National Science Foundation Status
Exoplanet Science Strategy Committee
April 2018

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Solar and Planetary Astronomy Program

Division of Astronomical Sciences

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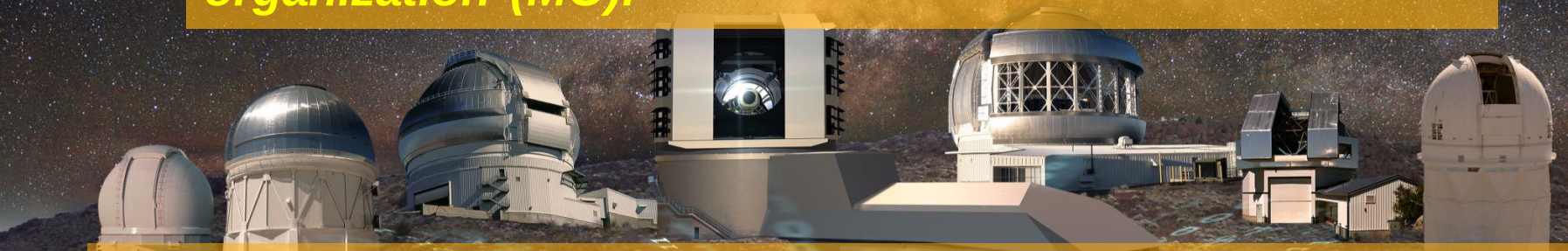
Status

- FY18 budget finally approved
- National Center for O/IR Astronomy (NCOA)
- TESS launched!

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. 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.

New Directions - NCOA

- National Center for O/IR Astronomy
- Integrates NSF-funded NOAO, Gemini, and LSST operations under a single organizational framework, managed by one management organization.
- National focal point for domestic and international partnerships.
- No additional funding, no change in programs, no interruption of current operations, and no change in currently supported management organization.
- Consolidates NSF oversight responsibilities.
- Plan to implement as of Oct 1, 2018.

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

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.

