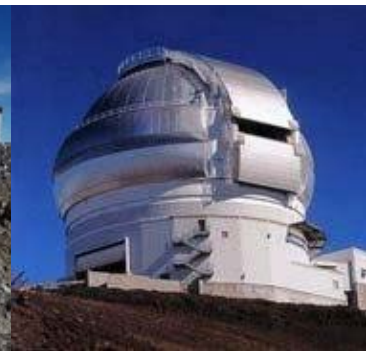


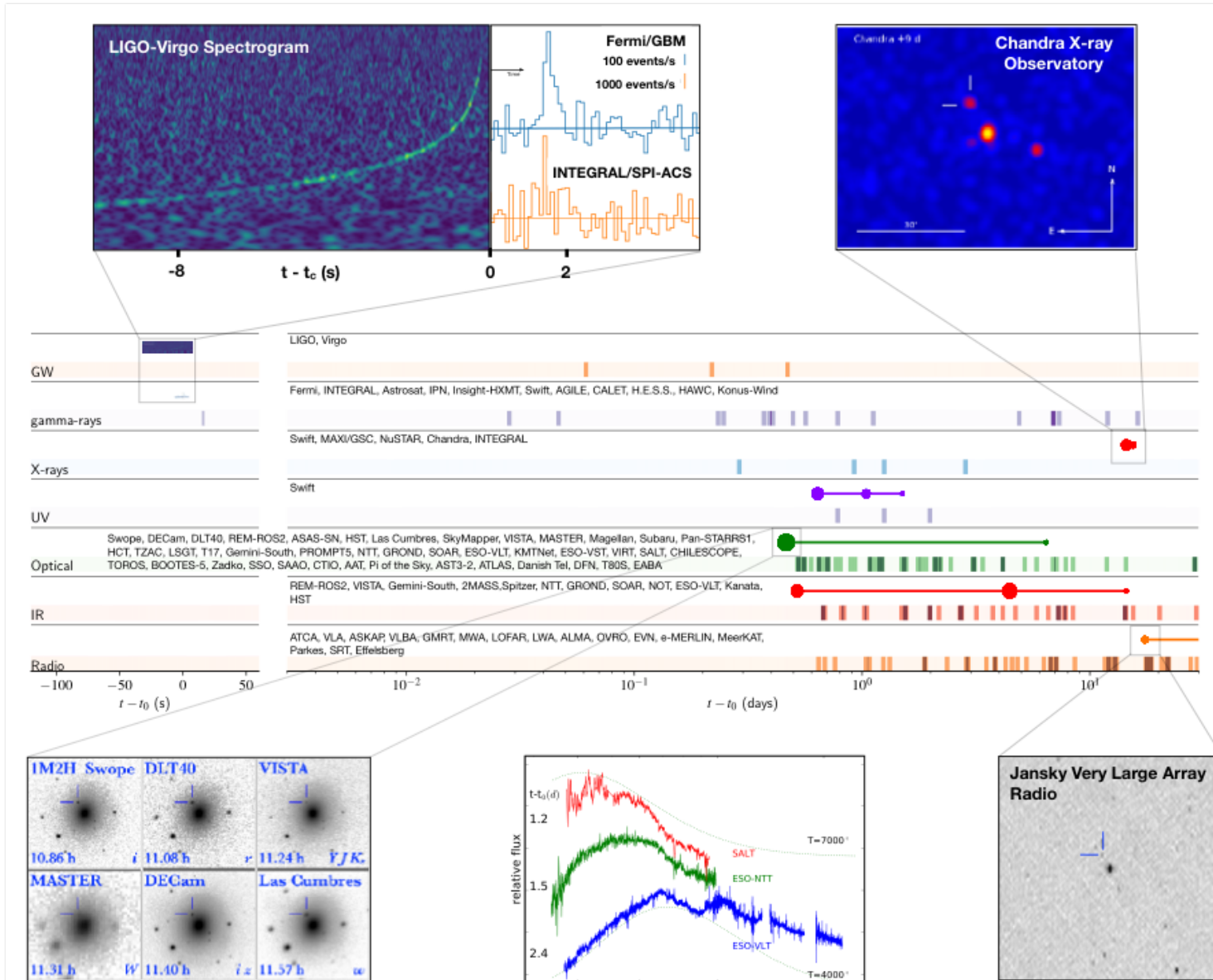
# NSF/AST Update to MPSAC

Richard Green  
Division Director,  
MPS/AST





# Binary Neutron Star Merger in NGC 4993



# AST Mission

- The mission of the Division of Astronomical Sciences is to support forefront research in ground-based astronomy; to help ensure the scientific excellence of the U.S. astronomical community; to provide access to world-class research facilities through merit review; to support the development of new instrumentation and next-generation facilities; and to encourage broad understanding of the astronomical sciences by a diverse population of