AAAC NSF/AST Update

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AST Mission: Enable breakthrough science

GMOS Confirms Radio Galaxy at z=5.72

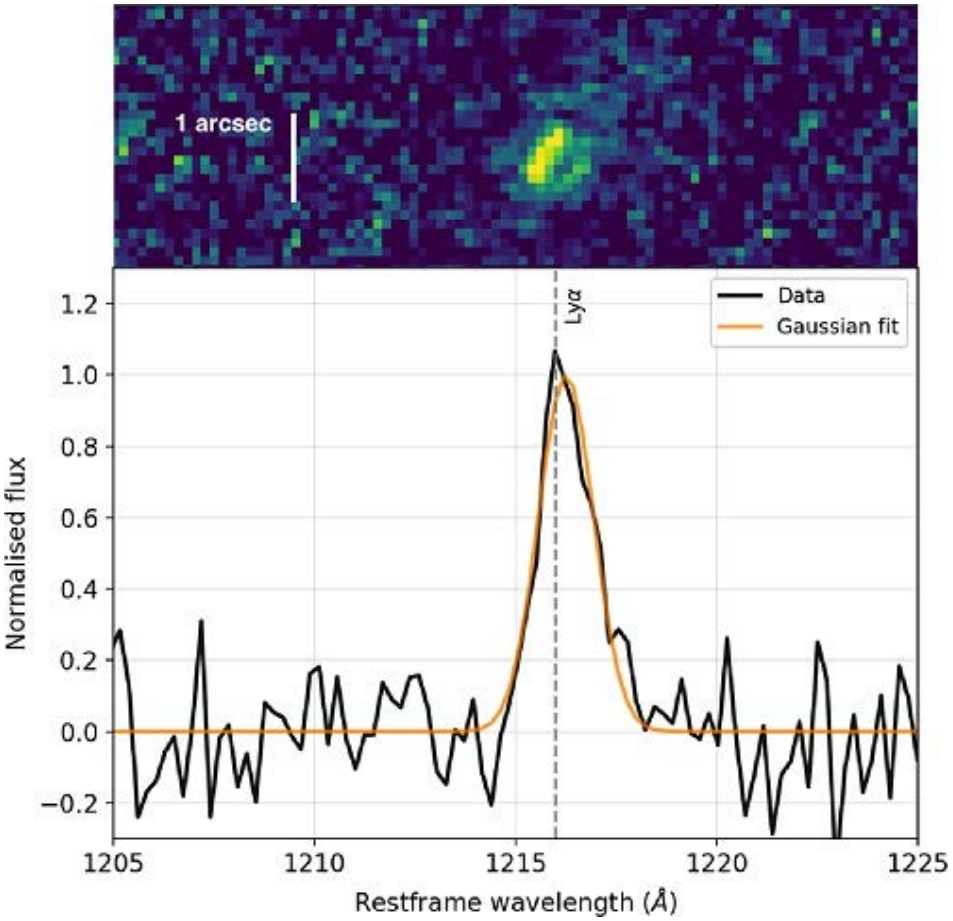
- Very steep spectrum, compact, high power.
- TGSS survey at 150 MHz, followed by VLA imaging at 1.4 GHz.
- Pathfinder for systematic discovery of high-z RGs.
- See Saxena et al. 2018, MNRAS, 480, 2733.