DKIST Current Construction Site

Operations in 2019

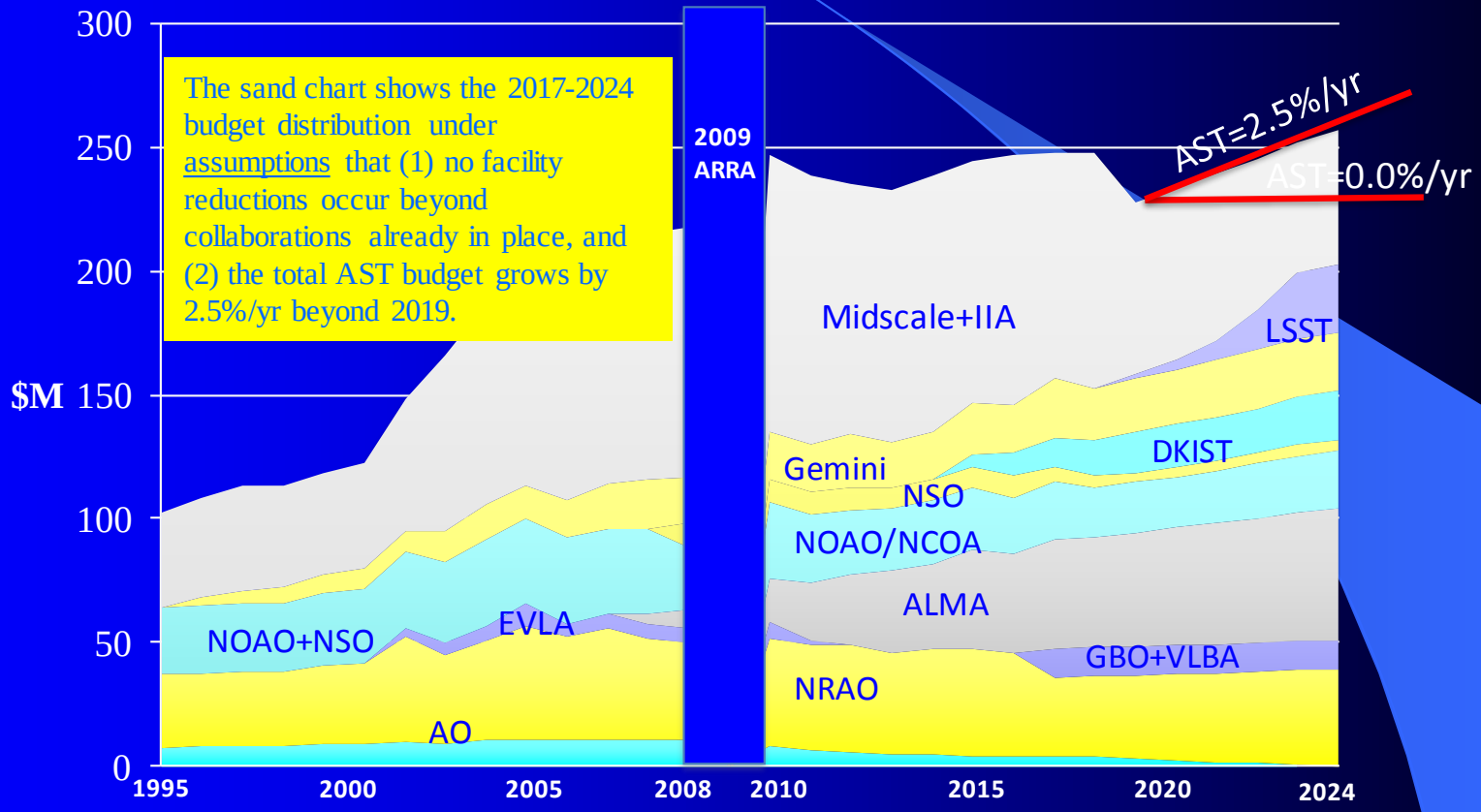
LSST Current Construction Site

Operations in 2022

The Elephant in the Room

- NSF practice is that operations costs of Major Research Equipment and Facility Construction (MFREC)-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.

Hypothetical Budget Runout for AST



New Solicitations

- The FY 2019 President's Budget request allocates $30M each for Windows on the Universe and Harnessing the Data Revolution
- 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 already appearing (CSSI, Tripods+X), so watch the NSF website.
- These "off the top" investments in key future directions result in a ~8% reduction of core funding for AST, 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 also give access to Rules of Life (astrobiology) and Quantum Leap (BH entropy).

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; 23 invited for full proposals.
- Advanced Technologies and Instrumentation—60 prop.
- CAREER—60 prop.
- Astronomy and Astrophysics Postdoc. Fellowships—100 prop.
- REU—20 prop.
- Partnerships in Astronomy and Astrophysics Research and Education—5-10 prop.

