#### **NSF Town Hall**

# Richard Green Division Director, MPS/AST











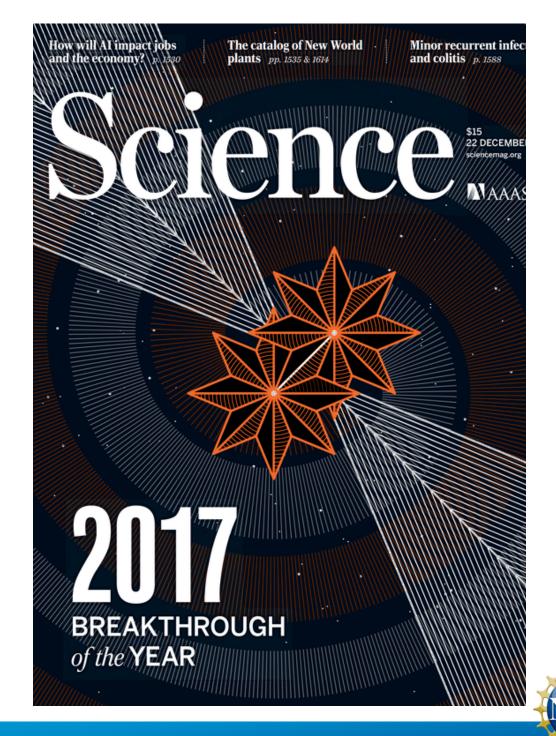


#### Town Hall Protocol

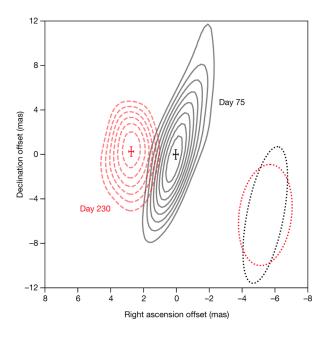
- The (second) NSF Town Hall will be recorded and made available by AAS at <a href="http://bit.ly/aas-agency-townhalls">http://bit.ly/aas-agency-townhalls</a>
- Participants will be in "listen only" mode during the town hall
- Questions can be submitted in writing via the Q&A box (see bottom, center of the Zoom window)

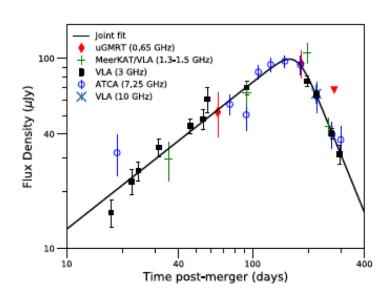


AST Mission: Enable breakthrough science



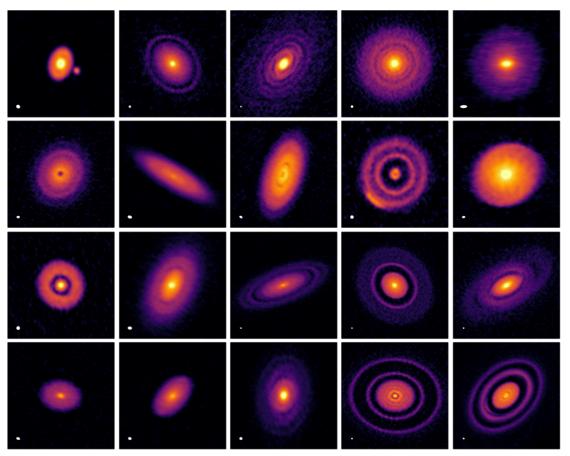
#### Jet Breakout from Neutron Star Merger





- VLBI observations including GBT showed that the compact radio source showed superluminal motion, consistent with a narrow-angle jet at later times with viewing angle ~20°.
- The sharp inflection in the 0.6-10 GHz light curve suggests initial cocoon-dominated outflow, followed by jet breakout with power-law slope of t<sup>-2.2</sup>.
- Mooley+ 2018, Nature 561, 355; ApJ 868, L11.





DSHARP is ALMA imaging survey of 20 protoplanetary disks with ~0.035" (5 AU) FWHM in 1.25 mm continuum emission.

