# AAAC

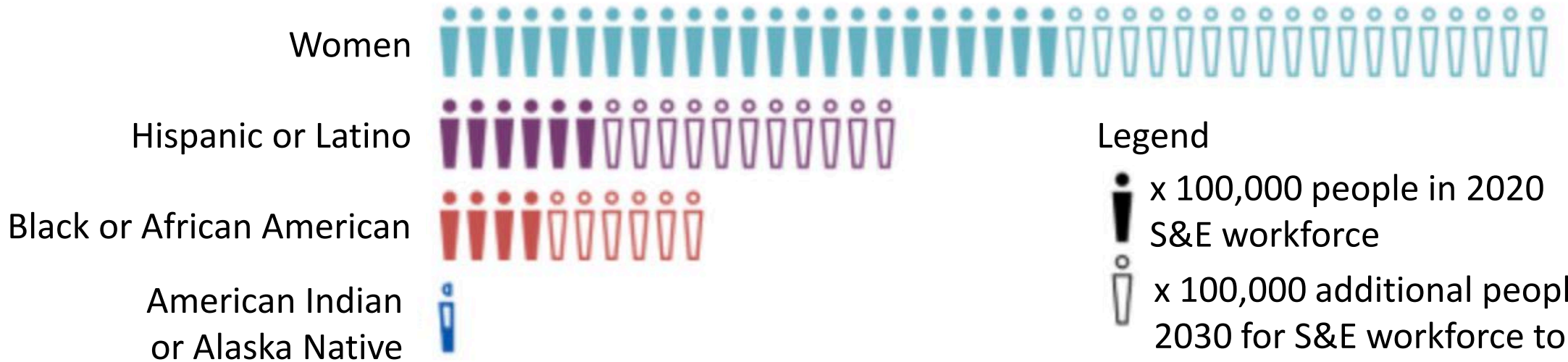
Debra Fischer
NSF MPS/AST DD

September 26, 2022

# Hiring IIP (exoplanets / planetary) and ESM program officer

# My priorities as AST DD: building inclusivity

Faster progress increasing diversity is needed to reduce significant talent gap.



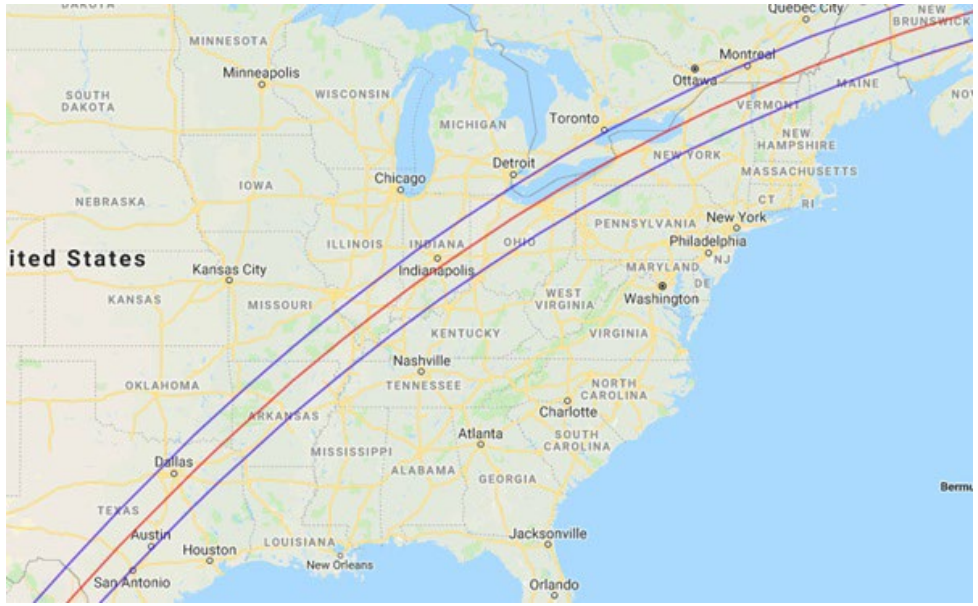

The qualities that make great scientists are not linked to gender, race, ethnicity, country of origin. They are linked to opportunities and inclusion.

NSF cannot do this alone. We must partner with universities.

# My priorities as AST DD: reducing GHG emissions

Whose job is it to
combat Climate Change?

# My priorities as AST DD: partnerships




Big year of the Sun

- Solar eclipse in Apr 2024
- NSF DKIST science
- closest approach NASA Parker Probe

Coordinating with private and public organizations!

# My priorities as AST DD communication, informing the community

## Branding and communication – a tool for science.

NSF does “science by the pound” – equivalent to a pile of Legos. Congress hopes that scientists will do something with this, but it is an amorphous pot of $$ and therefore hard to motivate funding. Our message:

- Science contributes to job and high tech workforce in local districts.
- International leadership: competition vs collaboration.
- Urgency: we are solving problems today

Because of conflict of interest laws, these messages must come from the community. Helpful to let representatives know when constituents receive funding (and for what), invite them on tours of facilities or open houses, profile young people in STEM.

# My priorities as AST DD

## Mitigating threats:

Nearing point of no return – you will hear about these issues during the AAAC meeting:

- Mega constellation satellites
- Climate change
- Eroding U.S. expertise: instrumentation, lab astrophysics
- An NSF FY23 budget that does not increase for core science means we cannot start big new initiatives

## Responding to Astro2020

## Balancing our funding portfolio

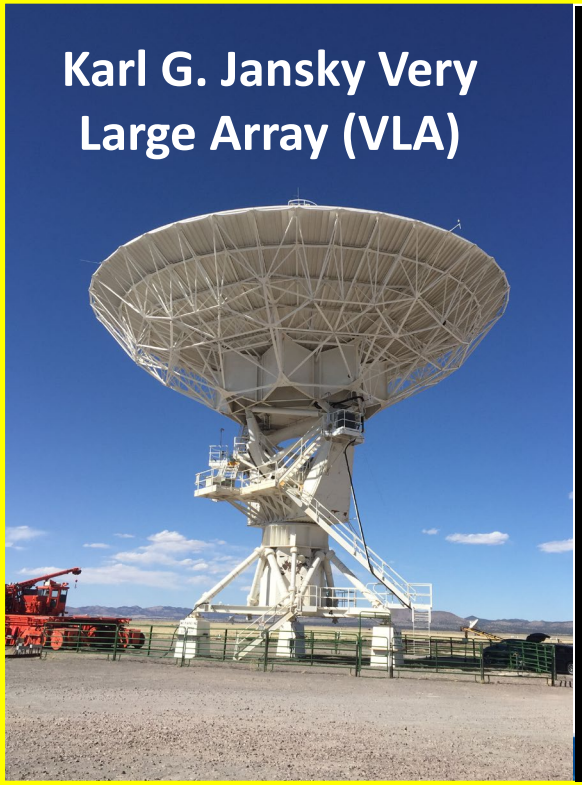

NSF
AUI
NRAO
NRAO
GREEN BANK OBSERVATORY
UNIVERSITY OF CENTRAL FLORIDA
1963
AO
AURA
NOIR Lab
NSO
National Solar Observatory
NSF

