NSF Update to Astronomy & Astrophysics Advisory Committee

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6 June 2022

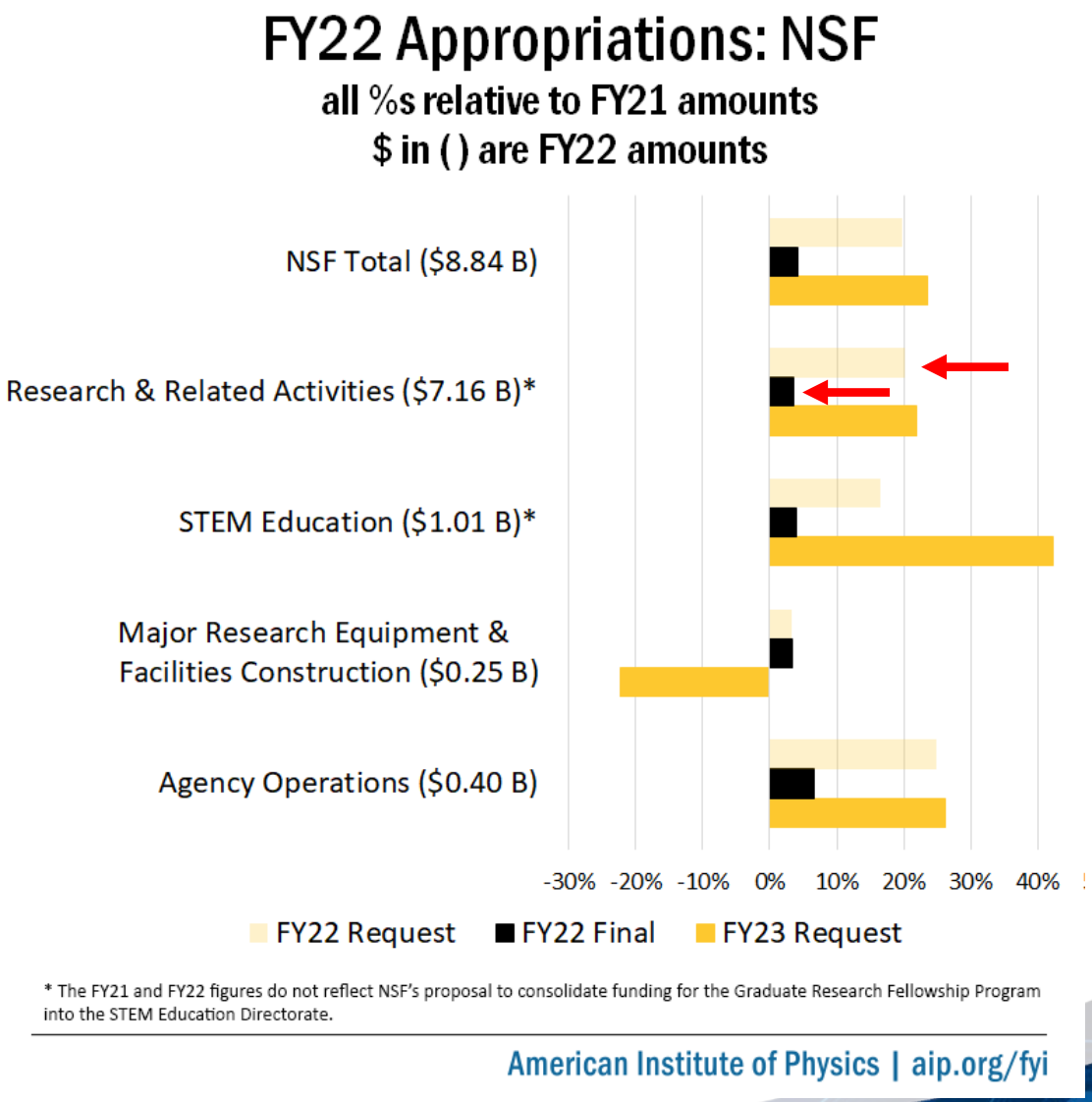
Outline

1. Noteworthy events since 4 March AAAC meeting
2. Science Highlights
3. Grant Programs Updates
4. Electromagnetic Spectrum Management Updates
5. Observatory Updates
6. Progress towards meeting recommendations by Decadal Survey(s), AAAC, etc.

