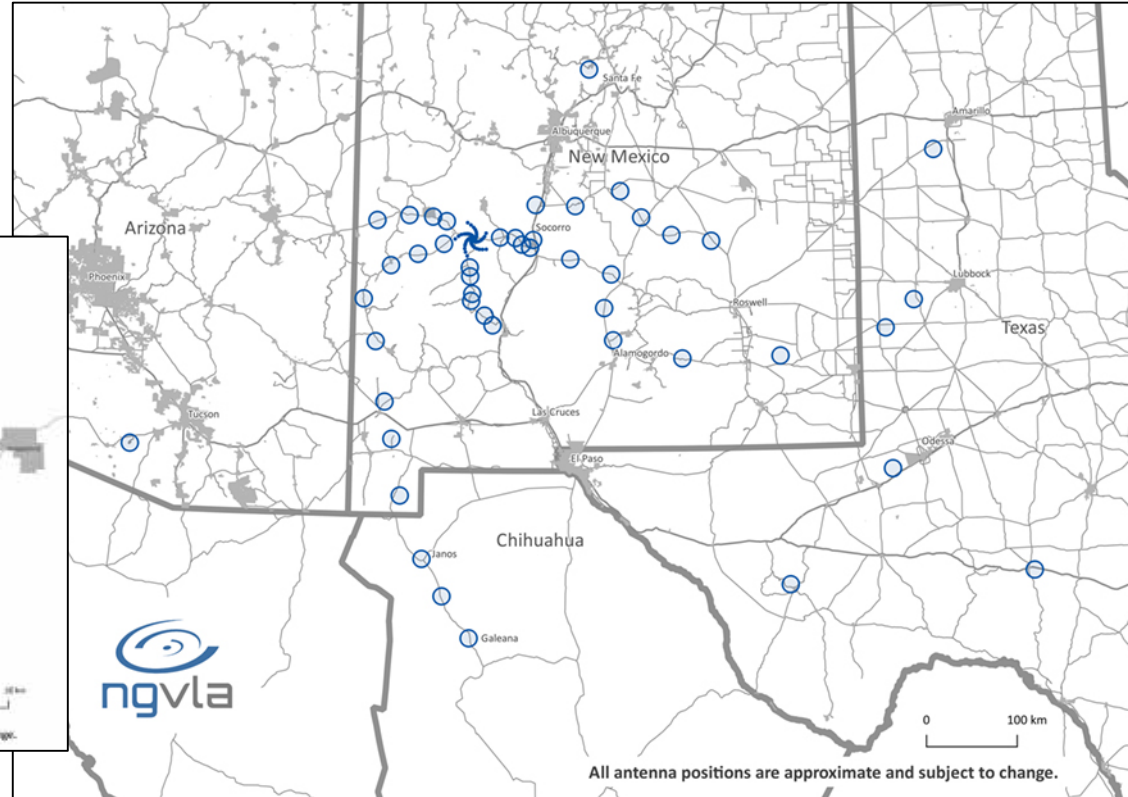
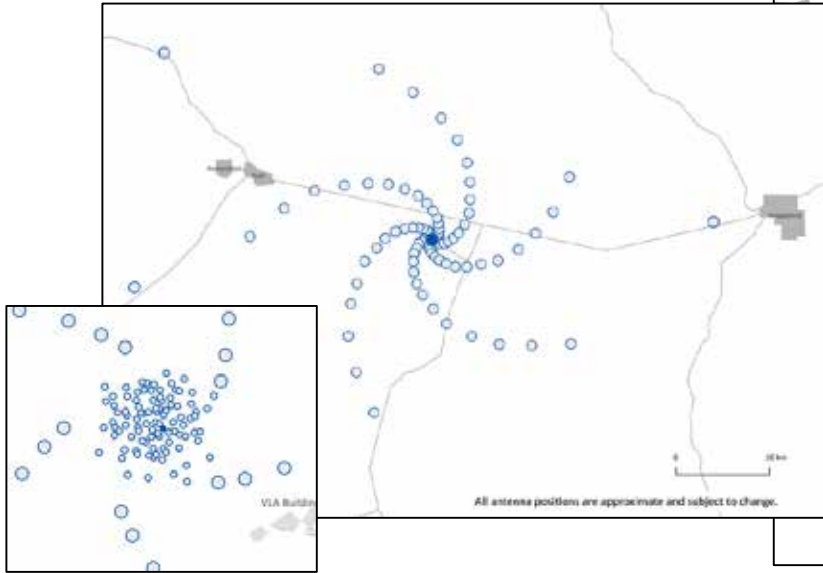
Short Baseline Array (SBA) And Total Power