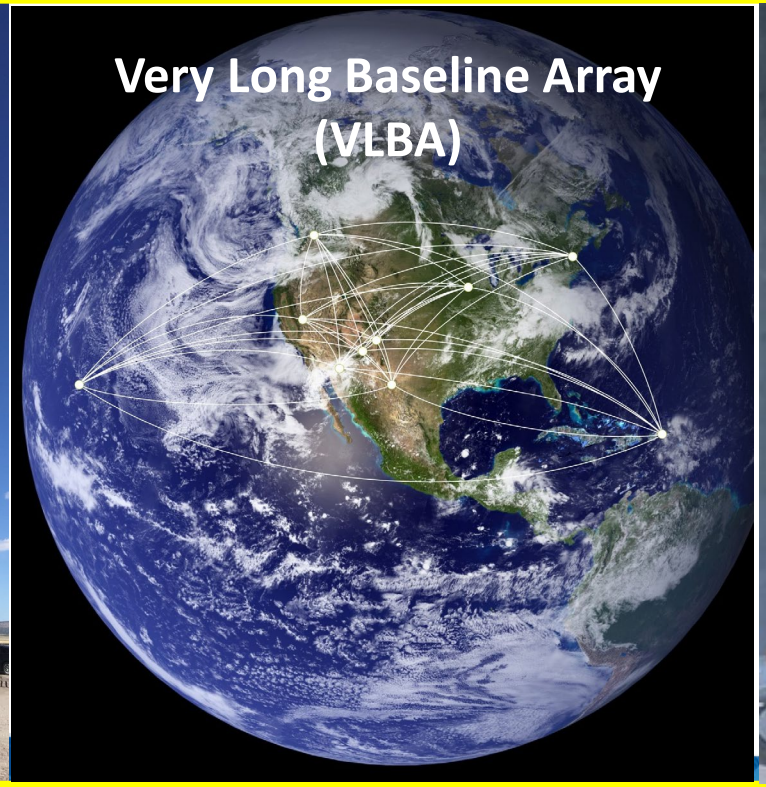
# National Facilities

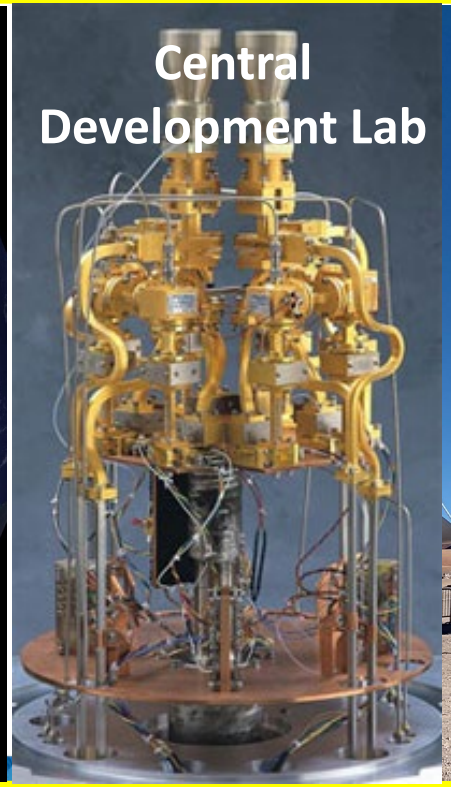
provide open access to all astronomers, broadening participation.

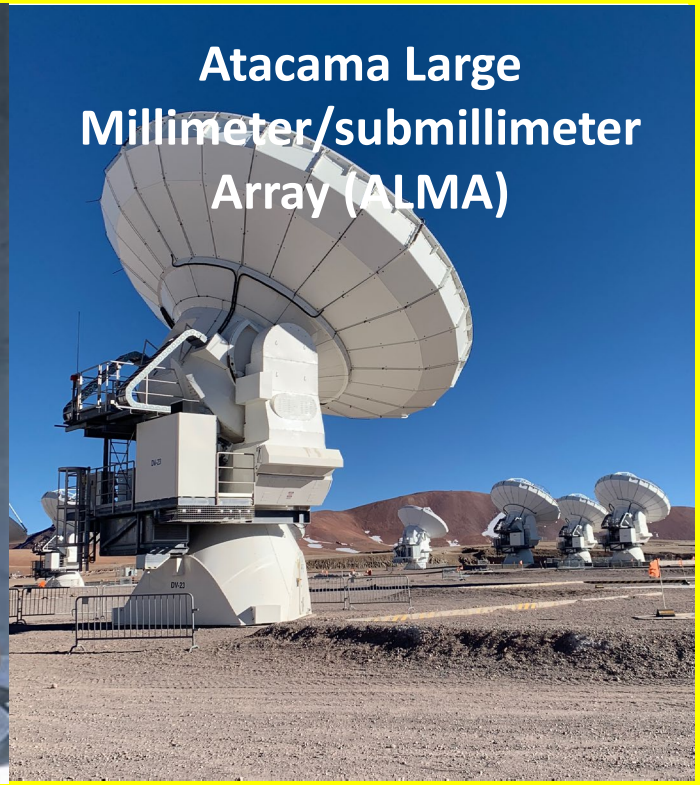
# The National Radio Astronomy Observatory (NRAO)

- ALMA, VLA ,and VLBA fully operational
- VLA Sky Survey continues
- ngVLA prototype antenna production in process