Gemini Observatory: Exploring The Universe From Both Hemisphere

Gemini Confirms the Most Distant Radio Galaxy

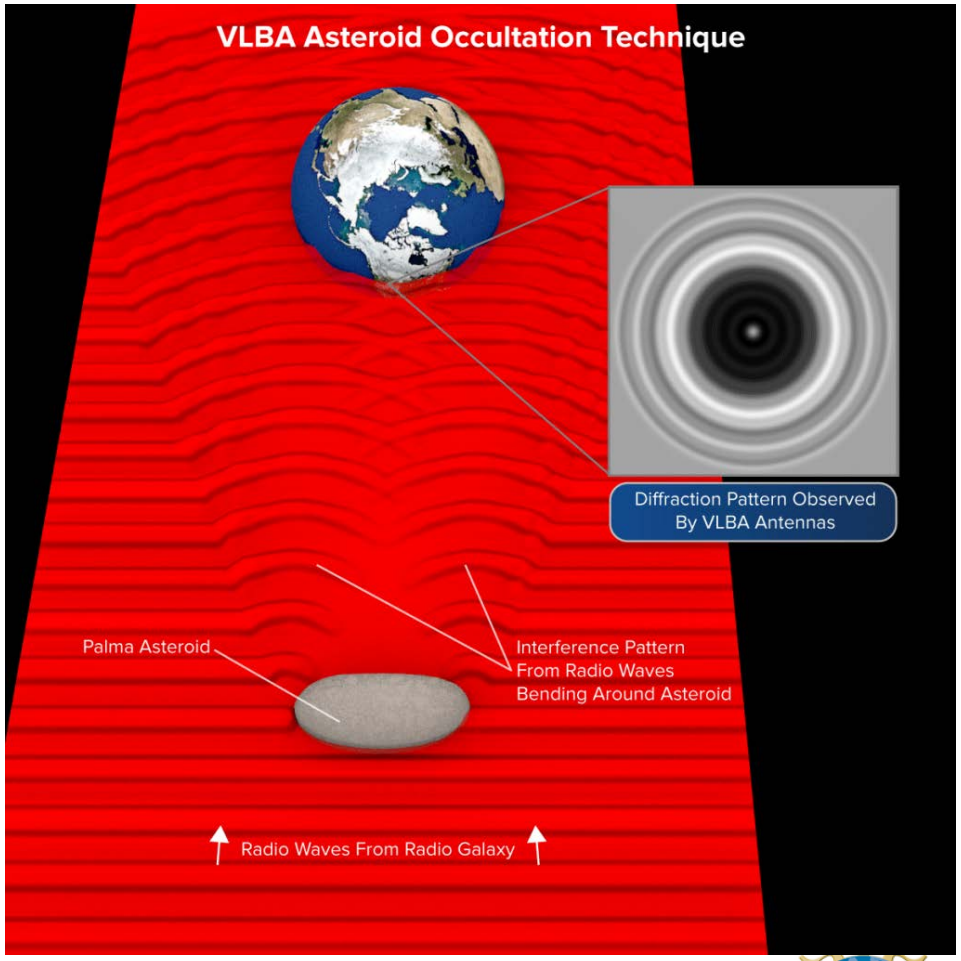
August 27, 2018

Tweet



Asteroid Occults Radio Galaxy

- Precision measurements of size (192 km), position, and shape by six elements of the VLBA.
- This one measurement reduced the uncertainty by 10x compared to the 1600 previous measurements of the 5.6-yr orbit over 120 yrs.
- See Harju et al, 2018, AJ, 156, 155.



Inter-Agency Cooperation

- Finding: NSF, DOE, and NASA continue to work well together to support the priorities of the astronomy and astrophysics research community, both in collaboration on large managed projects and through coordination of diverse research programs.
- Current examples for NSF-NASA include co-sponsorship of the Decadal Survey, joint NSF-NASA FACA review panels (e.g. your committee), cooperation on space weather and solar research, joint ground-space observations of astrophysical objects (e.g., neutron star mergers), collaboration on the exoplanet research program (WIYN 3.5m telescope), cooperation on Near Earth Object detection and characterization (Arecibo and LSST Observatories), search for techno-signatures, and semi-annual joint NSF-NASA staff meetings.
- Current examples for DOE include the Dark Energy Camera, Dark Energy Survey Instrument (DESI), LSST, and the CMB Task Force.

AST Implementation

- High-demand Individual Investigator programs.
- Suite of forefront ground-based Optical/IR (OIR), Radio-Millimeter-Submillimeter (RMS), and Solar observing facilities plus data holdings supported by AST for merit-based access.
- Construction through the MREFC line of two major new facilities, DKIST and LSST.
- Reorganization of management of NSF OIR facilities to optimize time-domain science.
- Divestment of facilities given lower priority by external review process to accommodate operations of new facilities and maintain programmatic balance.
- Sponsoring National Academies decadal survey to set future priorities for scientific direction and facilities development.