Characterized by concentric narrow emission rings and depleted gaps, sometimes large-scale spiral patterns & small azimuthal asymmetries.

Most compelling interpretation is that gas giants form more quickly than current theory suggests at large distances from host stars.

Disk perturbations observed in dust density allow longer accretion growth time for planetesimals.

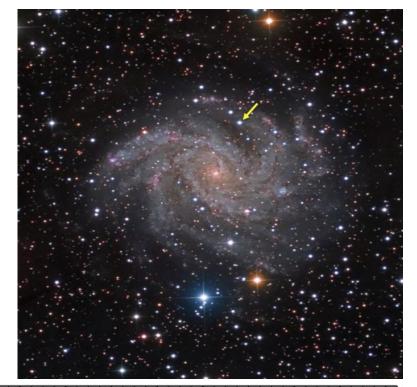
Ten papers accepted for publication in ApJ Letters. Data release at https://bulk.cv.nrao.edu/almadata/lp/DSHARP/.

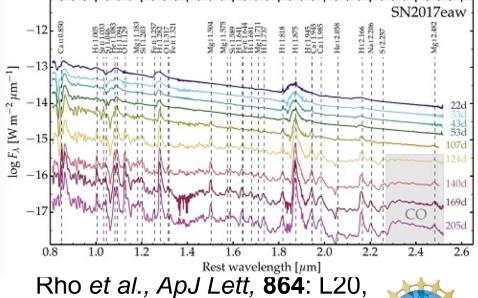
## Nearby Core Collapse Supernova Shows Production of CO and Graphitic Dust

SN2017eaw was discovered 5/14/17 in NGC6946, 7 Mpc. Ten GNIRS spectra were obtained between 22 & 387 days after discovery.

CO and graphitic dust signature clearly detected on Day 124 (and marginally on Day 107).

CO mass consistent with 15 solar mass progenitor, T=1300K CO effective coolant for dust production – clues about dust in early Universe.

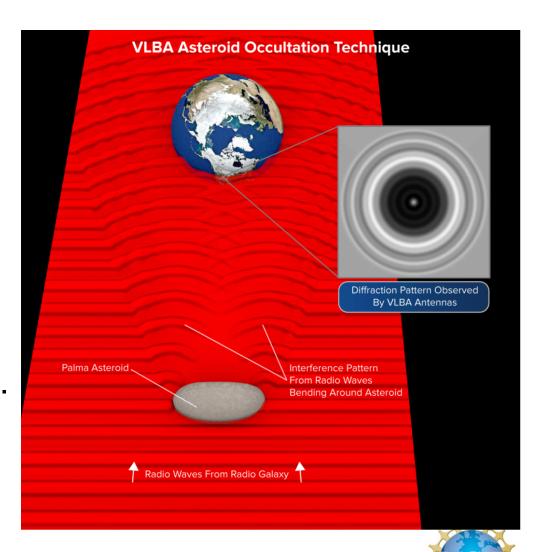




2018

## **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.



#### **AST Mission**

- The National Science Foundation's Division of Astronomical Sciences has a mission of enabling excellence in US ground-based astronomy.
- The Division invests in three approaches:
  - Supporting the programs of individual investigators,
  - Providing access to world-class research facilities and datasets, and
  - Enabling the development of new instrumentation and next-generation facilities, all through competitive merit review.
- Other aspects distinguish the mission:
  - Encouraging broad understanding of the astronomical sciences by a diverse population of scientists, policy makers, educators, and the public at large
  - Supporting career development for students and early-career professionals.
  - Engaging in numerous interagency and international collaborations.
- The formal mission statement is at https://www.nsf.gov/mps/ast/about.jsp



# **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.



#### **AST Division Programs**

Individual Investigators

(Lead: James Neff)

AAG

**CAREER** 

**AAPF** 

ATI

**Technology/** 

**MRI** 

REU

PAARE

and **Special Programs** 

Mid-scale

(Lead: Rich Barvainis)