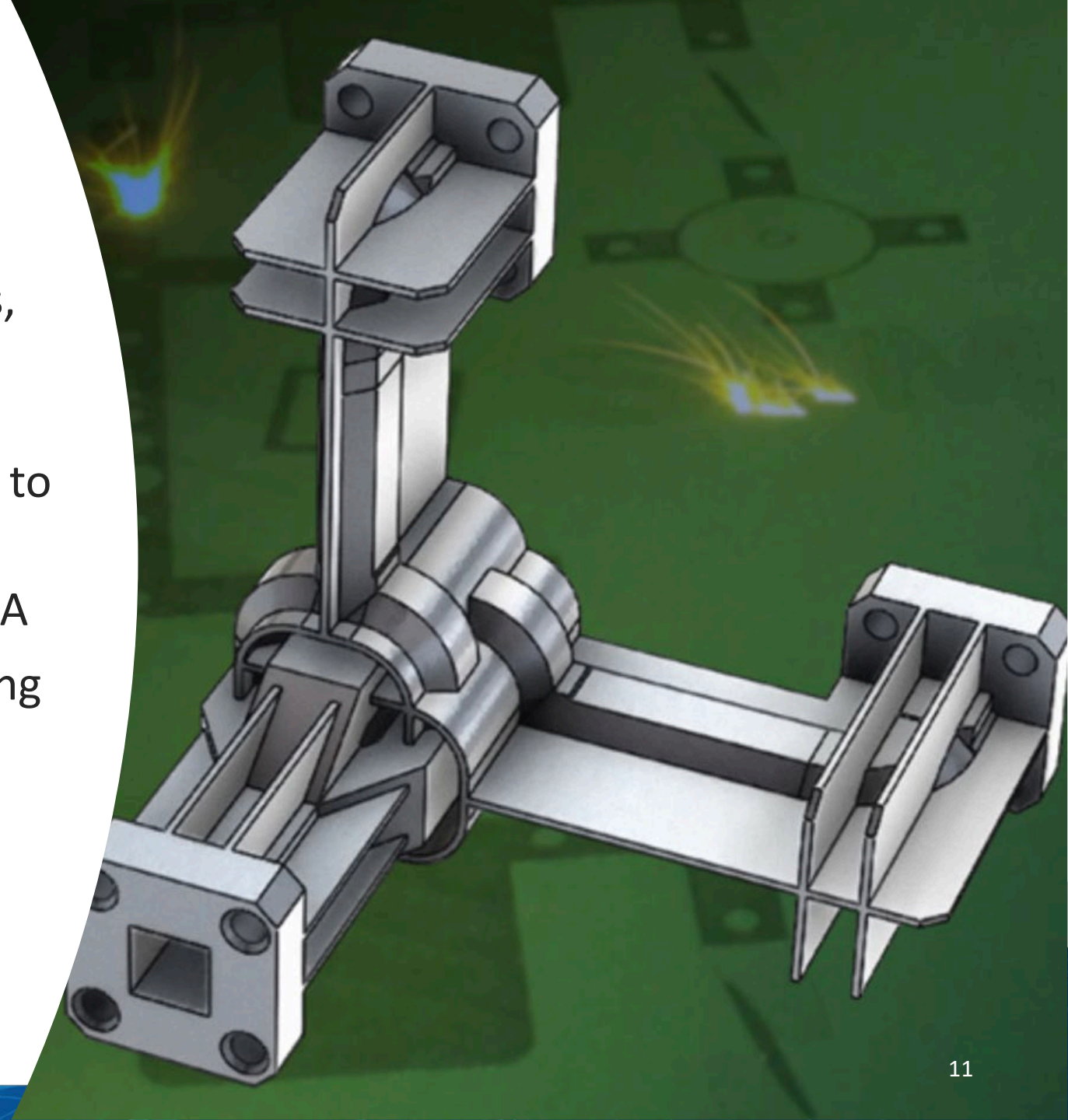



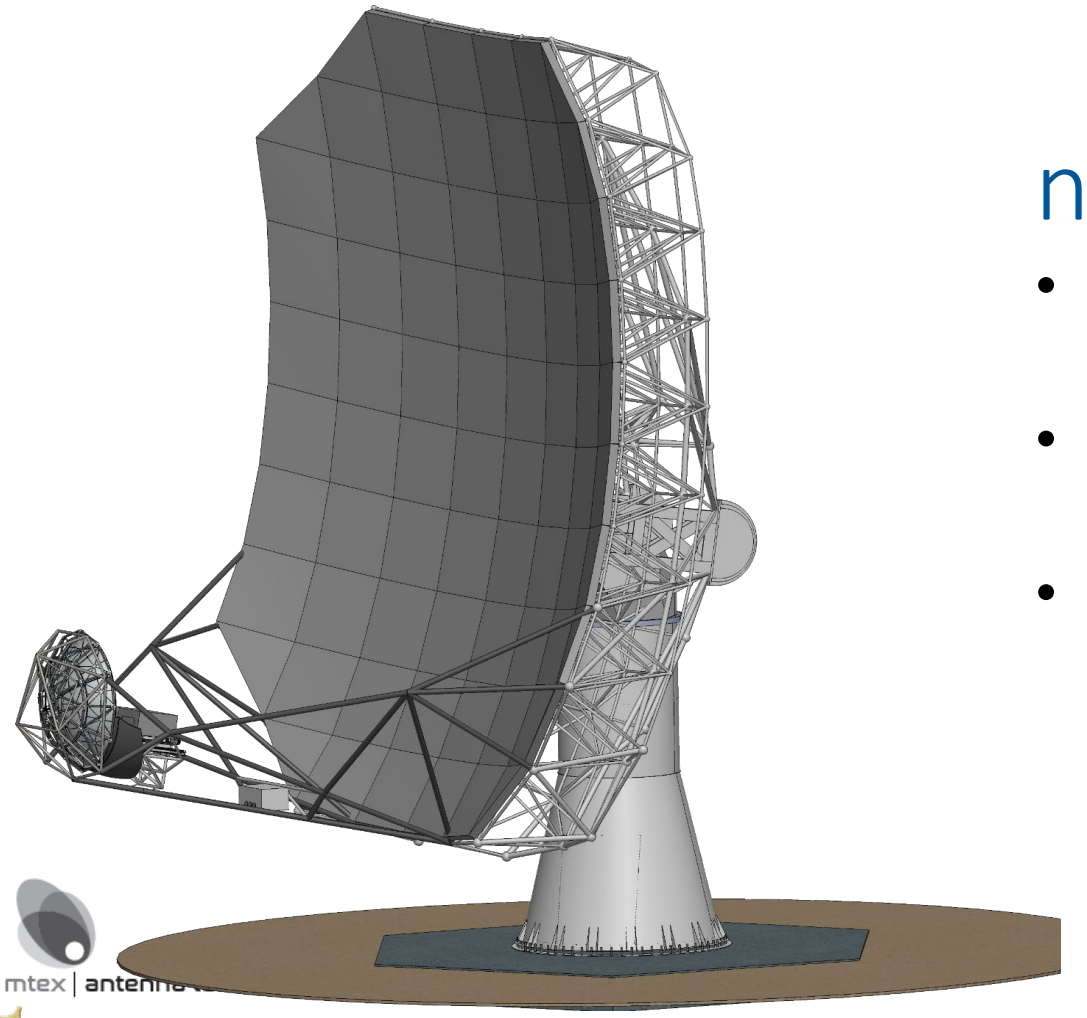



# NRAO Technology News

- 3-D printing of microwave components, TKIP amplifiers at CDL.
- VLBA New Digital Architecture project underway; 200 Mb/s fiber connections to all antennas.
- Wideband Sensitivity Upgrade for ALMA
- Spectrum Management – Starlink testing



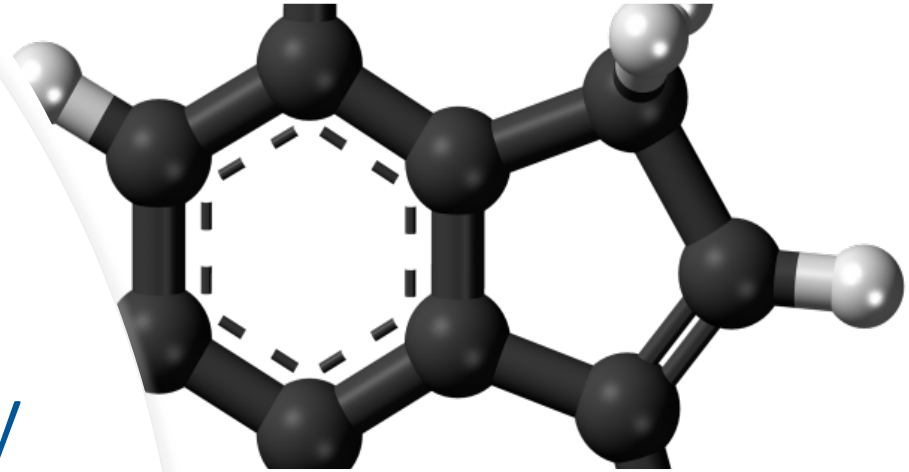
# NRAO Technology News




## ngVLA

- Prototype antenna design underway, plan for testing at VLA in 2023.
- Design/Development activities continuing – Project Office established in Albuquerque.
- Community participation in ngVLA scientific meetings and design reviews – important.

# Green Bank Observatory



- Pulsar timing: most massive neutron star
- Fast Radio Bursts: polarization
- Direct detection of small PAHs
- OH emission, probing thick disk structure
- **Instrumentation**: Ultrawideband receivers (0.7-4 GHz) being commissioned, radar
- **Data**: GBT Archive Facility (1-3 PB) under construction

# GBO-NRAO

## Pilot Radar Observations
## solar system bodies

1.25m resolution
6000s integration
750W

# Arecibo Observatory

Cleanup is complete; structures stabilized.

Working on options for future.

Angel Ramos Foundation Science and Visitor Center has reopened to the public and school groups visiting again

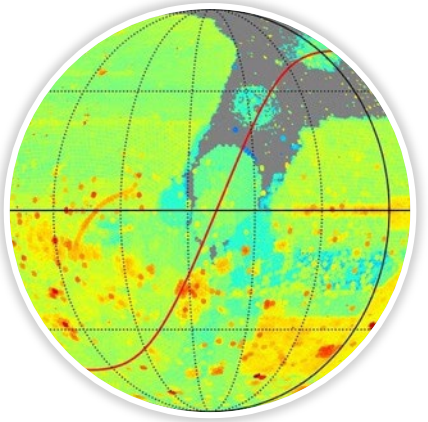
Watching for impact of hurricanes (Fiona and Ian). This site feeling impact of climate change.

# NSF's National Optical-Infrared Astronomy Research Laboratory (NSF's NOIRLab)

**Mid-Scale Observatories**

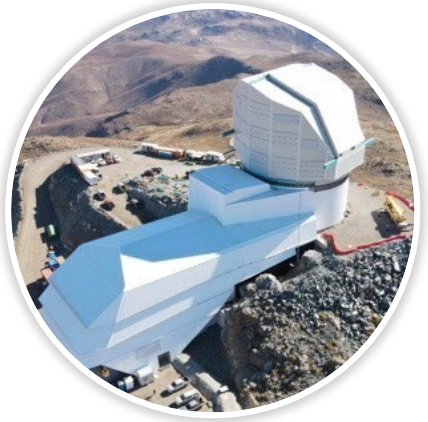
Cerro-Tololo Inter-American Observatory, Chile