scientists, policy makers, educators, and the public at large. The Division supports research in all areas of astronomy and astrophysics as well as related multidisciplinary studies. Because of the scale of modern astronomical research, the Division engages in numerous interagency and international collaborations. Areas of emphasis and the priorities of specific programs are guided by community recommendations, which have been developed and transmitted by National Research Council decadal surveys and by federal advisory committees.



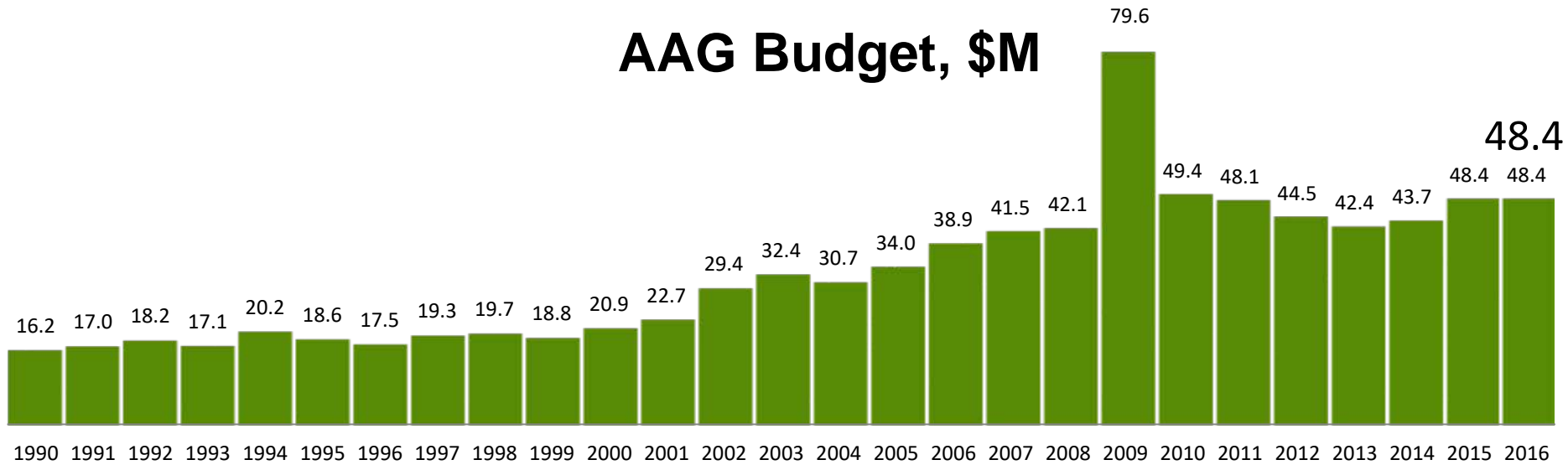
# AST Implementation

- 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.