- Short Baseline Array of 19 x 6 m (shortest baseline = 11 m)
- Total Power Array of 4 x 18 m (included as part of the 214 main array).



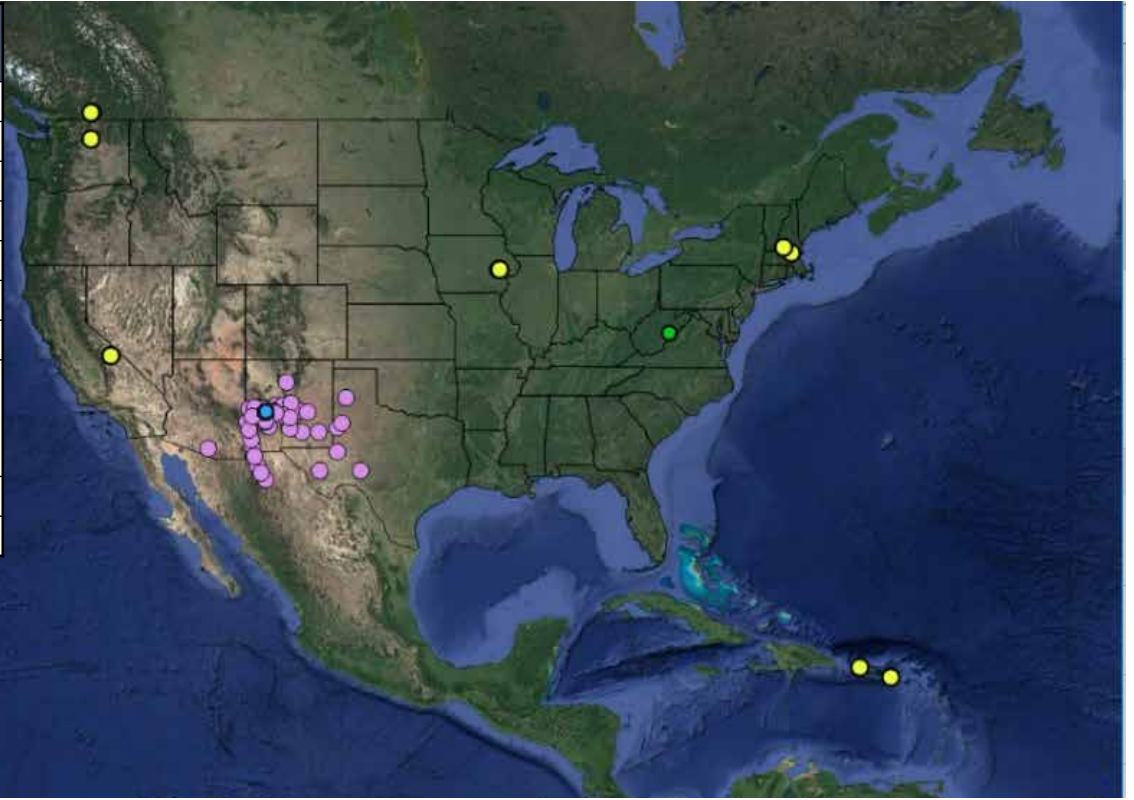
The Main Array Configuration