Kitt Peak National Observatory, Arizona



Community Science & Data Center, Arizona

International Gemini Observatory, Hawai'i & Chile

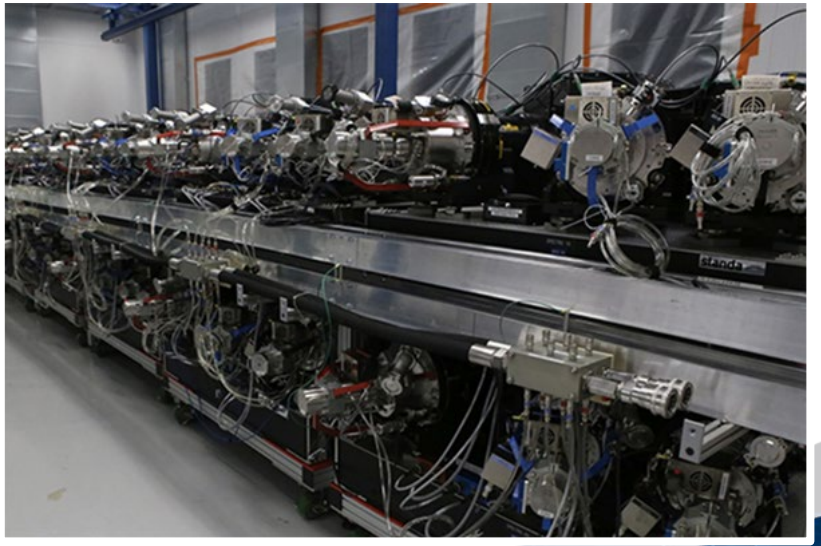


Vera C. Rubin Observatory, Chile

Unites OIR facilities for public access

# NOIRLab 4-m telescopes

- **WIYN (40%)**
  - NASA-NSF Exoplanet Observations Research (NEID)
- **Mayall**
  - DOE's DESI commissioned in mid-2021, already >10 million redshifts!
- **Blanco**:
  - DECam surveys continue, NEWFIRM recommissioning underway
- **SOAR (30%)**:
  - Now largely queue-scheduled (AEON)




# Kitt Peak Observatory
# Multiple facilities return to science operations:

- **WIYN 3.5m:** ***First night of NESSI science complete. HYDRA ready for instrument swap and science next week***. NEID will continue "on hold" until new back-up generator funded by Heising-Simons installed
- **Mayall:** ***Back to normal DESI operations!!***
- **NOIRLab 2.1-m**: Dome cleaned and ready for instrument removal for planned pre-fire upgrade of new instrument SEDM. Current plan is to commence commissioning when line power is restored
- **MDM Observatory 2.4-m** (SW ridge): ***Back on sky and doing science as scheduled.***
- **Univ Arizona 90-inch:** ***Science progressing as normal.***
- **Robotic Controlled Telescope 1.3m:** Instrument lead now scheduled for on-site visits, clean-up, and walkthrough Oct 1 & 2.

# THE 8-m INTERNATIONAL GEMINI OBSERVATORY

- Gemini-N and -S provide open access.
- The coming decade will be an exciting era of new Gemini facility instruments, delivering ASTRO2020 science priorities:

| | | |
|---|---|---|
| 2022 | GHOST | Visible high-resolution spectrograph R ~ 75,000 |
| 2024 | IGRINS-2 | IR high resolution spectrograph R ~ 45,000 |
| 2024 | SCORPIO | Multi-channel Rubin and MMA follow-up |
| 2024 | GPI-2 (Gemini-N) | Upgraded AO coronagraph; higher throughput, smaller IWA. |
| 2028 | GNAO/GIRMOS | laser tomography adaptive optics + IFUs |

## NSF / DOE partnership

# Rubin Construction

- In December 2021, National Science Board authorized new project baseline of $571 million.
- Telescope mount and dome construction making good progress.
- Camera's original vapor compression refrigeration system will be replaced with a pumped coolant system.
- Transition to operations anticipated in 2024

## Windows on the Universe

Center for Astronomy Outreach
(McMath-Pierce Solar Telescope)

Renovation work complete this summer, anticipated opening mid/late 2023

Planned exhibits:

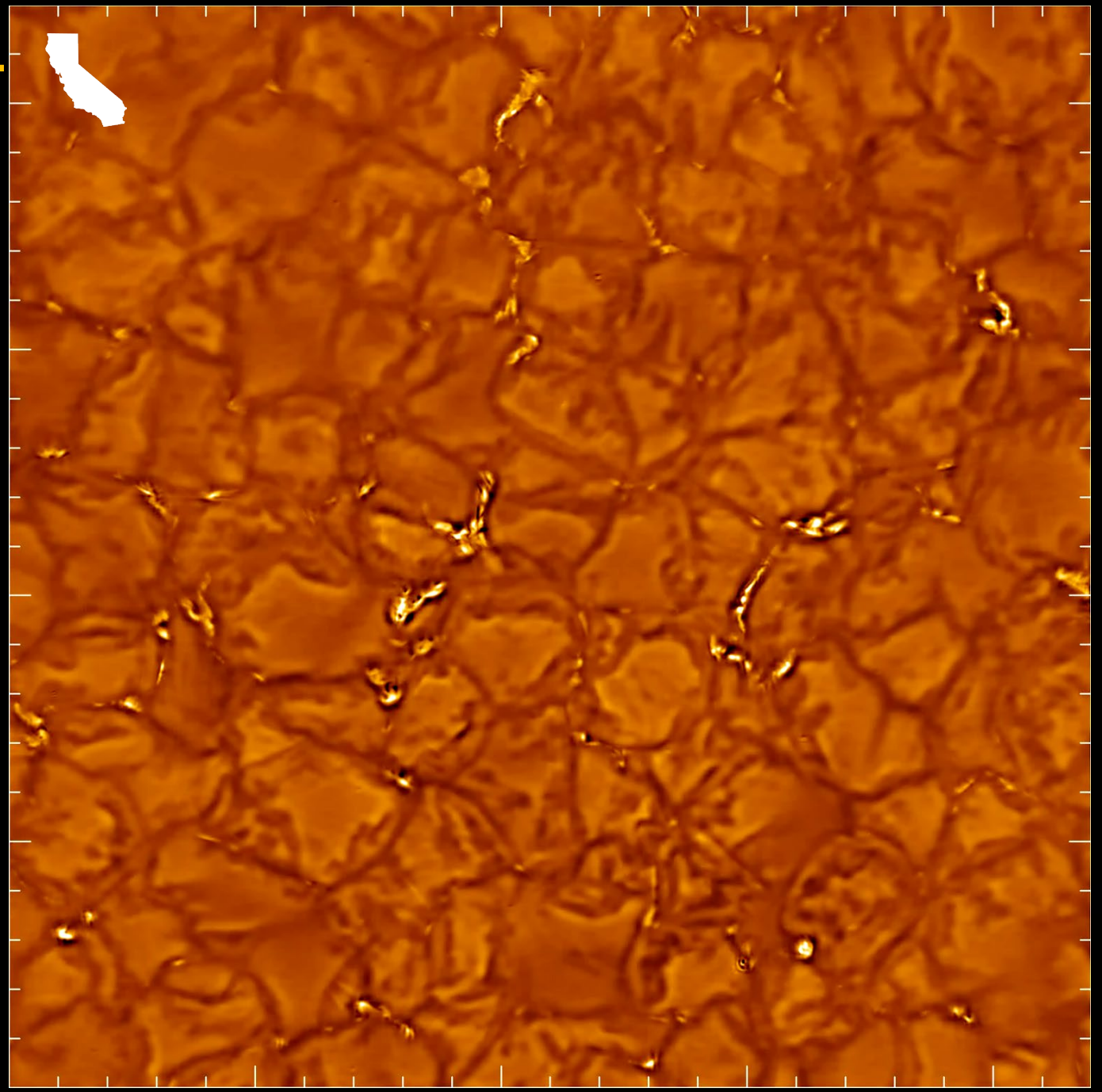
- Science-on-a-Sphere
- (Planetarium)
- NSF facilities exhibits
- MMA/TDA
- Solar telescope demos
- Classrooms

NSO National Solar Observatory

DKIST

The largest, most powerful solar observatory on planet Earth

- Short video clip from observations – May 27, 2022
  - VBI Blue – 430 nm
  - 4.5 sec = 8.3 min on Sun
- Bright points are concentrations of high magnetic flux



# DKIST inauguration – Aug 30, 2022

# NSF Budget Primer

(drives everything we do)