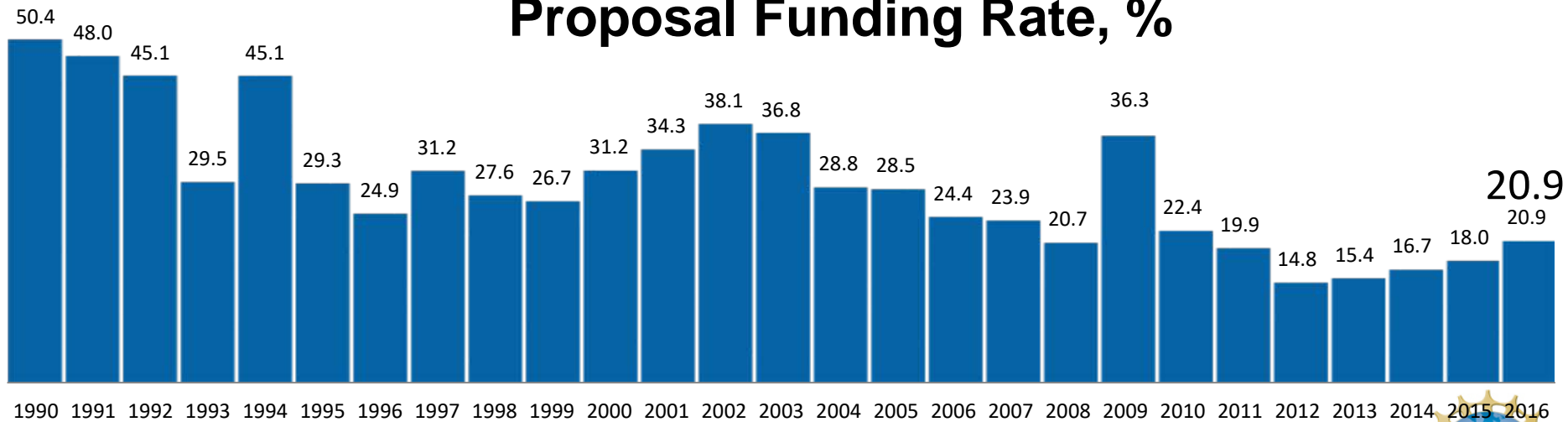


# AAG Funding History, 1990-2016

## AAG Budget, \$M



## Proposal Funding Rate, %



# Current Forefront Facilities

- OIR
  - Gemini North and South 8-m telescopes
  - National Optical Astronomy Observatory
    - CTIO - Blanco and SOAR 4m class telescopes in Chile
    - KPNO - Kitt Peak operations in Arizona
    - Community Science and Data Center
- RMS
  - National Radio Astronomy Observatory
    - ALMA – Atacama Large Millimeter Array - Chile
    - JVLA – Jansky Very Large Array – New Mexico
    - CDL – Central Development Lab – Virginia
- Solar
  - National Solar Observatory
    - Legacy telescopes in NM and AZ transitioning
    - Lab and Data Center in Colorado



# DKIST Current Construction Site



Operations in 2019

# 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 is on schedule for stand-up about 1 Oct 2018.
- LSST operations is on track for initial funding in FY 2019.

Background is a montage of major facilities under NCOA.



# Background: AST Divestment

- AST Portfolio Review Report (MPSAC subcommittee) recommended divesting a number of telescopes from AST budget.
- Divestment needed to enable support of new highest priority facilities, while balancing support for individual investigator science.
- The process shows AST's seriousness in changing the complement of cutting edge national facilities and is scoped to save \$10-15M/yr for new operations.
- Subsequent AST actions:
  - Pursued funding collaborations aggressively.
  - Solicited input on innovative operations models.
  - Carried out engineering feasibility studies and baseline environmental reviews for many facilities.
  - Embarked on preparation of formal Environmental Impact Statements (EIS) as part of the decision process for three facilities: Arecibo, Green Bank, Sacramento Peak.
- Status officially updated by NSF Dear Colleague Letter 17-079, April 27, 2017.





# Divestment Summary

Telescope	Status
KPNO 2.1m	Caltech-led consortium (Robo-AO) operating for FY 2016-2018.
Mayall 4m	Slated for DESI; bridge from NSF to DOE; NSF/DOE MOU for transition.
WIYN 3.5m	NOAO share to NASA-NSF Exoplanet Observational Research Program; NSF/NASA MOU in place; NASA instrument under development.
GBO	Separation from NRAO in FY 2017; ~30% collaboration for basic scope; Draft Environmental Impact Statement (EIS) issued on Nov. 8, 2017.
LBO/VLBA	Separation from NRAO in FY 2017; MOA with US Navy in place for 50%.
McMath-Pierce	No obvious partner opportunities; possible public education use.
GONG/SOLIS	GONG refurbishment; Interagency Agreement with NOAA signed to share GONG operations costs. SOLIS moved from Kitt Peak to Big Bear.
Sacramento Pk.	Possible consortium but funding challenges; NSF funded NMSU for transition to consortium; started EIS process; completion in 2018.
Arecibo	Formal EIS process concluded with issuance of Record of Decision today. Negotiations to begin for new collaborator with reduced NSF share.
SOAR	Post-2020 status to be reviewed.