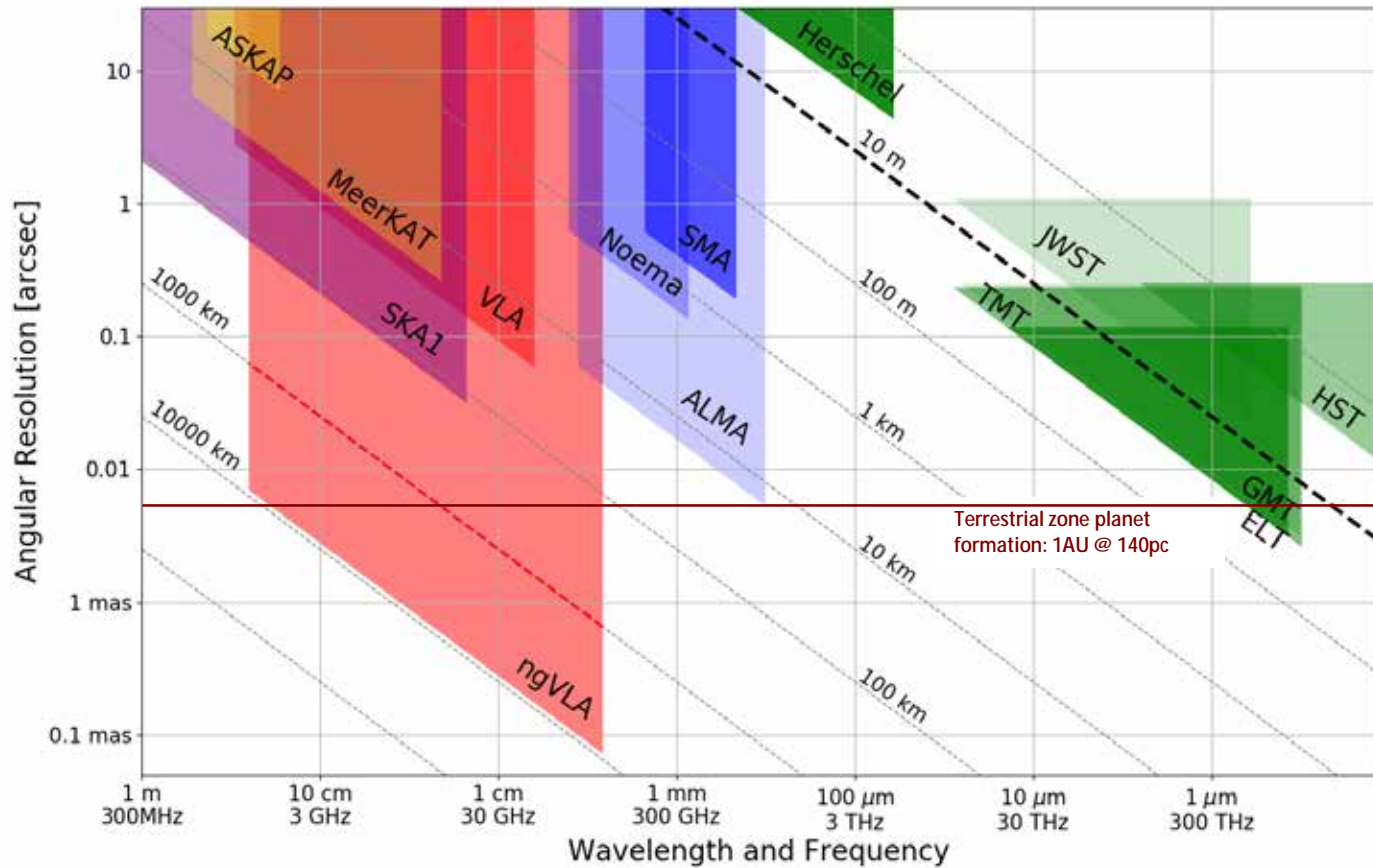
- Array of 214 x 18m off-axis antennas
- 44% core: $b < 1.3 \text{ km} \Rightarrow 1.5''$ at 30GHz
- 79% mid: $b < 37 \text{ km} \Rightarrow 0.6''$
- 100% to long: $b < 1000 \text{ km} \Rightarrow 0.002''$