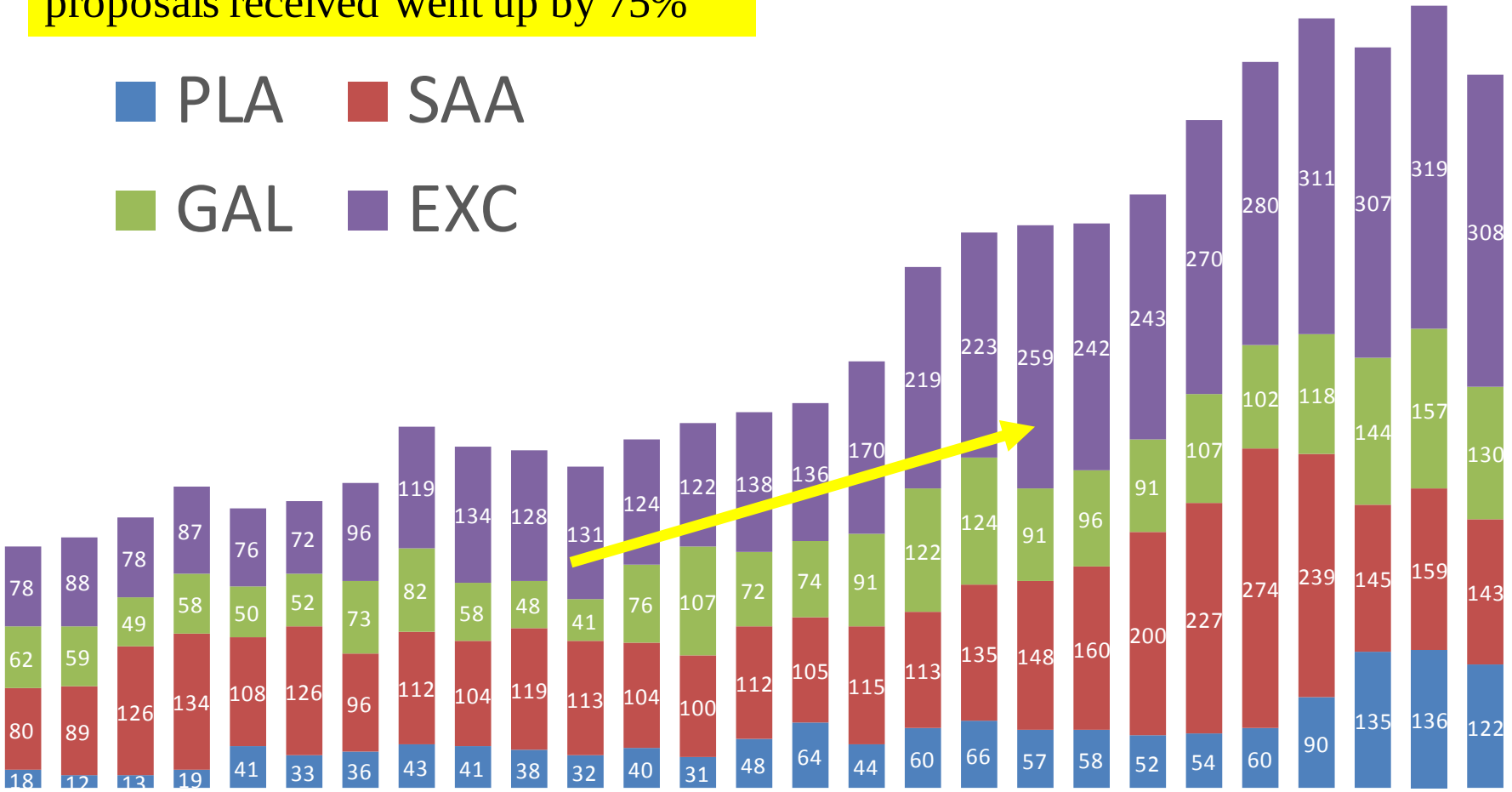
Examples of NSF Support for Exoplanet Science

- Basic Research Grants (AAG/SPG, CAREER, AAPF)
  - exoplanet and host star characterization
  - theory and computational modeling
  - star-planet interactions

- Instrumentation Grants (ATI, MRI)
  - High-Precision RV Spectrometers: e.g. HPF (PI Mahadevan), EXPRES (PI Fisher)
  - Robotic observatories for transit searches, host star characterization.

Proposals in AAG, 1990-2016

From 2000 to 2008, the number of proposals received went up by 75%



SOLAR AND PLANETARY RESEARCH GRANTS

NSF 16-602

PILOT PROGRAM – 2 YEARS

Covers planetary astronomy:
Solar System and extrasolar planets

Covers solar astronomy

THROUGH FY18...
THERE STILL REALLY IS NO DEADLINE DATE

We are working to reduce time pressure on you and on us

WHAT WE HAVE LEARNED SO FAR...

Scientists don't really believe it is a rolling deadline

Schedule at which different scientific disciplines covered by this program has received proposals varies

For Solar System And Exoplanets:

Proposal pressure - coupled with date – dictated number and date(s) of panels

Smaller panels held later in year

MORE ADVICE...