Individual Investigator Programs—1000 proposals/yr

- Astronomy and Astrophysics Research Grants—700 prop.
  - Solar and Planetary (now with no deadline)
  - Stellar Astronomy
  - Galactic Astronomy
  - Extragalactic Astronomy and Cosmology
- Mid-Scale Innovations Program—40 pre-proposals
- Advanced Technologies and Instrumentation—60 prop.
- CAREER—60 prop.
- Astron. and Astrophys. Postdoc. Fellowships—100 prop.
- REU—20 prop.
- Partnerships in Astronomy and Astrophysics Research and Education—5-10 prop.

AST Division Programs

Individual Investigators
(Lead: James Neff)

Success rate

- 1/6 AAG
- 1/10 CAREER
- 1/10 AAPF
- ATI
- MRI
- REU
- PAARE

Mid-scale
(Lead: Rich Barvainis)

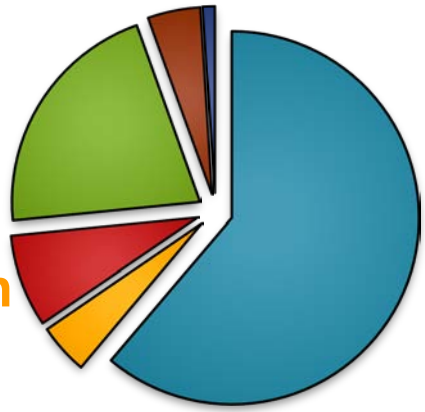
MSIP

Facilities

- ALMA
- NRAO
- Gemini
- NOAO
- NSO
- Arecibo
- GBO & LBO

Research

Technology/ Instrumentation



Education and Special Programs

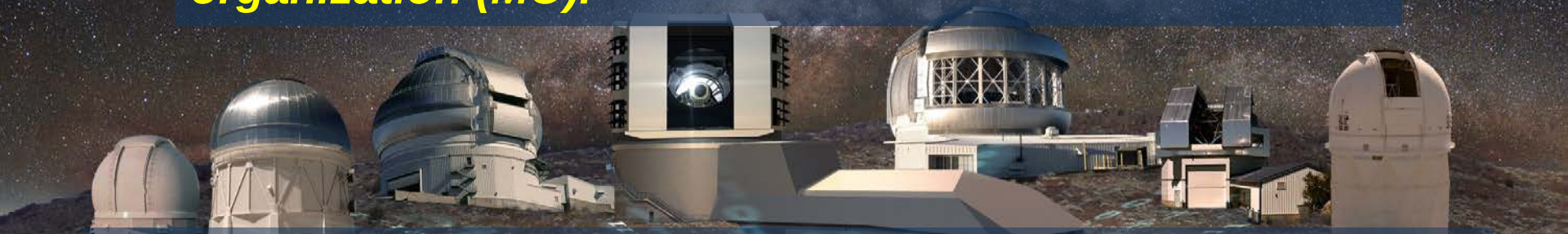
DKIST Current Construction Site

Operations in 2020

LSST Current Construction Site

Operations in 2022

NSF's National Center for Optical-Infrared Astronomy (NCOA) integrates the NSF-funded entities -- National Optical Astronomy Observatory (NOAO), Gemini Observatory, and Large Synoptic Survey Telescope (LSST) operations -- under a single organizational framework, managed by one management organization (MO).



- **NCOA initiation no later than 1 Oct 2019. Approved by National Science Board to proceed.**
- **LSST operations is on track for initial funding in FY 2019.**

Background is a montage of major facilities under NCOA.

Note – Jennifer Lotz new Gemini Director as of Oct 1.

FY 2018 Budget

- Very good outcome in the end for AST – total $307M, compared to FY17 actual of $252M.
- Much of the increase went to one-time specific projects (some dependent on FY19 availability of funds to complete):
  - MSIP, as discussed
  - Multi-messenger astrophysics grants
  - Forward funding DKIST operations for timely completion of data center
  - Funding of DKIST Level 2 data products
  - Center infrastructure upgrades with awards to be made soon.