**MSIP** 

Research

Instrumentation

**Education** 

**Facilities** 

**ALMA** 

**NRAO** 

Gemini

NOAO

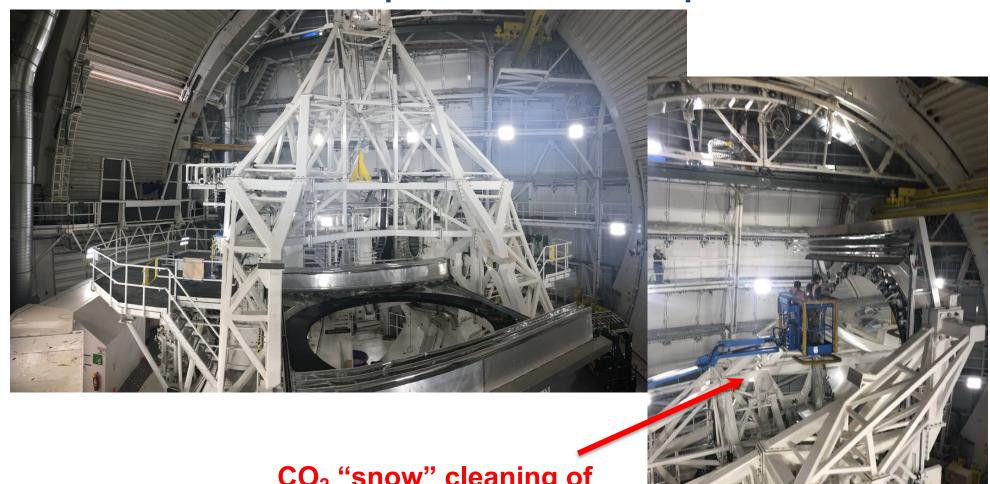
**LSST** 

Arecibo

NSO

**GBO** 

# DKIST Telescope Mount, Sept. 2018



CO<sub>2</sub> "snow" cleaning of the M1 primary mirror



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## **LSST Current Construction Site**



Operations in 2022

Feb 15, 2019 AAS Town Hall



Note – Critical milestone met with AURA submission of cost model in Dec

#### 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 in more detail following
  - Multi-messenger astrophysics grants
  - Major upgrade to Gemini N Adaptive Optics system in service of time domain follow-up, stellar populations studies
  - Forward funding DKIST operations for timely completion of data center, supplement for Level 2 data products.
  - Forward funding LSST operations pending NCOA initiation

Oct 29, 2018 CAA Update

# FY 2018 Budget

#### Several MSIP projects received awards:

- Keck All-Sky Adaptive Optics Wizinowich @ CARA
- Facility IFU Spectrograph for Magellan Simcoe @ MIT
- HERA Project for low-frequency Parsons @UCB
- MMT Adaptive Optics System Hinz @ Arizona
- BICEP upgrade to Stage 3 Kuo @ Stanford
- Dedicated FRB localization Hallinan @ Caltech
- Long Wavelength Array Taylor @ UNM
- GBT Metrology Lockman @ NRAO (won kudos from WVa Congressional staff...)
- ALPACA L-Band Phased Array for Arecibo Jeffs @ BYU