Long Baseline Array

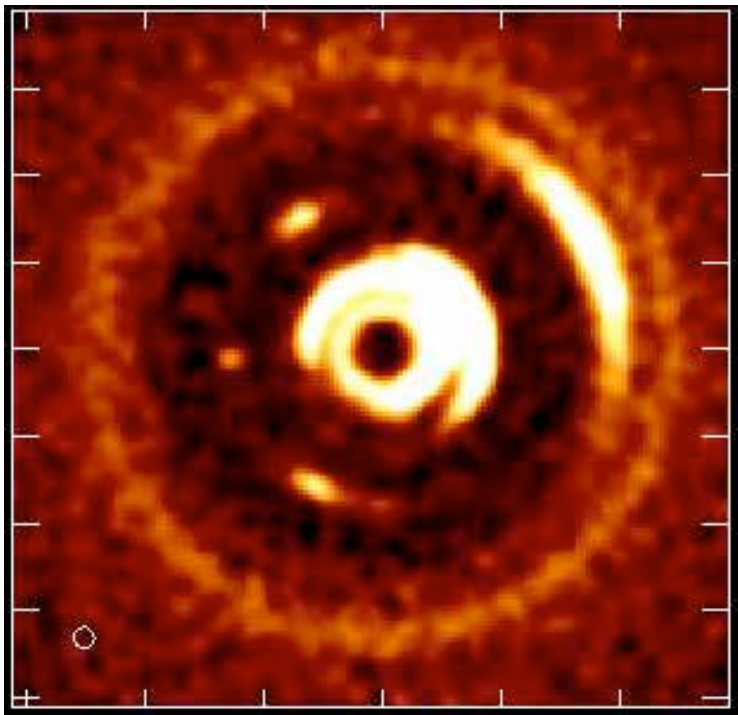
Antenna Qty	Location	Notes
3	Puerto Rico	Arecibo site.
3	St. Croix	Existing VLBA site.
3	Kauai, Hawaii	New Site.
3	Hawaii, Hawaii	<u>NOT on MK. New site.</u>
2	Hancock, NH	Existing VLBA site.
3	Westford, MA	Haystack Observatory.
2	Brewster, WA	Existing VLBA site.
3	Penticton, BC	Dominion Radio Astrophysical Observatory.
4	North Liberty, IA	Existing VLBA site.
4	Owens Valley, CA	Existing VLBA site.





Unveiling the Formation of Solar System Analogues

The ngVLA will measure the orbital motion of planets and related features on monthly timescales.



The ngVLA will measure the planet IMF down to ~5-10 Earth masses and unveil the formation of planetary systems similar to our own Solar System.