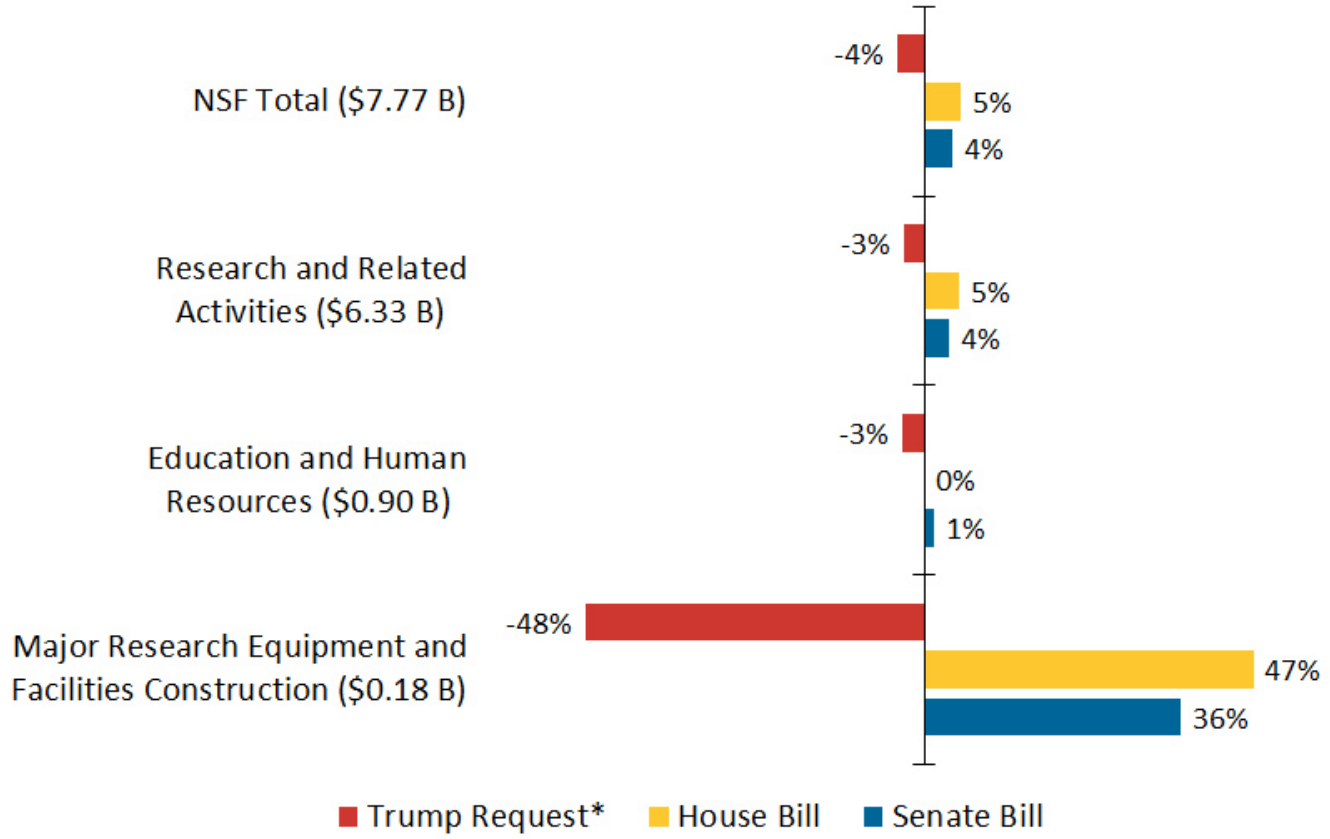
FY 2019 Budget

- President's Budget Request is a decrease from FY18 request.
- Congressional appropriations subcommittees levels are higher.
- NSF's bill is not under consideration for passage before the end of the FY, so initial operations after Oct 1 will be under a Continuing Resolution.
- Risks – stringency required to meet the President's Budget Request, government shutdown.