Noteworthy Updates Since March AAAC Meeting: Budgets

- FFY24 Budget under development; providing input to MPS
- FY22 "Current Plan" established; similar to FY21
- FY23 President's Budget Request Released 28 March
  - 1.7% increase over FY2021 MPS/AST "Actual"
  - But I caution against such simple line-by-line comparisons
  - It's more complicated than that…

- OD => MPS => AST (not bottom up)
- Federal agency: subject to congressional, administration, and agency priorities; NSB and O/D strategic plans
- Future year budgets are unknowable
- Facilities operate on 5 to10 year cooperative agreements, with expectation of ~3%/y increases
- Increases to overall NSF/AST budget have not kept pace (for a long time)
- AST committed to supporting Grants programs as part of a *balanced portfolio*
- Astronomy community receives substantial funding *outside the AST budget*; we need to do even better



TIP Directorate (Launched in FY2022)

Mission: The Directorate for Technology, Innovation and Partnerships, TIP, harnesses the nation's vast and diverse talent pool 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. TIP improves U.S. competitiveness, growing the U.S. economy and training a diverse workforce for future, high-wage jobs.

Focus areas — fostering innovation and technology ecosystems, establishing translation pathways, and partnering across sectors to engage the nation's diverse talent.

Noteworthy Updates Since March AAAC Meeting: Broader Science Impact of MPS/AST

- Other Decadal Surveys
  - Planetary Science & Astrobiology; released in April
  - Solar & Space Physics; underway
  - Met with Biological & Physical Science Research in Space

- Recent partnerships and programs
  - Geoscience Lessons for and from Other Worlds (NSF22-032) (GEO/EAR, GEO/AGS, MPS/AST)
  - CARSE center in Puerto Rico launched in March

Center for Advanced Radio Sciences and Engineering

AST partnership with EPSCoR that also includes collaboration with industry to work on active RFI cancellation.

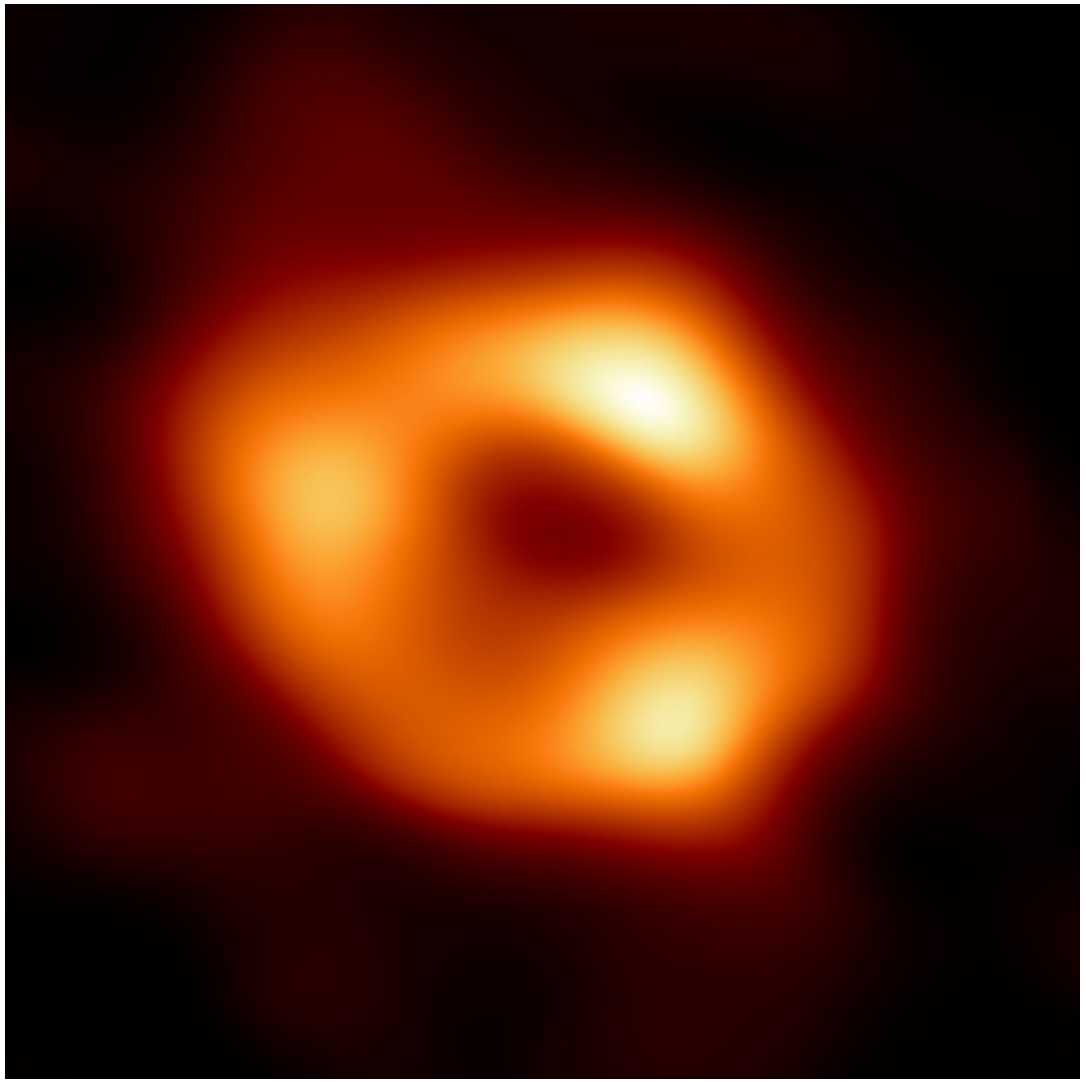
Center launched at end of March 2022 at the University of Mayagüez in Puerto Rico.