# NSF Budget Primer

## How is the AST budget allocated?

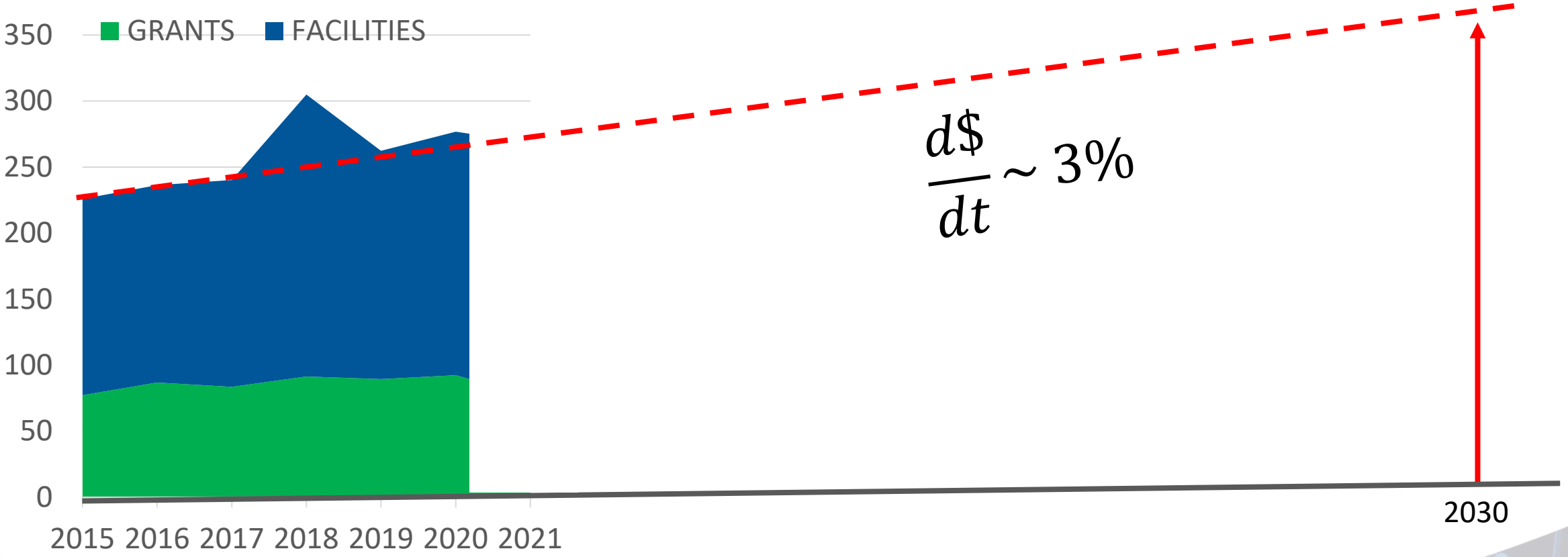
AST budget is allocated by OD => MPS => AST and is not fixed

Budgets in future years are unknowable, however we operate FFRDCs with out-year budgets with built in 3-4% increases each year.

As a division, AST is unusual in having 70% of budget locked into facilities.

## NSF AST Budget 2015 - 2021

## Out-year budgets are unknowable…



# Summary breakdown of cost for Astro2020 recommendations:

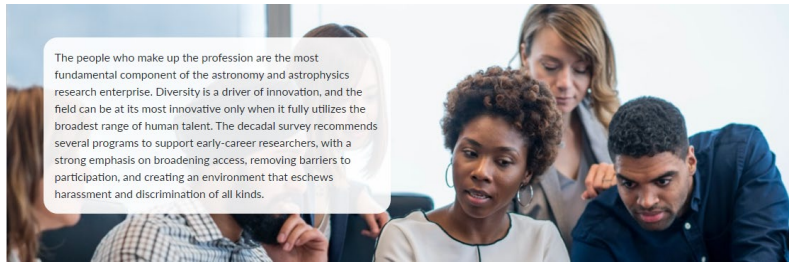
- AAG increase by $16.5M to $66M / yr
- ATI increase from $8M to $14M / yr
- Increase MSIP from $20M to $50M / yr
- ELTs, ngVLA, CMB-S4: (1) $400M D/D (2) MREFC $4B (3) O&M $150M

NSF's budgeting process makes it challenging to plan for the out-year scope of these recommendations (including life cycle costs of facilities). Fiscal-year federal budgets are built 18 – 24 months in advance.

# Astro2020

# Astro2020: Develop the Workforce

First decadal study directed to address State of the Profession.




## Astro 2020 recommended: "Start here"

<u>Fund people and develop the workforce</u>

- Augment and protect individual investigator grants
- Build opportunities for diversity in workforce
- Increase transparency (in budgets and proposal statistics)
- Reduce carbon footprint associated with research

Aligned with existing MPS and AST initiatives supporting students, postdocs and early-career faculty from under-represented groups.

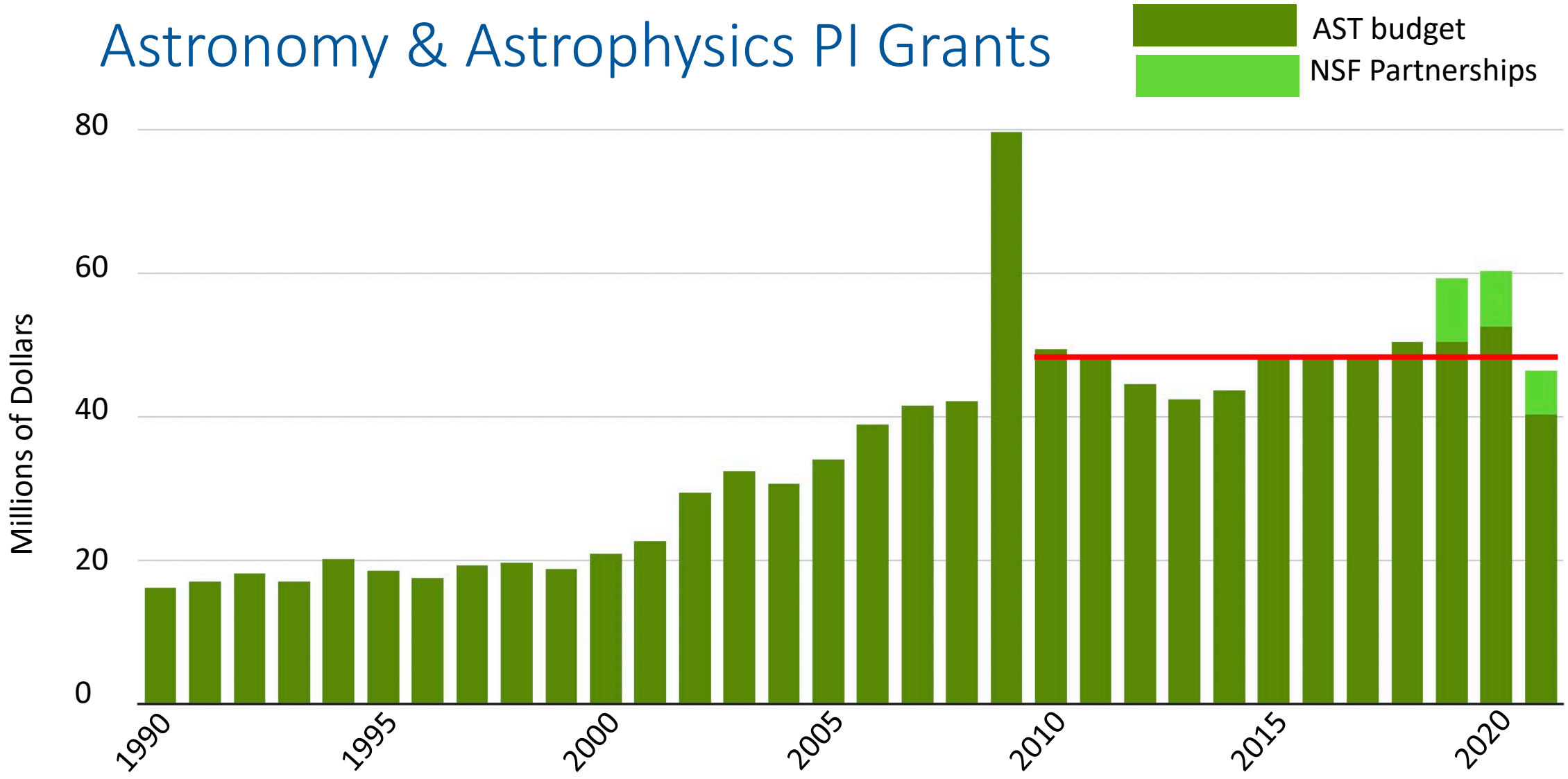
Complex future for national workforce training in astronomy powers the workforce, creative analytical skills and jobs that inherently offer flexibility and adaptability.