FY19 Spending Proposals: National Science Foundation

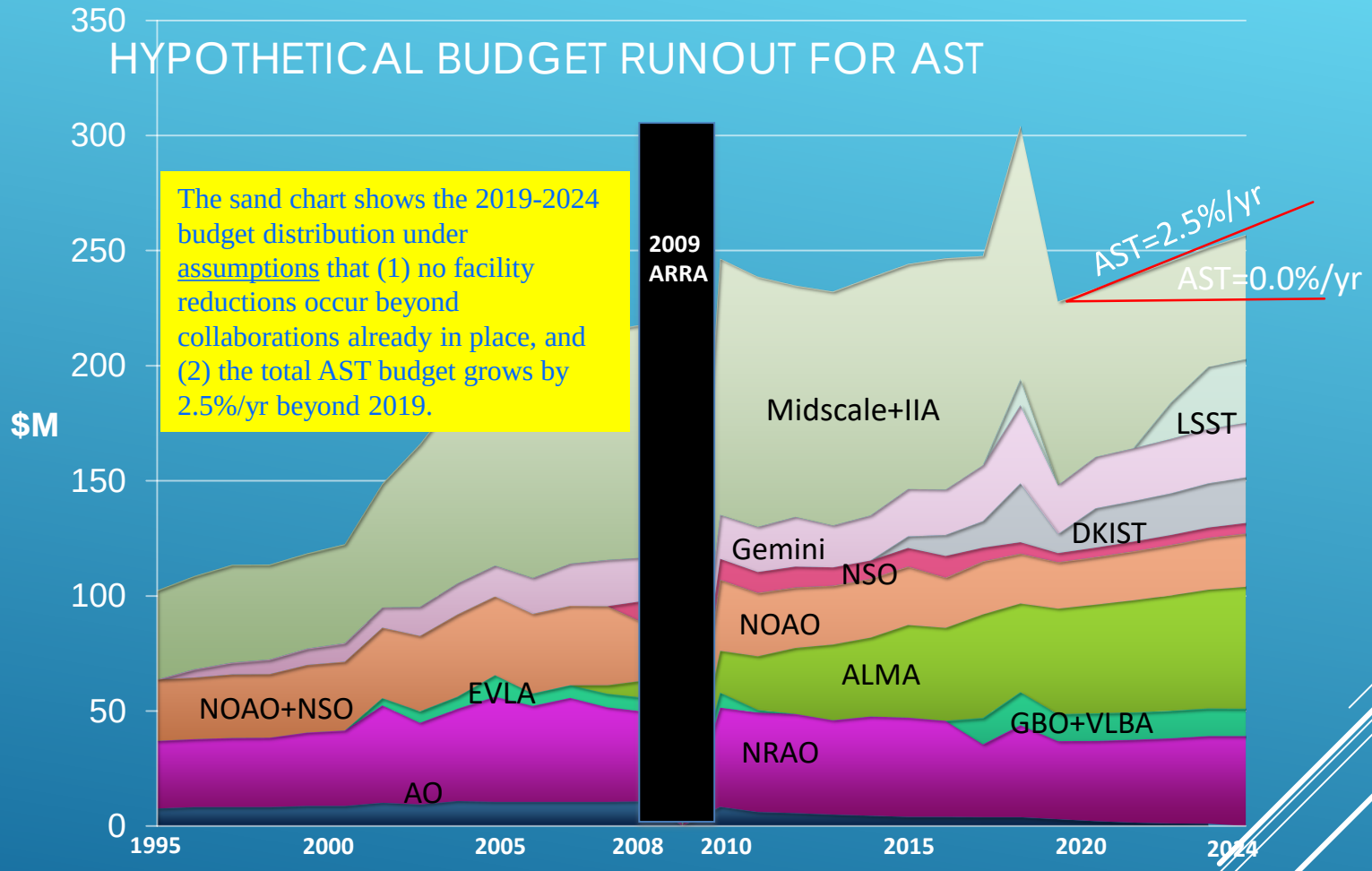
% change from FY18 enacted

$ in ( ) are the FY18 amounts



*The administration submitted the budget request to Congress before the final amounts for fiscal year 2018 were set.