Noteworthy Updates Since March AAAC Meeting: Operational Status

- Building is open, and we are hosting visitors at NSF HQ
- Panels still virtual, but some governance meetings are hybrid
- 100% telework widely utilized
- Site Visits have restarted!
- In person presence at Pasadena AAS meeting/town hall

Science…

Supermassive Black Hole at Center of Milky Way (Sgr A*)

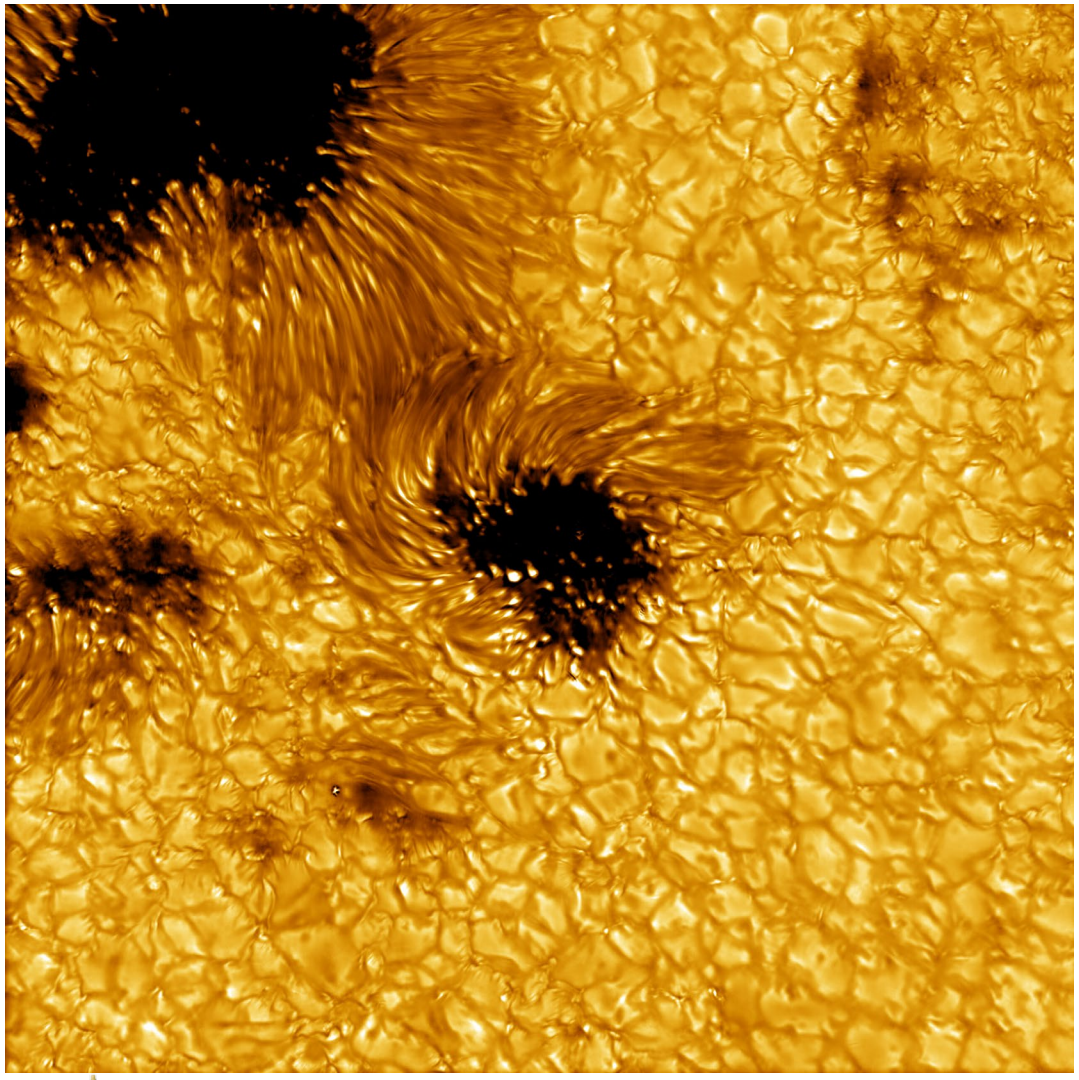


Credit: EHT Collaboration

Coordinated press conferences on 12 May; one hosted by NSF

More than 300 researchers from 80 institutes around the world that together make up the Event Horizon Telescope (EHT) Collaboration

Observations from a worldwide network of radio telescopes, including ALMA



On 23 Feb 2022, the Daniel K. Inouye Solar Telescope (DKIST) began year long commissioning

First Science Observations

The world's most powerful solar telescope obtains high resolution images of sunspots coupled with measurements of electric fields. These data will reveal how magnetic reconnection suddenly reconfigures the solar magnetic fields, producing jets of plasma that reach into the chromosphere.

Grant Programs Updates

Early Career and Broadening Participation Programs

- MPS LEAPS
- MPS ASCEND

- CAREER
- AAPF
- REU Sites

- Supplements: MPS-AGEP, MPS-GSRV, MPS-HI, FASED, REU, RET, etc
- PAARE…

Partnerships in Astronomy & Astrophysics Research and Education (PAARE)

- Broaden participation in astronomy
- Partnerships that
  - Strengthen education infrastructure
  - Strengthen research capacity
  - Create opportunities for student and faculty research
- Pathways into the research enterprise
  - Increase recruitment, retention and success
  - Foster a diverse, inclusive and equitable environment

Research, Instrumentation, and Technology Programs

Astronomy & Astrophysics Grants (AAG)
Advanced Technology & Instrumentation (ATI)

- All proposals reviewed
- Award recommendations just starting; will be complete by early August

Mid-Scale Innovations Program (MSIP)

- No new proposals solicited in FY2022

Electromagnetic Spectrum Management Updates

SpectrumX Center

Designed to:

- Coordinate industry, government and academia
- Solve co-existence challenges (e.g., passive-active)
- Enhance workforce development