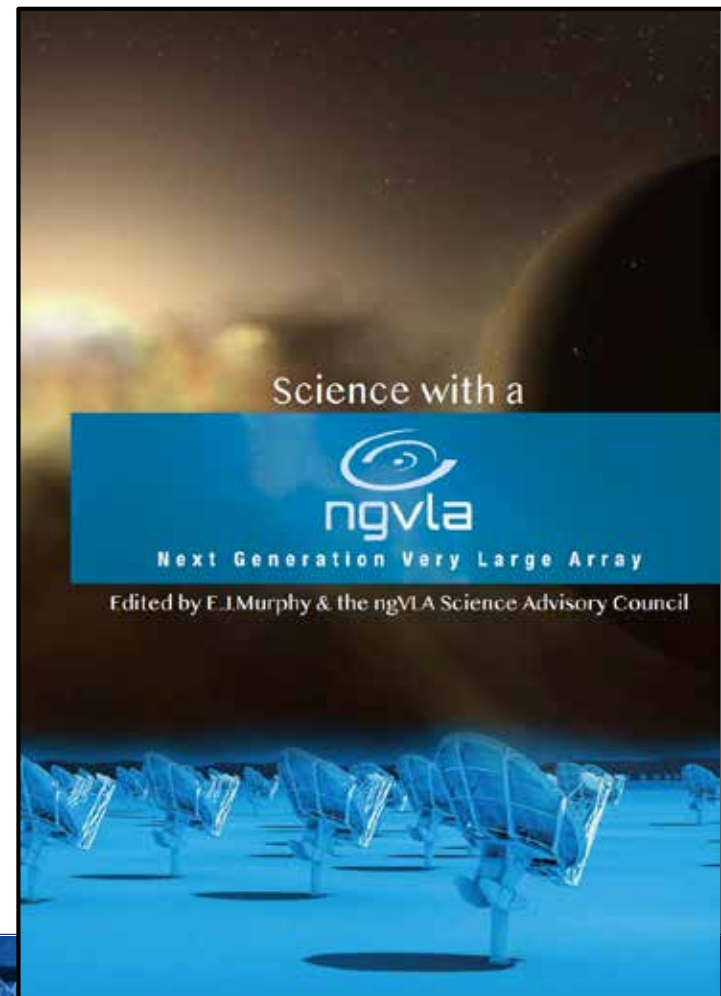
Simulated 100 GHz ngVLA observations of a newborn planetary system comprising a Jupiter analogue orbiting at 5 AU from a Solar type star.

Ricci et al. (2018)