American Institute of Physics | aip.org/fyi


HYPOTHETICAL BUDGET RUNOUT FOR AST
The sand chart shows the 2019-2024 budget distribution under assumptions that (1) no facility reductions occur beyond collaborations already in place, and (2) the total AST budget grows by 2.5%/yr beyond 2019.
2009 ARRA
AST=2.5%/yr
AST=0.0%/yr
$M
350
300
250
200
150
100
50
0
1995
2000
2005
2008
2010
2015
2020
2024
Midscale+IIA
LSST
DKIST
Gemini
NSO
NOAO
ALMA
GBO+VLBA
NRAO
NOAO+NSO
EVLA
AO

NSF's 10 "Big Ideas" for Future Investment

RESEARCH IDEAS

Harnessing Data for 21st Century Science and Engineering

Work at the Human-Technology Frontier: Shaping the Future

Navigating the New Arctic

Windows on the Universe: The Era of Multi-messenger Astrophysics

The Quantum Leap: Leading the Next Quantum Revolution

Understanding the Rules of Life: Predicting Phenotype

PROCESS IDEAS

Mid-scale Research Infrastructure

NSF 2026

Growing Convergence Research at NSF

NSF INCLUDES: Enhancing STEM through Diversity and Inclusion

New Solicitations / Dear Colleague Letters

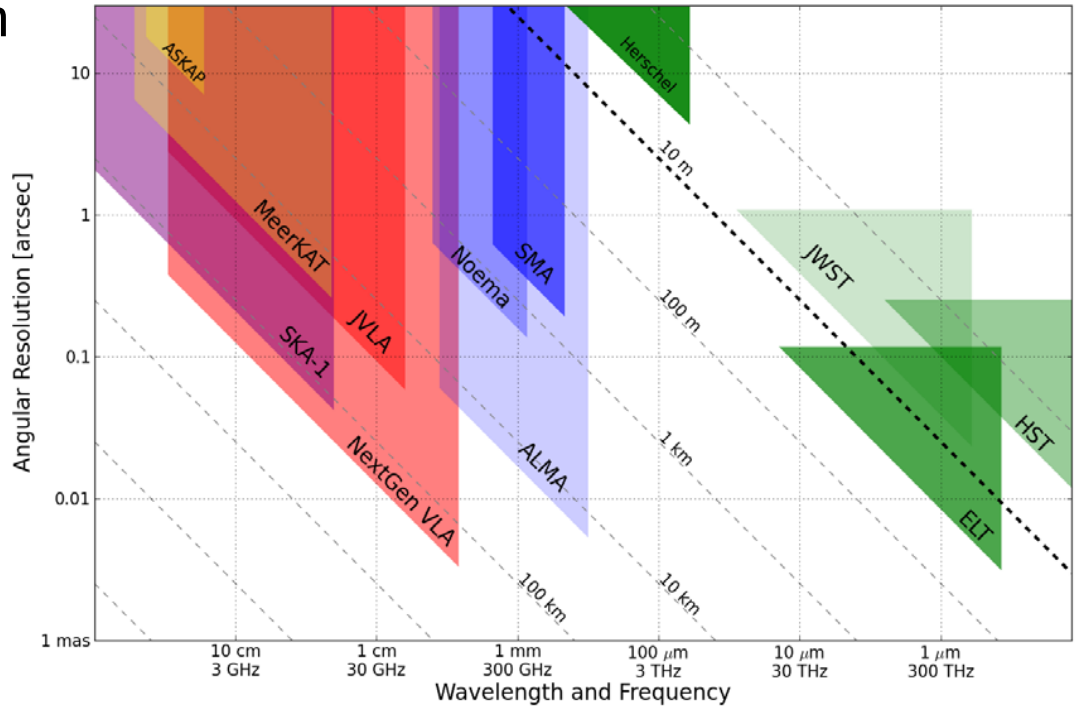
- The FY 2019 President's Budget request allocates $30M each for Windows on the Universe and Harnessing the Data Revolution and $60M for mid-scale projects.
- These programs can support the rich mix of ground-based data acquisition, development of systems and structures for end-user data science (search for lower σ GW events in the data stream post facto), and the theoretical modeling required for interpretation and prediction.
- Some solicitations and announcements already appearing, so watch the NSF website.
- These "off the top" investments in key future directions result in a ~8% reduction of core funding for AST in the PBR, given the flat top line request. Astronomers are well positioned to compete and win a larger total of research support than a flat-funded core grants program.
- More creative approaches may give access to Rules of Life (astrobiology) and Quantum Leap (BH entropy, quantum tels.).