No advantage to submitting early, late or whenever –

No limits on the number of proposal submissions on different topics

We aren't in a rush to consider your proposal, even if you are

We will reject proposals that we determine will not be funded as soon as practicable

If your proposal is rejected, you cannot submit another version of the same proposal until *one year* after you *submitted* the rejected proposal

AREAS OF CONCERN

I. PLANETARY SCIENCES FOCUSED MORE TOWARD PLANETARY GEOLOGY

THERE IS NO PLANETARY SCIENCE DIVISION AT NSF

THIS IS A GREY AREA

If you choose to apply to planetary astronomy (SPG), you must demonstrate how your proposed research benefits planetary astronomy.

The Program Director will screen proposals

The Review Panel will be instructed to consider a proposal's applicability to planetary astronomy

AREAS OF CONCERN

II. CIRCUMSTELLAR DISKS:

Consider whether your proposal is related more to planet detection and formation or to star formation when submitting to SPG

THIS IS A GREY AREA

If you consider your proposal to be possibly more related to AAG, *submit it by their 15 Nov deadline*. If we think it is better suited for SPG, we will shift it over from AAG and no harm is done.

BUT, a proposal submitted to SPG that is largely star formation related to circumstellar disks, will be Returned Without Review, if it is submitted after the 15 Nov AAG deadline

AREAS OF CONCERN

III. DUPLICATION OF PROPOSALS BETWEEN NASA AND NSF

We ask you to let us know if they have been submitted to NASA

...and we check

If the proposal is already approved for full funding by NASA, we will not consider it

Sometimes the agencies will jointly fund a proposal

We WILL NOT FUND the same research twice

AREAS OF CONCERN

IV. AND MORE ABOUT NASA

The NSF does not consider proposals that are predominantly intended to reduce NASA spacecraft or archival data only (this includes HST)

That's what NASA and HST grants are for.

The NSF WILL consider proposals that incorporate NASA spacecraft or archival data as part of a broader investigation

PROSPECTIVE PROPOSERS SHOULD PAY CLOSE ATTENTION TO THE CHANGES THIS YEAR IN

PROPOSAL AND AWARD POLICIES AND PROCEDURES GUIDE, NSF 18-1, (aka PAPPG)

WHICH DESCRIBES ALL REQUIREMENTS EXCEPT FOR THOSE SUPERSEDED SPECIFICALLY IN AN INDIVIDUAL SOLICITATION.

NN-EXPLORE BASICS

- "NASA-NSF Partnership for Exoplanet Observational Research"

- NSF Contributes the operations funding for the NOAO share (40%) of the WIYN telescope. Open access to the facility for exoplanet science.

- NASA Contributes the purpose-built NEID spectrometer, a funded GO program, funding to modify facility to house NEID and incremental operations funding

NN-EXPLORE STAGE 1.

- MOU covers Oct 2016 – Sep 2018.
- All NOAO time devoted to exoplanet science, using existing suite of instruments
- Time allocation by regular NOAO TAC
- Limited GO funding provided by NASA
- NEID spectrometer built by Penn State University
- WIYN facility modifications made to accept NEID
- TESS launch!

NN-EXPLORE STAGE II.