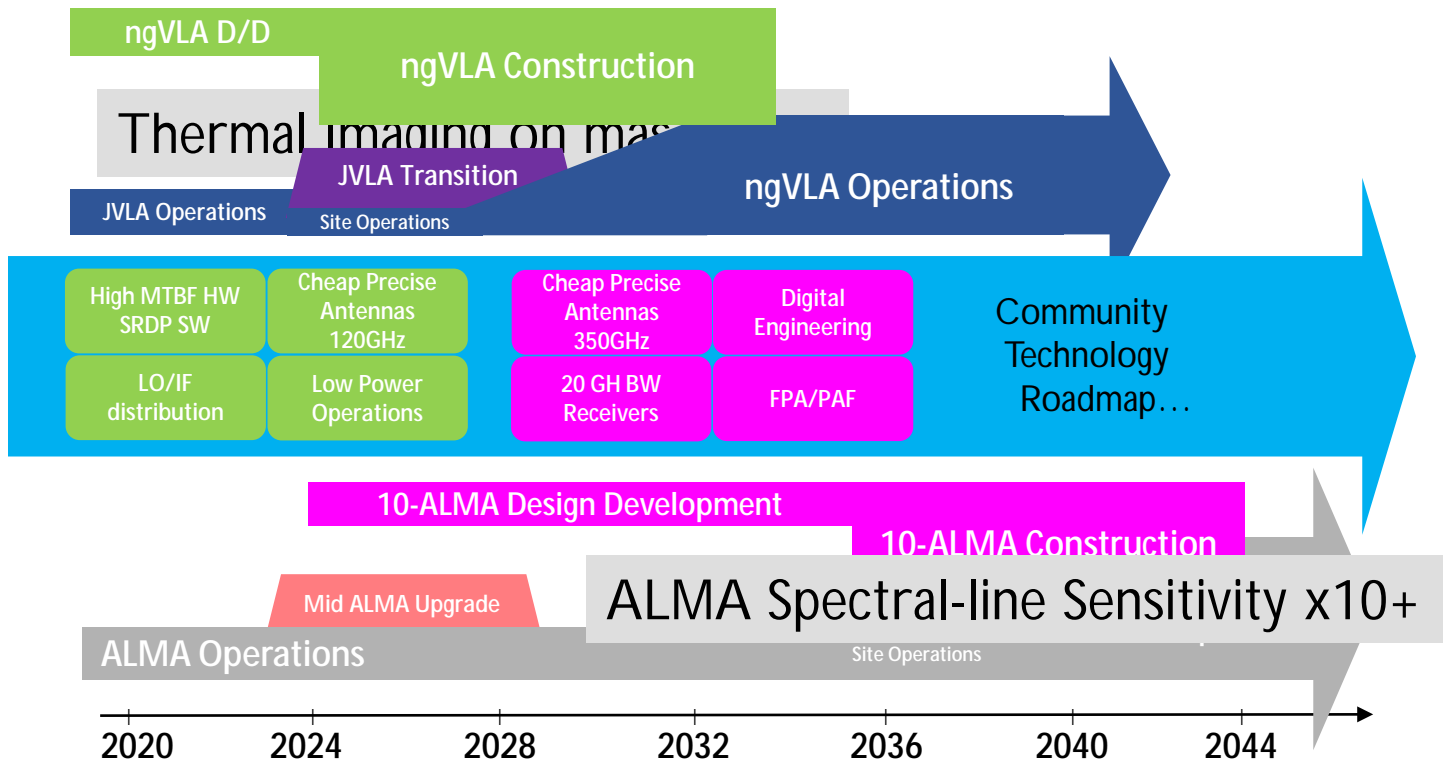


ngVLA Science Book

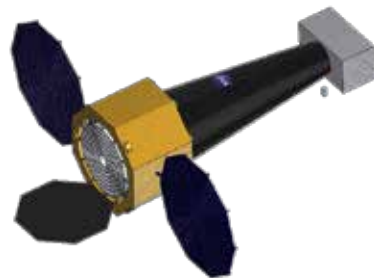
- Released here at AAS 233
 - 57 (refereed) contributions
 - ~200 unique authors
 - Volume is culmination of numerous science/technical meetings, beginning with Jan 2015 AAS
- Community Studies Program:
 - 38 studies over 2 rounds, financially supported by NRAO
 - Community-led Science Use Cases: 80 submitted for 'Reqs to Specs' process (ngVLA memo # 18)
- Related: Kavli science meeting series: 2016-2017
- Science Meeting – June 2019



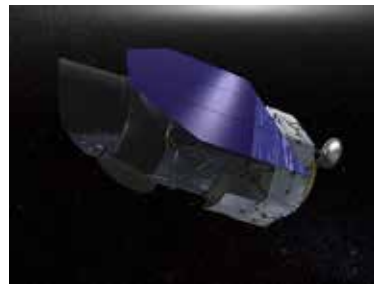
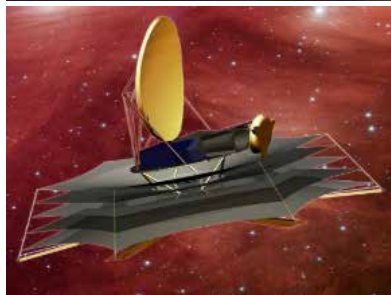
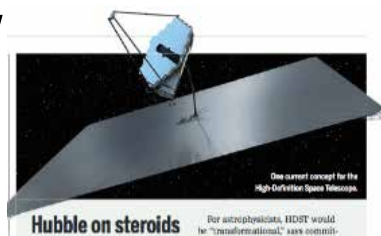
25 Years of US Major Facility Radio Astronomy...