# NSF response: old and new programs to enhance inclusivity:

| Program | Description | |
|---|---|---|
| PAARE | Partnerships in Astronomy & Astrophysics Research and Education | |
| REU | Research Experience for Undergraduates | |
| GRFP | Graduate Student Research Fellowships Program | |
| *ASCEND* | MPS: postdocs with potential to broaden participation | |
| *LEAPS* | MPS: early career faculty at institutions with little NSF STEM funding | |

…but we need to give these scientists the tools to make the next discoveries

# Astronomy & Astrophysics PI Grants



# Astro2020 midscale recommendations

to support research and workforce:

- sustain instrumentation
- laboratory astrophysics
- data science and archives

Consistent with NSF priorities:

*NSB-2018-40:* "Mid-scale research infrastructure and cyberinfrastructure…. must be growth areas for NSF…"

NSF Response:

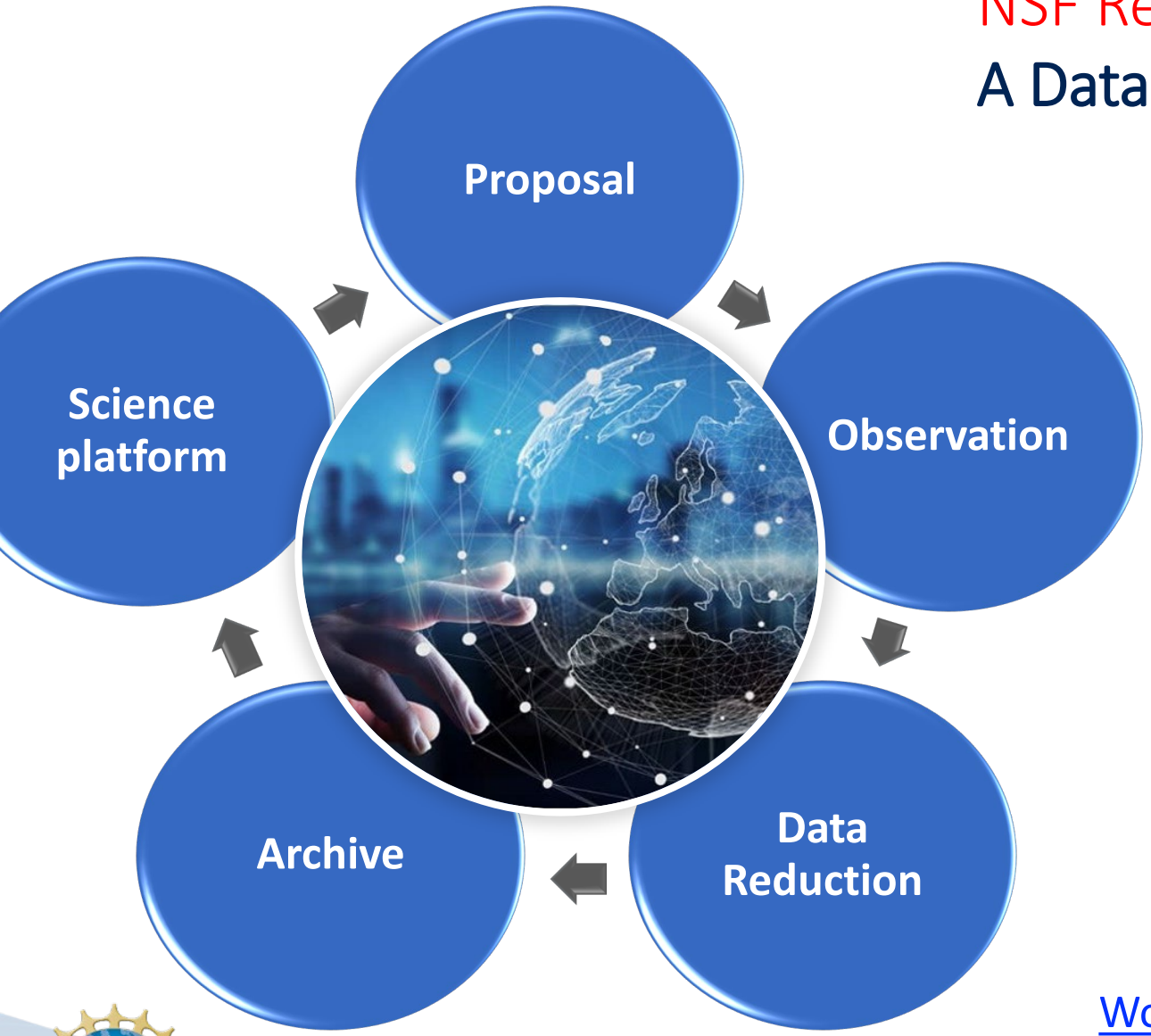
## Centers of Excellence: Instrumentation and technology

Thinktank: building an integrated system of centers in universities (astronomy, physics, engineering, business), each with specialized technical expertise to retain scientist-engineers and seed innovation

- Workforce development, translation of innovation into commercial ventures
- Potential partnerships with TIP, federal facilities, community, private organizations. Coordinate and collaborate with other agencies, potentially NASA, DOE.

Planning a workshop for Spring 2023

# NSF Response:
## A Data-oriented Integrated OIR System



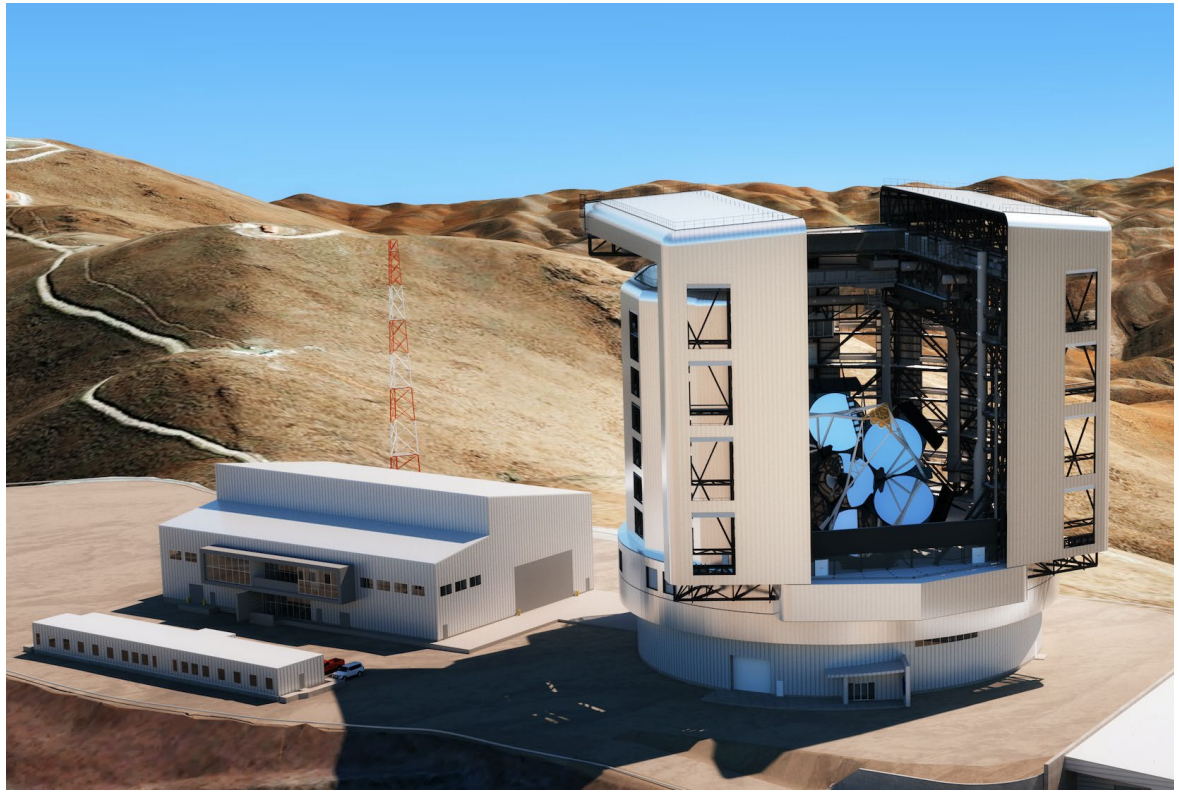

**Thinktank**: build an integrated system focused on delivering high quality, science ready data for all instruments:

- Unified archive and science platform
- Unified data reduction framework
- General data acquisition framework and standardized metadata
- coordinate private and federal facilities, collaborate with NASA and DOE, and leverage the expertise of our data centers and of the community