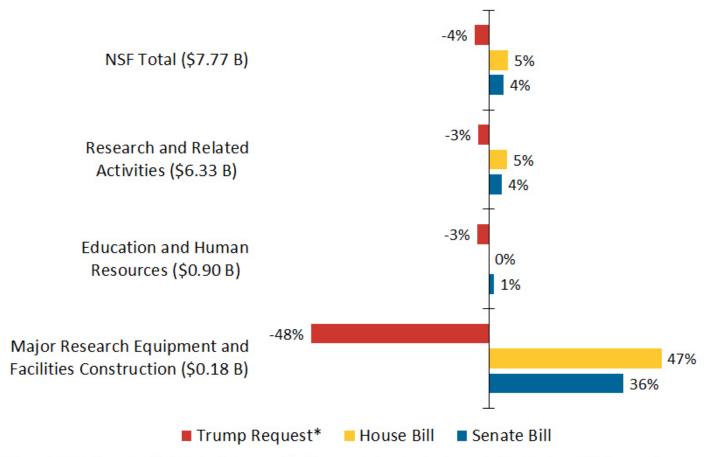
#### FY 2019 Budget

- President's Budget Request is a decrease from FY18 request.
- Congressional appropriations subcommittees levels are higher.
- NSF's bill was not under consideration for passage before the end of FY 18, so operations after Oct 1 were under a Continuing Resolution until Dec 21st. 35-day shutdown followed. Current CR through tonight.
- Risks
  - Government shutdown made construction and facilities operations challenging.
  - Uncertain funding level given competing priorities.

# FY19 Spending Proposals: National Science Foundation

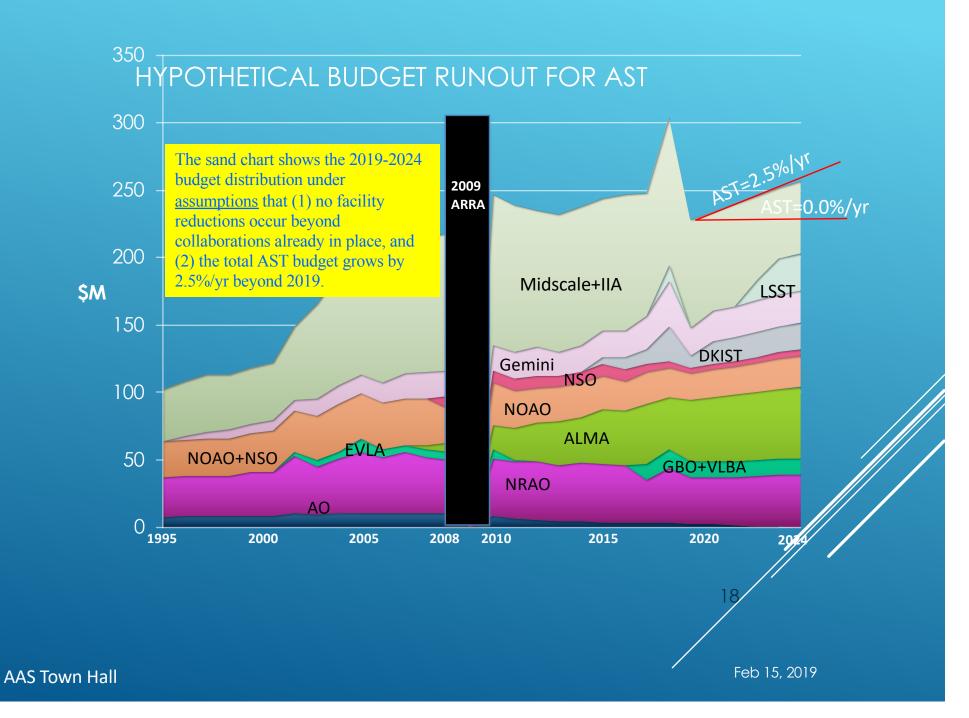
% change from FY18 enacted

\$ in () are the FY18 amounts



<sup>\*</sup>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



**Divestment Summary** 

Telescope	Status
KPNO 2.1m	Caltech-led consortium operating for FY 2016-2020.
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; Final Environmental Impact Statement (FEIS) planned for this month; NSB approval pending. MOA in work for new partner; more new partners desired.
LBO/VLBA	Separation from NRAO in FY 2017; MOA with US Navy in place for 50%.
McMath-Pierce	Funding for utilization as science outreach center.
GONG/SOLIS	GONG refurbishment; Interagency Agreement with NOAA signed to share GONG operations costs. SOLIS moved from Kitt Peak to Big Bear.
Sacramento Pk.	Initial NSF and State funding for consortium led by NMSU; NSO to provide continuing site support; NSB approval for ROD.
Arecibo	UCF new operator, along with Yang Ent. and UMET, with plans for increasing share; hurricane recovery funding being deployed.
SOAR	Post-2020 status to be reviewed.