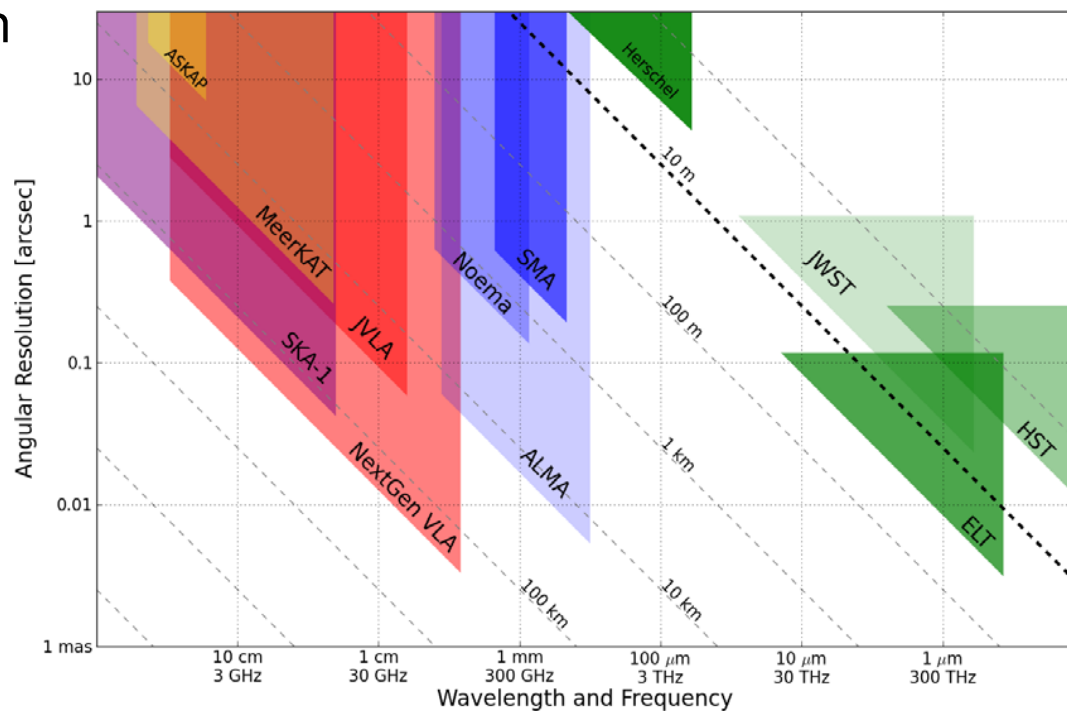
# AST Budget Considerations

- NSF practice is that operations costs of MREFC-funded major new facilities are borne by the Division that is the host discipline.
- AST is absorbing DKIST operations into current budget planning.
- LSST operations are the next wedge. In the event of continued flat funding (or less) and no change in policy, a major realignment of facility support will be required to preserve a balance with the grants program.
- In the short term, the reduction in the FY18 President's budget was allocated to Individual Investigator and instrumentation grants, with some restoration possible at Congressional appropriations levels. (With no restoration, success rate predicted to be ~18%.)



# 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



# AST Decadal Survey Preparations

- NOAO is collecting OIR community white papers
- Submission by Nov 20<sup>th</sup> for public meeting Feb 20-21, 2018.
- Topics addressed to date include
  - Community participation in GSMT science
  - Dedicated wide-field spectroscopic survey telescope
  - Enhanced time-domain telescope network (GW follow-up)
  - Data science development for LSST and other large datasets





# Cosmic Microwave Background (CMB)



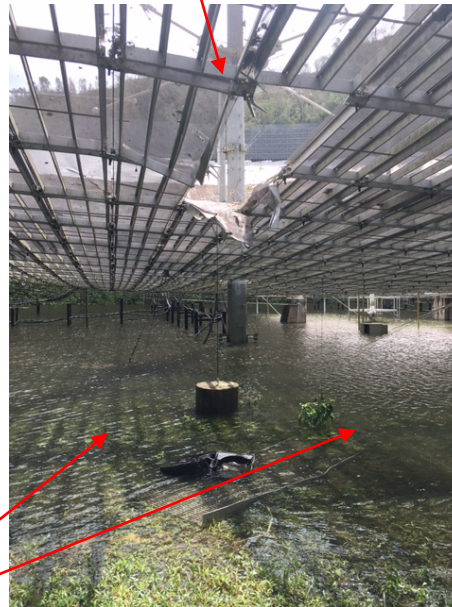
- CMB Stage 4 goals: testing inflation, determining the number and masses of the neutrinos, constraining possible new light relic particles, providing precise constraints on the nature of dark energy, and testing general relativity on large scales.
- Two sites: South Pole and Atacama
- Fourteen small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



# Arecibo Observatory: Hurricane Maria



Damaged panels



12 m damage

standing water

truncated line feed

- Damage to Arecibo Observatory is less than originally feared.