Workshop scheduled for February 2023

# Astro2020: The Tools

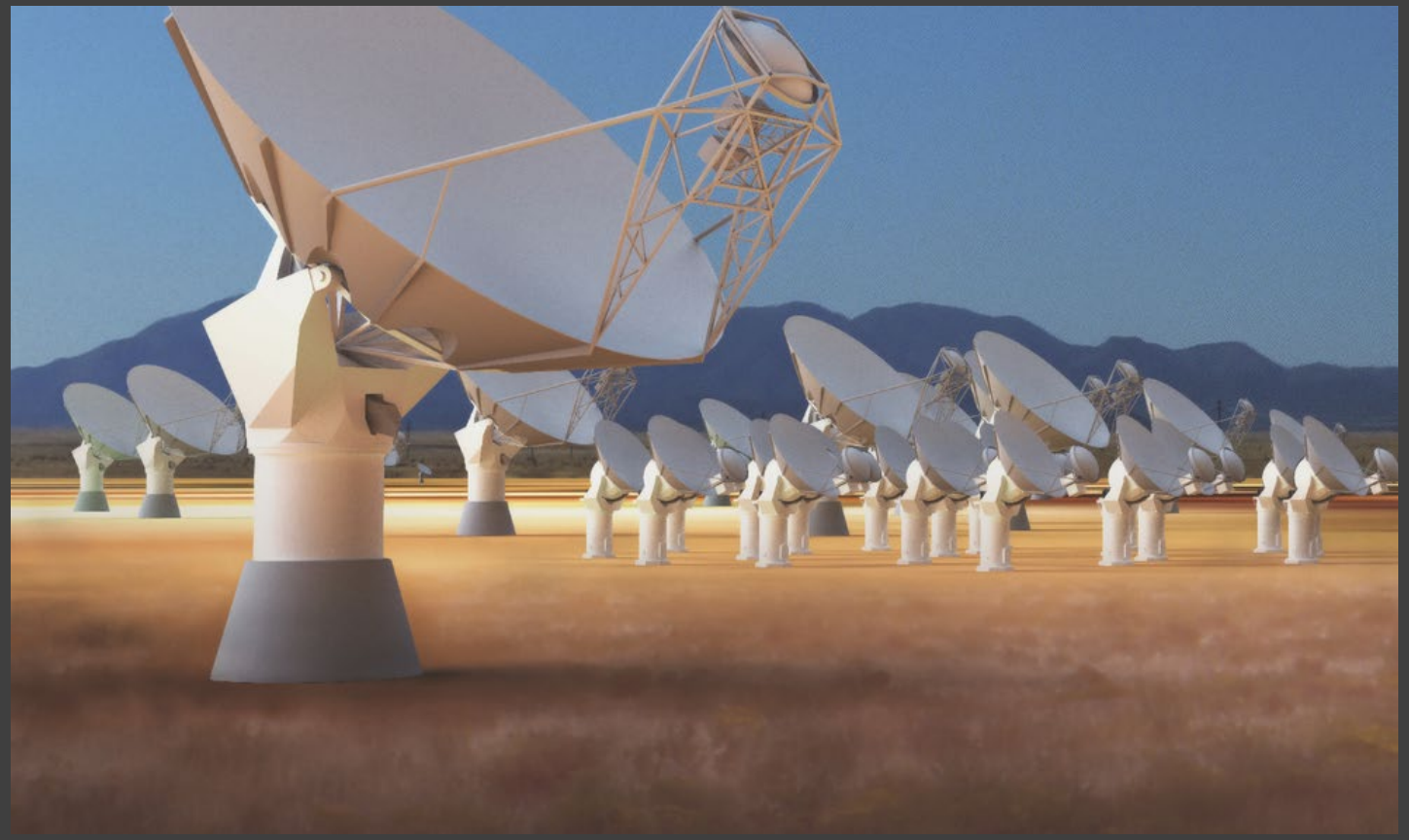
To make substantial progress on science questions, major facilities are needed that are available to the entire community.



## The US-ELTP vision: all-sky community access

NSF's NOIRLab plays a key role, unifying the system, leveraging scientific productivity and providing community access to telescope time and archives.

NSF share would facilitate 30 – 50% share community time on both telescopes.



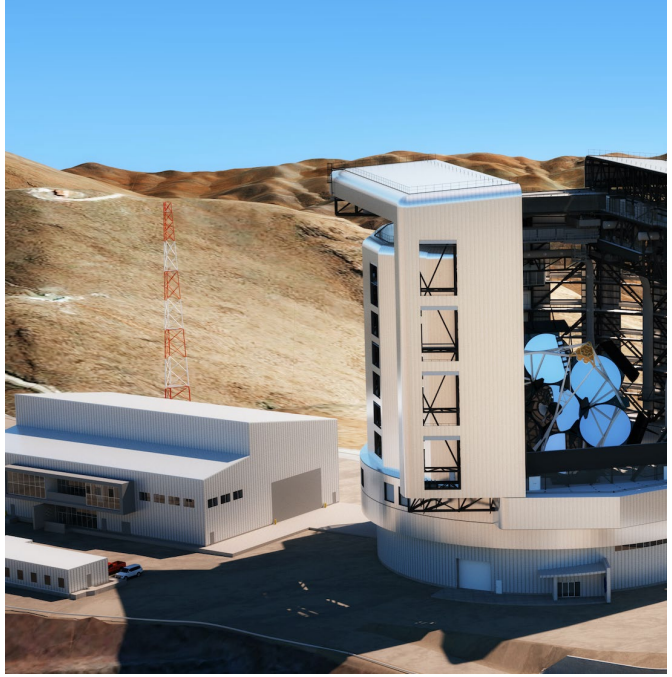
Cosmic Microwave Background – Stage 4 (CMB-S4) probe the earliest moments of the universe, trace seeds of galaxy formation. (50% split w/DOE)

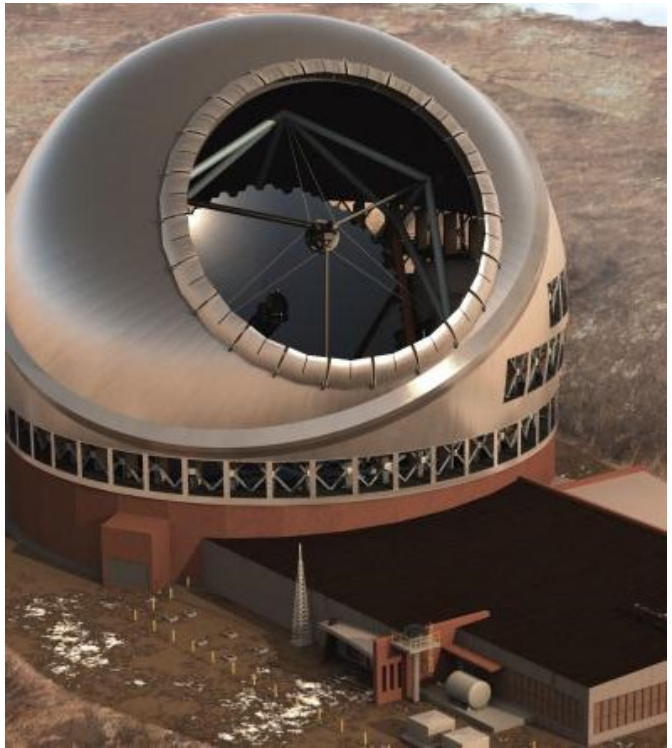
Next-Gen Very Large Array (ngVLA) formation and orbital motion of planets and complex pre-biotic molecules, chart assembly, structure and evolution of the earliest galaxies, formation and evolution of black holes, Earth orientation (GPS and global navigation satellites).

# Are these investments that we should make?

*Is there a role for the Nation in these facility recommendations?*

- Ensure US leadership and scientific competitiveness
- National infrastructure (GPS, Near Earth Asteroids, space weather)
- Develop workforce – not just for astronomy, but for the nation.