# NSF's 10 "Big Ideas" for Future Investment





Harnessing Data for 21<sup>st</sup> Century Science and Engineering Work at the lumanechnology ontier: aping the



Navigating the New Arctic Windows on the Universe: The Era of Multimessenger Astrophysics





The Quantum
Leap:
Leading the Next
Quantum
Revolution



\*\*\*\*\*\*



#### PROCESS

Mid-scale Research Infrastructure



**NSF 2026** 



Growing Convergence Research at NSF



NSF INCLUDES: Enhancing STEM through Diversity and Inclusion



- 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  $\sigma$  GW events in the data stream post facto), and the theoretical modeling required for interpretation and prediction. Intended to be funded at this level for several years.
- 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. (Pie chart showed ~1/4 for grants, sand chart showed typical level of ~\$240M, so 8% of \$60M is ~\$5M. If astronomers get even ½ of the Windows funding, total grants \$ go up.)



- Windows Dear Colleague Letter specifies using your current favored solicitation (AAG), to be labeled by PI or Program Officer as referring to sources or potential sources of at least 2 messengers.
- HDR solicitation 19-543 describes one or more Ideas Lab(s) on Data-Intensive Research in Science and Engineering (DIRSE) as part of the HDR Institutes activity.
  - The first opportunity in FY 2019 will encourage individuals with compelling data-intensive science and engineering problems and/or technical expertise to self-organize into teams with the aim of developing innovative, collaborative research proposals through an Ideas Lab process.
  - The second opportunity in FY 2019 will encourage applications from teams of researchers proposing frameworks for integrated sets of science and engineering problems and data science solutions.
  - NSF anticipates implementing the subsequent convergence and codesign phase in the 2021 timeframe for HDR Institutes.

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- Mid-scale Research Infrastructure-1 (19-537)
  - Design and Implementation projects may comprise any combination of equipment, infrastructure, computational hardware and software, and necessary commissioning.
  - Mid-scale RI-1 "Implementation" projects may have a total project cost ranging from \$6 million up to below \$20 million.
  - Only Mid-scale RI-1 "Design" projects may request less than \$6 million, with a minimum request of \$600,000 and a maximum request below \$20 million as needed to prepare for a future mid-scale or larger infrastructure implementation project. (Successful award of a Mid-scale RI-1 design project does not imply NSF commitment to future implementation of that project.)
  - Pre-proposals due February 19<sup>th</sup>.
- Divisions have the option to (co-)fund highly ranked MSRI proposals that don't win Foundation-level funding.
- AST will still offer MSIP in alternate years.

NSF)



- Mid-scale Research Infrastructure-2 (19-542)
  - The Mid-scale RI-2 program supports implementation of projects in high states of readiness, i.e., those that have already matured through previous developmental investments. They may comprise any combination of equipment, instrumentation, computational hardware and software, and the necessary commissioning and human capital in support of implementation.
  - Mid-scale RI-2 does not support pre-implementation (early-stage design or development) or post-implementation research, operations or maintenance, the anticipated source(s) of which are expected to be discussed in the proposal.
  - The total cost for Mid-scale RI-2 projects ranges from \$20 million to below the minimum award funded by the Major Research Equipment and Facilities Construction (MREFC) Program, currently \$70 M.
  - Letters of Intent due February 8th; Pre-proposals due March 11th.

#### AAAC Subcommittee on Gemini, Blanco, & SOAR

- The Gemini international agreement is up for renewal in 2021; assessment point next year and current partners announced intentions at the Board meeting in Nov.
- SOAR international agreement up in 2020.
- AST and DOE jointly requested AAAC to form an ad hoc subcommittee to evaluate the scientific utility and US community priorities for the telescopes for the next five or so years, as motivation for agency decisions prior to Decadal Survey release.
- Chair is Klaus Honscheid (OSU); the panel is examining a wide range of topics from precision cosmology through time domain/multi-messenger and exoplanets.
- Preliminary briefing to AAAC in early November; final report expected in February.