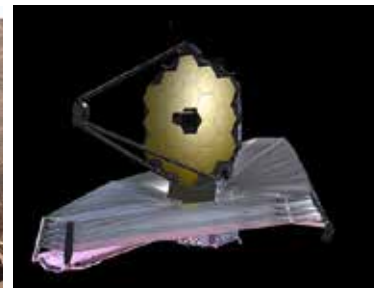
ASTRONOMY in 2020s



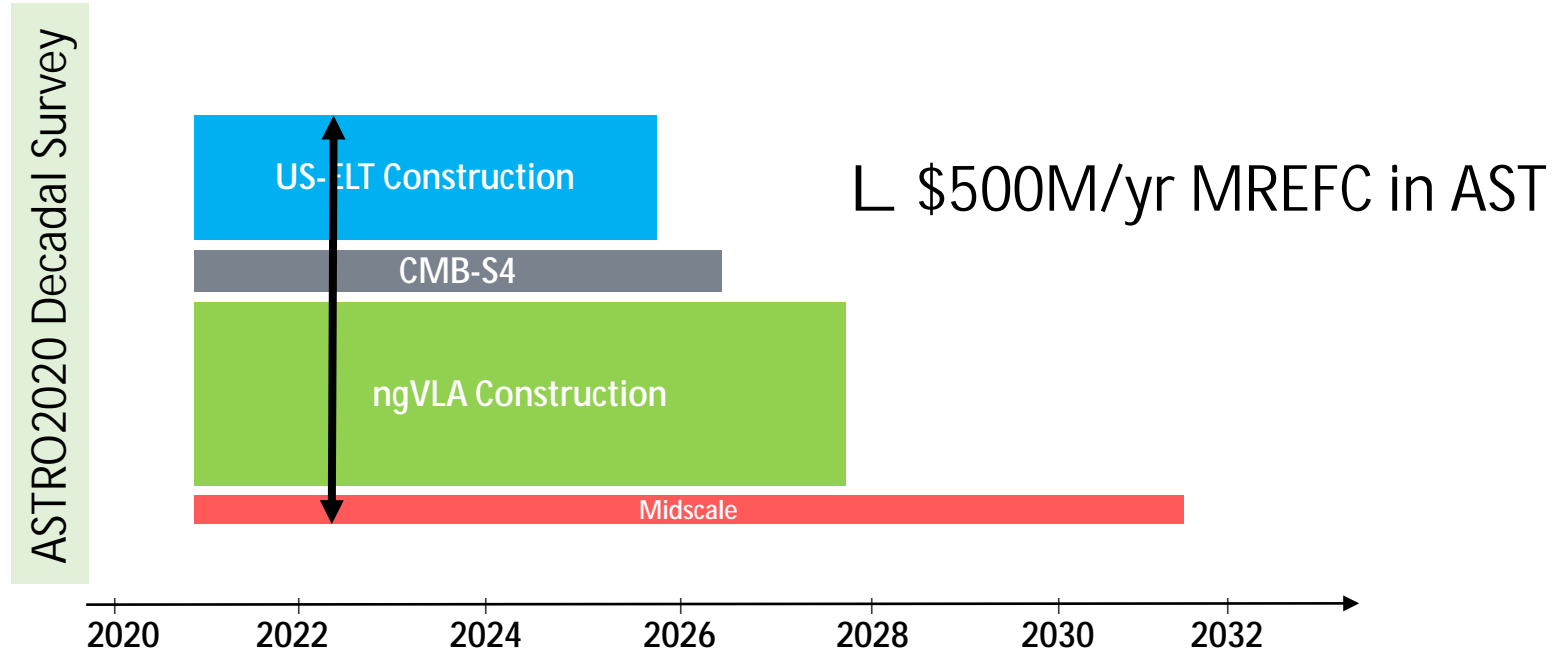
Decadal Survey Underway!