Decadal Survey

- Planning is now well underway for input to the next Astronomy & Astrophysics Decadal Survey.
- NSF/AST and NASA Astrophysics Division are the primary sponsors of the survey. DOE Cosmic Frontier in the Office of Science is also a sponsor.
- Agencies and National Academies have agreed on the Statement of Task; the entire process is then organized by the Academies.
- The NASEM proposal for NSF's share has been awarded.
- NSF is including all ground-based astrophysics (i.e., gravitational wave detection and astro-particle detection) for project prioritization, not limited to AST.
- The call for science white papers was issued, with due date early 2019.

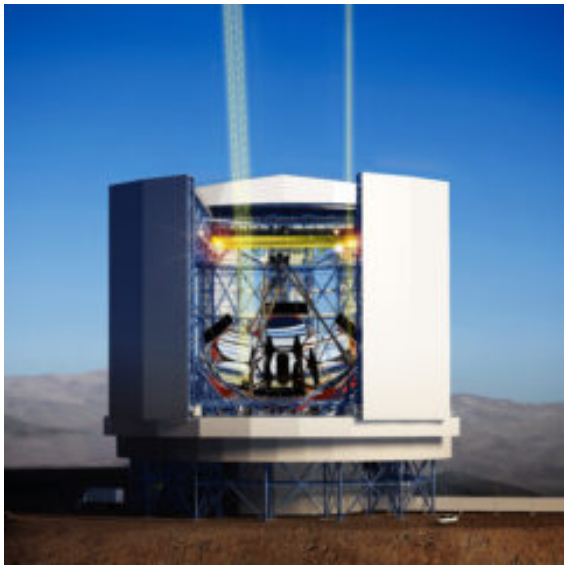
AST Decadal Survey Preparations

- NRAO held a series of three Kavli-sponsored workshops to identify and prioritize the key scientific problems the RMS community would address in the coming decade.
- Many of the scientific goals can be achieved with a concept called Next Generation VLA, including
  - •Unveiling the Formation of Solar System Analogues
  - •Probing the Initial Conditions for Planetary Systems and Life with Astrochemistry
- •Funded technical concept studies are underway within NRAO, and science book is linked.



AST Decadal Survey Preparations

- NOAO is coordinating with the TMT and GMT projects to develop a community science case requiring time on both telescopes.
- The approach will be based on key science programs, requiring substantial allocations of time.
- Over 200 community scientists working on defining the case.
- The projects have met with NSF to understand the conditions and reviews required by the law under the AICA so that award(s) can be made.
- New NSB report addresses how to handle lifecycle costs beyond scope of individual Divisions.



Cosmic Microwave Background (CMB)

- CMB Stage 4 goals: testing inflation, determining the number and masses of the neutrinos, constraining possible new light relic particles, providing precise constraints on the nature of dark energy, and testing general relativity on large scales.
- Two sites: South Pole and Atacama
- Fourteen small (0.5m) telescopes and three large (6m) telescopes, with 512K total detectors
- Report released to AAAC by its subcommittee on 10/23/17.
- Detailed programmatic follow-up in DOE update.

Coupled Themes

- The meeting agenda focus items are the Decadal Survey and two broad priority areas for investment in astrophysical research: multi-messenger astrophysics and the science and characterization of exoplanets.
- In keeping with the charge, the valued perspective of this committee is in identifying where close communication and informal collaboration among agencies is sufficient to advance the science, and where more formal joint efforts are desired.