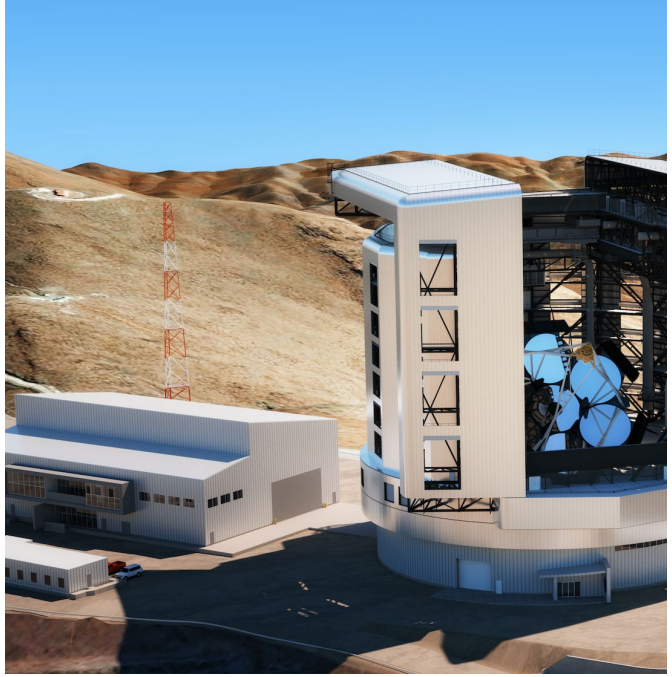


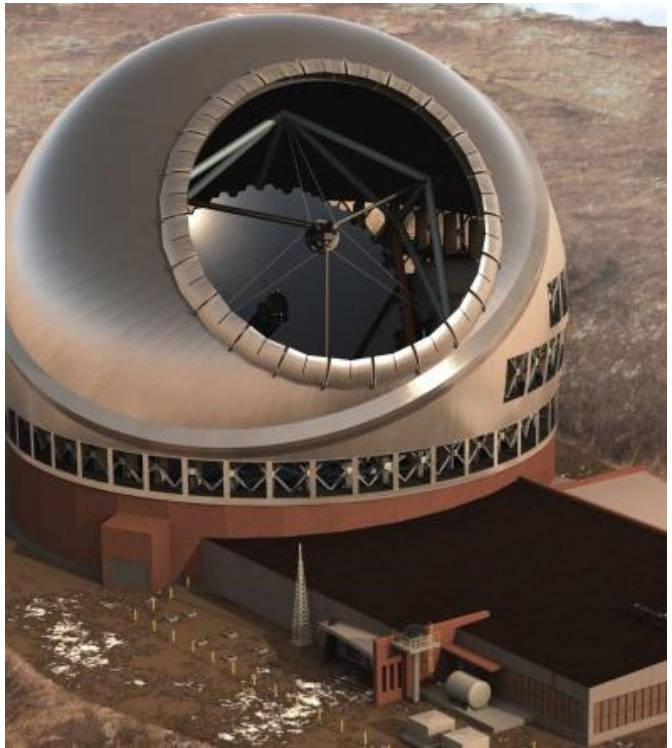


# Are these investments that we should make?

*Is there a role for the federal government?*

- Too big for states or universities
- Partnerships with other divisions and agencies
- International partnerships

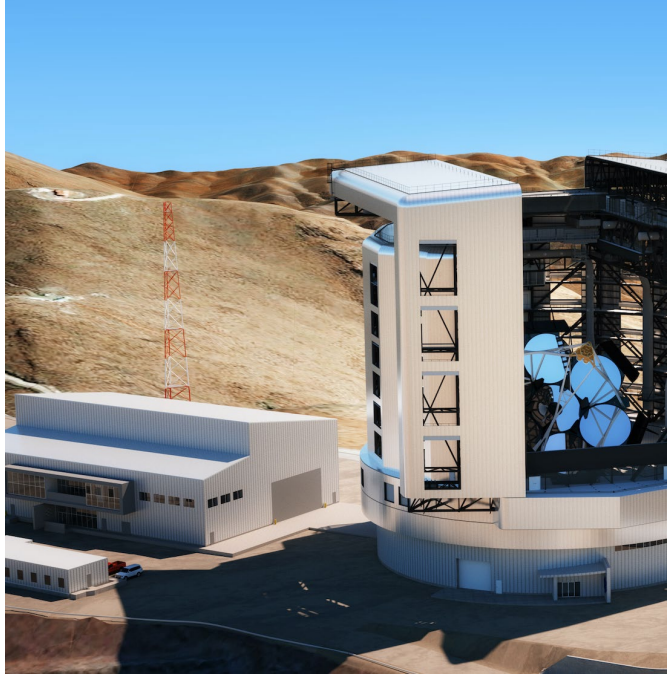


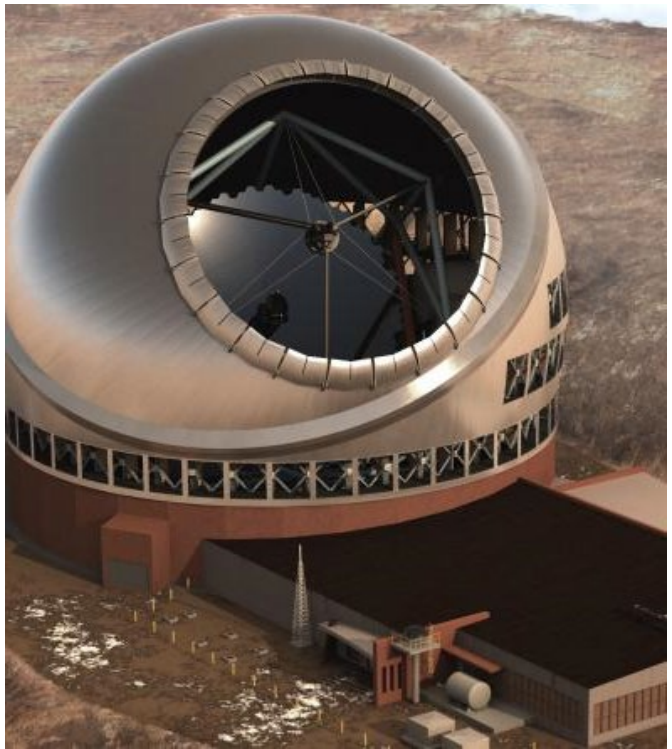


# Are these investments that we should make?

*Is there a role for the NSF?*

- "To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense…."
  - Ground-based astronomy
  - Broaden participation – STEM for the country, missing millions.
  - Access for all astronomers





# Status of Maunakea and TMT

We have been engaged - in discussions within NSF, with other Maunakea Observatories, with members of the Native Hawaiian community, and with the IfA at UH about astronomy on Maunakea.

Management of Maunakea has been transferred to a new Mauna Kea Stewardship and Oversight Authority that will consist of 11 members representing a broad range of interests and expertise, including, importantly, a recognized practitioner of Native Hawaiian traditional and customary practices.

NSF is committed to building a stronger relationship with the Hawaiian community. NSF is engaged in an Environmental Impact Statement process and a Section 106 consultation process under the National Historic Preservation Act.

# News & changes

A new directorate at the NSF

# The TIP Directorate

**Mission**: The Directorate for Technology, Innovation and Partnerships to advance critical and emerging technologies, address pressing societal and economic challenges, and accelerate the translation of research results from lab to market and society.

# New guidance for proposals

NSF strives to allocate federal funding to maximize scientific discovery in coordination with other funding agencies. It is expected that proposals which predominantly exploit NASA data or resources will be submitted to NASA. Proposals submitted to NSF with an extensive work effort to model or analyze data from NASA missions or archives must include a labeled section in the project description explaining why NASA data are required to advance the scientific goals of an NSF proposal. Please contact a cognizant NSF program officer if you have any questions about the suitability of your proposal for the AAG Program.

Working on balanced portfolio: data, instrumentation, individual investigator grants, facilities.

- Significant funding needed for the major facility recommendations – needs to be top-line NSF.

- Working on creative partnerships – across NSF directorates, federal agencies, universities, philanthropic partnerships to maximize science.