#### **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.
- NSF is including all ground-based astrophysics (i.e., gravitational wave detection and astro-particle detection) for scientific consideration, not limited to AST.
- AST is supporting development of three major projects, two through activities in national centers, and one through a continuing series of grants. OPP/PHY support a fourth.
- AST does not explicitly support preparation of mid-scale proposals for Decadal submission; these are communityinitiated, so the scope and breadth of topics are known only informally to AST.

## **AST Decadal Survey Preparations**

 NRAO held a series of three Kavli-sponsored workshops and one AUIsponsored to identify and prioritize the key scientific problems the RMS community would address in the coming decade.

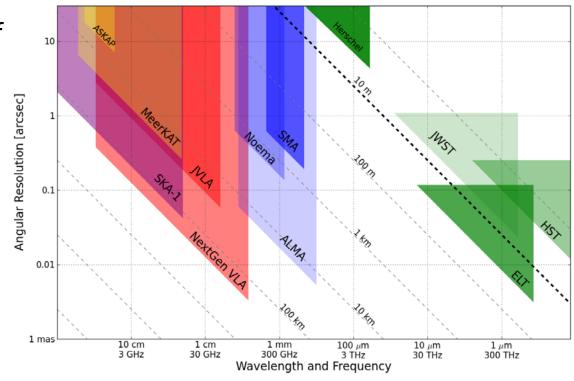
Many of the scientific goals can be achieved with a concept called Next

Generation VLA, including

Unveiling the Formation of Solar System Analogues

Probing the Initial
 Conditions for Planetary
 Systems and Life with
 Astrochemistry

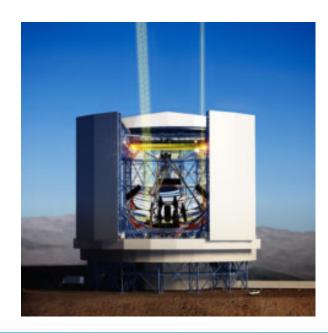
•Funded technical concept studies are underway within NRAO, and science book is linked as ASP Conference 517, with 850+ pages and 285 authors.



#### **AST Decadal Survey Preparations**

- NOAO is coordinating with the TMT and GMT projects to develop a community science case requiring time on both telescopes through the new US ELT Program. Open House last night.
- 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 for awards.
- New NSB report addresses how to handle lifecycle costs beyond scope of individual Divisions.







#### Cosmic Microwave Background (CMB)





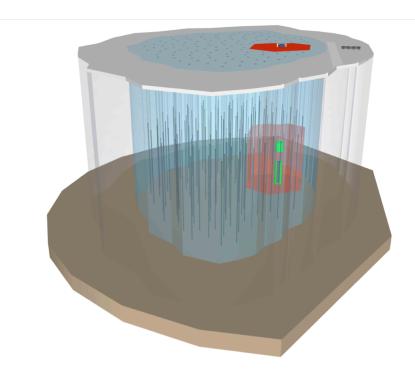
- CMB Stage 4 goals: testing inflation, determining the number and masses
  of the neutrinos, constraining possible new light relic particles, providing
  precise constraints on the nature of dark energy, and testing general
  relativity on large scales.
- Two sites: South Pole and Atacama
- Fourteen small (0.5m) telescopes and three large (6m) telescopes,
   with 512K total detectors
- Report released to AAAC by its subcommittee on 10/23/17.
- Prioritized for DOE support in P5 report.



# NSF

#### IceCube-Gen2

- Purpose is in-depth exploration of neutrino Universe in the PeV to EeV range with hundreds of detections above 100 TeV.
- Double the current spacing of photometer strings detecting Cherenkov flashes from 125 to 250 meters and doubling the deployed instrumentation will extend volume to ten cubic kilometers.



- Precision IceCube Next Generation Upgrade (PINGU) denser subarray (shown in green) targets precision measurements of the atmospheric oscillation parameters and the determination of the neutrino mass hierarchy as well as the search for dark matter.
- Proposed surface radio array will detect air showers to allow for vetoing to enhance sensitivity.
- Development supported by OPP and PHY, but part of Decadal considerations for NSF astrophysics.