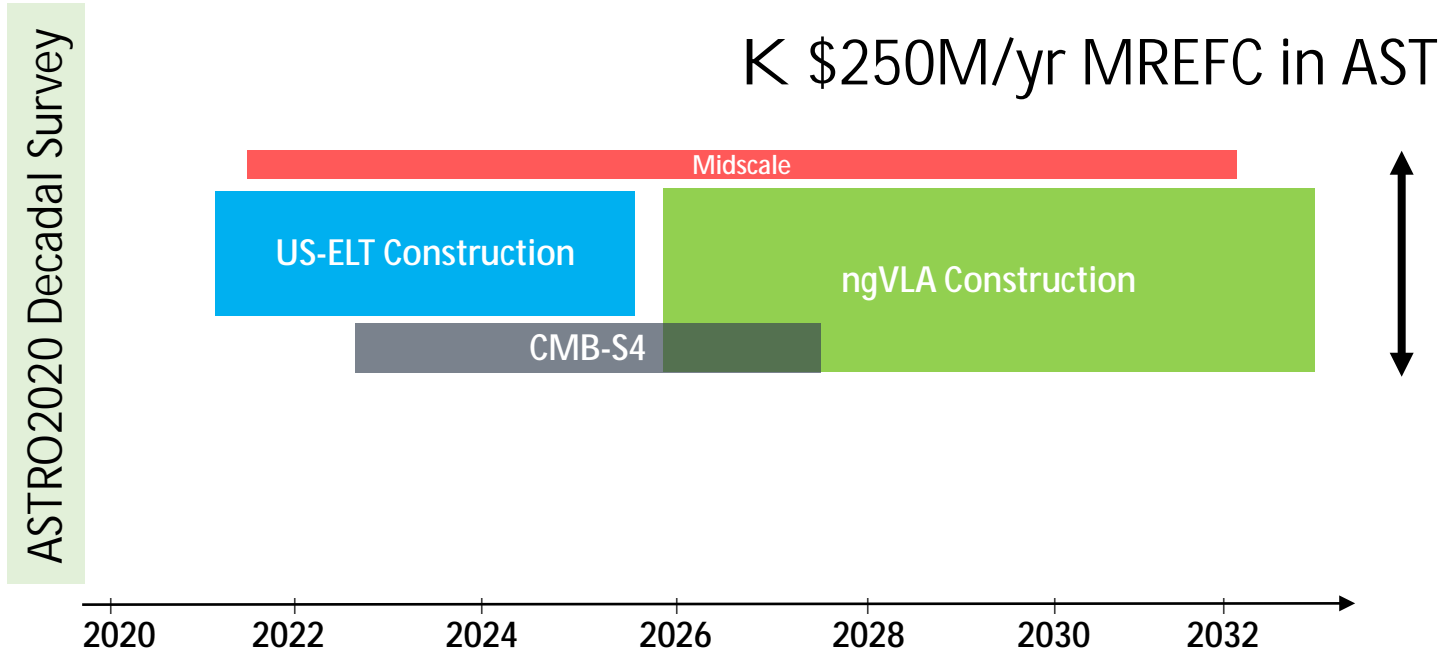
- + CMB-S4
- + Midscale
- + ??



2020s – US Astronomy Coordination needed!



2020s – US Astronomy Coordination needed!



Other US factors:

- Science drivers evolve... 2020s “Transients”
- NSF Facilities Operations costs - unsolved
- MREFC process/definition – under review
- Costs of “science business” increasing
- Science funding in the US
- My opinion: all the science is remarkable, and all these projects can happen if we coordinate, support and advocate!
- Also: align with international initiatives...



SKA

- Welcome our SKA colleagues to AAS
- Exciting time ... ramping up to construction in next year or two
- SKA1 Low and Mid – important 2020s instruments dm/m I
- Some overlap, but highly complementary (frequency, sensitivity)
- SKA1 – ngVLA – ALMA → right tools for astronomy!
- Under discussion: symmetric access on SKA1 and ngVLA for our respective communities – a **global radio alliance**
- Maintain the “open skies” approach that we value as a community
- **Summit meeting – ngVLA & SKA – June. Stay tuned!**



Summary

- NRAO: continue to serve the astronomy community – science, data, infrastructure, expertise, training, student & publication support, engineering collaboration,
- Pursuing our key initiatives, working closely with the community and NSF. We need your inspiration and support.
- Decadal Survey – US coordination – international coordination critical.
- Ignore the current political madness. We are very lucky.

NRAO: We are your national radio observatory.



Thanks to the NSF and AUI

Many Thanks to the NRAO Staff!





www.nrao.edu
science.nrao.edu

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