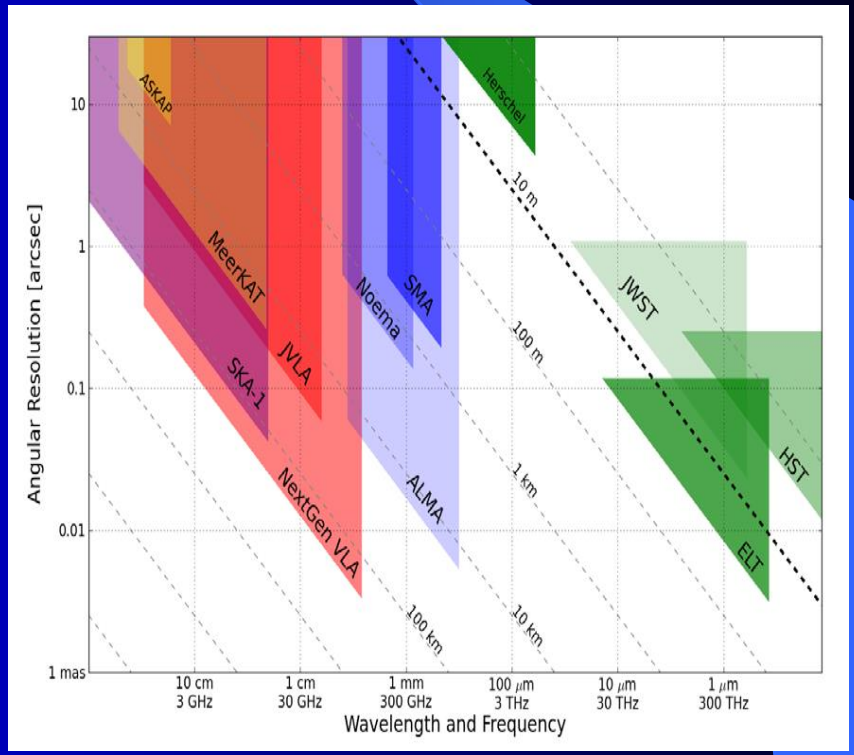
- Plan to renew MOU to cover Oct 18 – Sep 23
- All NOAO time devoted to exoplanet science, using NEID
- Time allocation presumably by NOAO TAC, but possibly with special provisions (e.g. to accommodate GTO, special cadence, etc.)
- Limited GO funding provided by NASA
- NEID team carries out GTO program
- Reduction pipeline and data products maintained by NexSci
- TESS provides candidates for precision RV follow-up

Decadal Survey

- Planning is now well underway for input to the next 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.
- We provide a charge to the National Academies, then the entire process is organized by them.
- They submit a proposal for NSF's share, anticipated to be received this spring.
- We anticipate large ground-based programs for Decadal panel consideration to include ngVLA, Cosmic Microwave Bkg – S4, and community science programs for TMT/GMT.

AST Decadal Survey Preparations

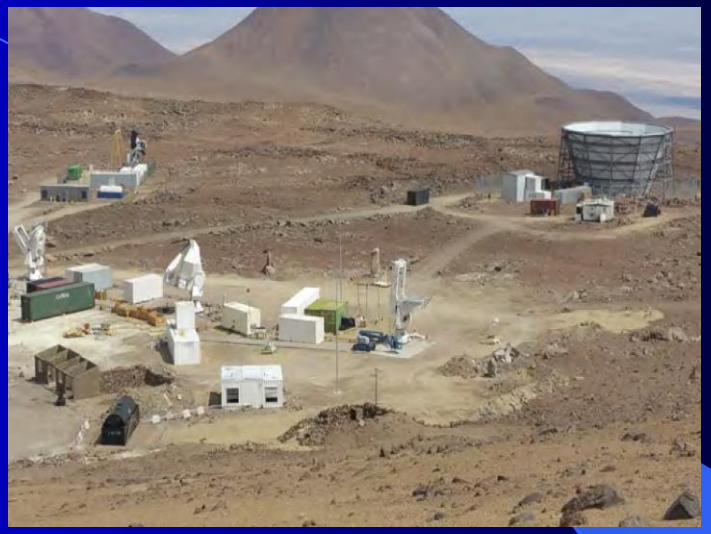
- NRAO held a series of three Kavli-sponsored workshops to identify and prioritize the key scientific problems the RMS community would address in the coming decade.
- Many of the scientific goals can be achieved with a concept called Next Generation VLA, including
  - Unveiling the Formation of Solar 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
- Submissions 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.

Decadal Survey

- We are now approaching the end of the current decade, with LSST development as a notable success.
- Other large projects in the 2010 queue will need to compete for a new prioritization in the 2020 survey.
- Reasonable expectation from recent past experience is that only the top-ranked large project will have a chance to be supported in the coming decade.

- NST/AST remains optimistic that we can leverage a vital, competitive research program for our dynamic community.

QUESTIONS?






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

Windows on the Universe

- Cross-cutting approach that exploits the newfound ability to get cosmic information through 3 complementary channels:
  - Electromagnetic radiation (with high-energy a critical component)
  - Energetic particles (neutrinos, CRs)
  - Gravitational Waves
- NSF supports key facilities that enable these detections

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