#### **NSB** Report to Congress on Operations Costs

- Linked to NSB website: https://www.nsf.gov/nsb/publications/2018/NSB-2018-17-Operations-and-Maintenance-Report-to-Congress.pdf
- Finds that O&M costs for large facilities developed under MREFC can exceed the 'host' Division's capacity to absorb them fully, in analogy to the original reasons to establish the MREFC line for construction in the first place.
- Recommends Foundation-level ownership of the facilities portfolio with strategic ability to manage support.
- Foundation-level allocation of O&M funds could be possible as supplement to Division-level funding for initial cost sharing (5-10 years max at <50%).</li>
- Foundation-level O&M funding could be used to smooth the transition from construction to operations.
- It could also be used when a Division needed to divest but the Foundation had strategic interest in continuation.

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#### NSF Implementation of NSB O&M Report

- NSB recommended the mechanism of a more flexible MREFC account to expand to Foundation-level operations support.
- NSF senior management is still considering their response and specific mechanism of implementation.
- Fictional example for 50% Foundation-level support:
  - NSF invests \$1B through MREFC in a next-generation ground-based astronomy project.
  - Typical O&M era support is 5% of original capital/yr for O&M
     + 5% recapitalization (new instruments + major upgrades, replacements)
  - Division burden is then 50% x \$100M/yr = \$50M/yr, approximately the level of support of ALMA.
  - Could define new instruments to be separate, competed program to further limit committed O&M costs.

#### NSF Implementation of NSB O&M Report

- Adding a major new facility during the next decade would therefore have definite consequences for the distribution of AST funds, the nature of which depend on the evolution of the budget envelope.
- The NSB report also addresses the balance of funding between facilities and individual investigator grants.
   Maintaining a tolerable balance and continuing to support most of the current observing capabilities while adding new ones depends on an appropriate growth of Division support in the context of growth of the Foundation top line.



#### **Division of Astronomical Sciences (AST)**

#### Office of the Division Director



Division Director



Ralph Gaume Deputy Division



**Craig McClure** Program Support Manager



Donna O'Malley Financial & Operations Specialist



**Elizabeth Pentecost** Project Administrator

#### Administration



Program Analyst



Program Specialist



Program Specialist



Program Assistant

#### **Individual Investigator Programs (IIP)**



**James Neff** Program Director IIP Coordinator



**Richard Barvainis** Program Director Extragalactic Astronomy & Cosmology (EXC)



Glen Langston Program Director Galactic Astronomy



**Harshal Gupta** Program Director Astronomy & Astrophysics Postdoctoral Fellowships



Linda French Program Director CAREER; Planetary Astronomy; ESP



Nigel Sharp Program Director AAG; CDS&E; cross-NSF programs



**Hans Krimm** Program Director Stellar Astronomy & Astrophysics



Peter Kurczynski Program Director Advanced Technologies & Instrumentation; EXC; MRI



Matthew Benacquista Program Director REU; EXC; ESP



**Kenneth Johnston** Expert CAREER; AAG

#### Facilities, Mid-Scale, & MREFC Projects



**Christopher Davis** Program Director Gemini



Joe Pesce Program Director National Radio Obs.; ALMA



**David Boboltz** Program Director National Solar **DKIST** 



**Edward Ajhar** Program Director Large Synoptic



Ashley Zauderer Program Director Arecibo



**Richard Barvainis** Program Director Mid-Scale Innovations Program (MSIP)



**Luke Sollitt** Program Director



**Harshal Gupta** Program Director Green Bank Observatory

#### **ESM**



Jonathan Williams Program Director



AAS Town Hall

#### AST needs a few good astronomers

- Retirement of long-serving Program Director, Vern Pankonin. Served RMS and OIR communities – his vision helped create the path to NCOA. Creates a strong need for expertise in facilities oversight.
- Upcoming completion of terms of IPA rotators; opportunity for university and lab-based astronomers to serve as Program Officers for the individual grants program, bringing their knowledge of current science and the scientific community.
- You would be joining the most visible, collegial, and respected Division in the NSF (purely objective statement).
- Please contact me any time, or your PO or colleague to explore possibilities.