Awarded September, 2021

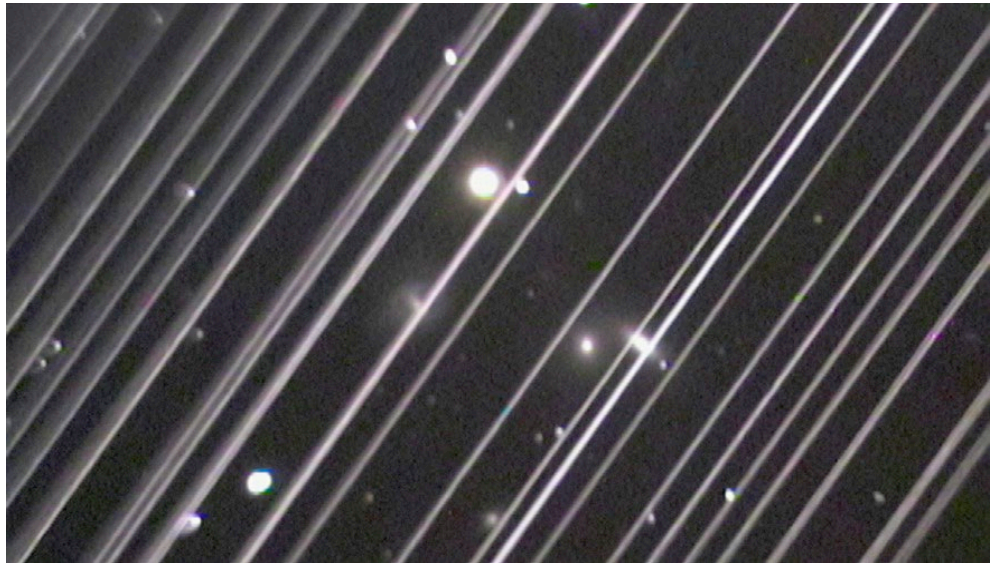
- See spectrumX.org
  - Holding radio shop chat webinars on numerous technical and spectrum matters
  - Recently formed their External Advisory Board, including high-level participation from NTIA and FCC

A key task for the center is to ensure science users of the spectrum, such as radio astronomers, maintain and enhance their ability to access the spectrum they need among increasing demands for spectrum.

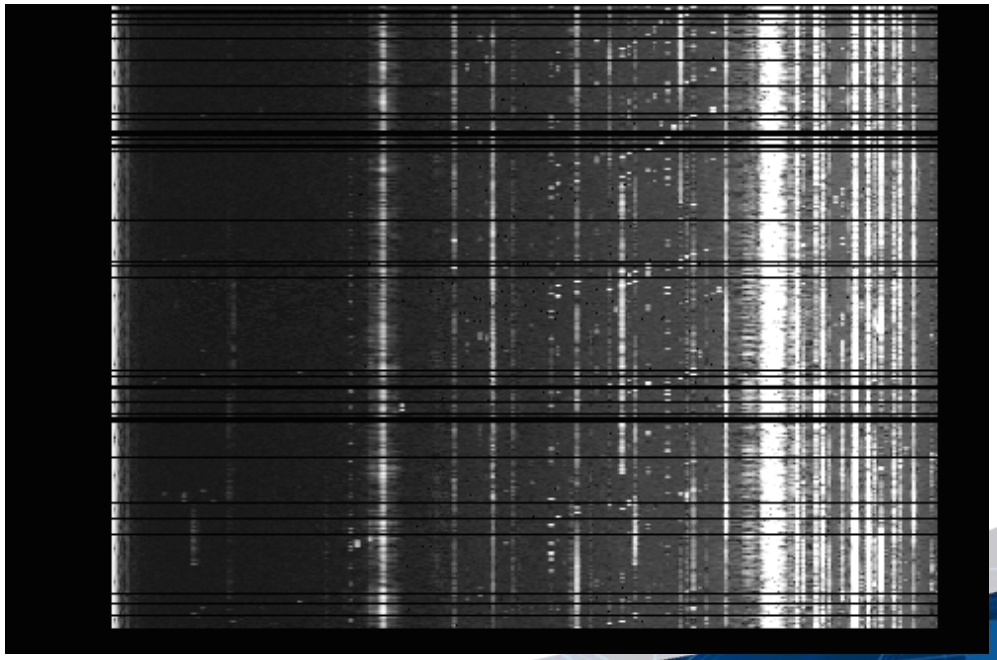
SWIFT solicitation expanded to include impact of satellites on astronomy

- See NSF 22-571 funding opportunity
- Proposals were due 11 May

Optical impacts



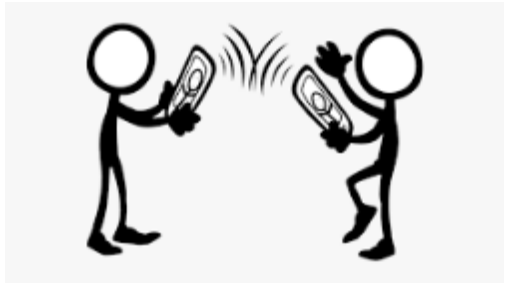
Radio impacts

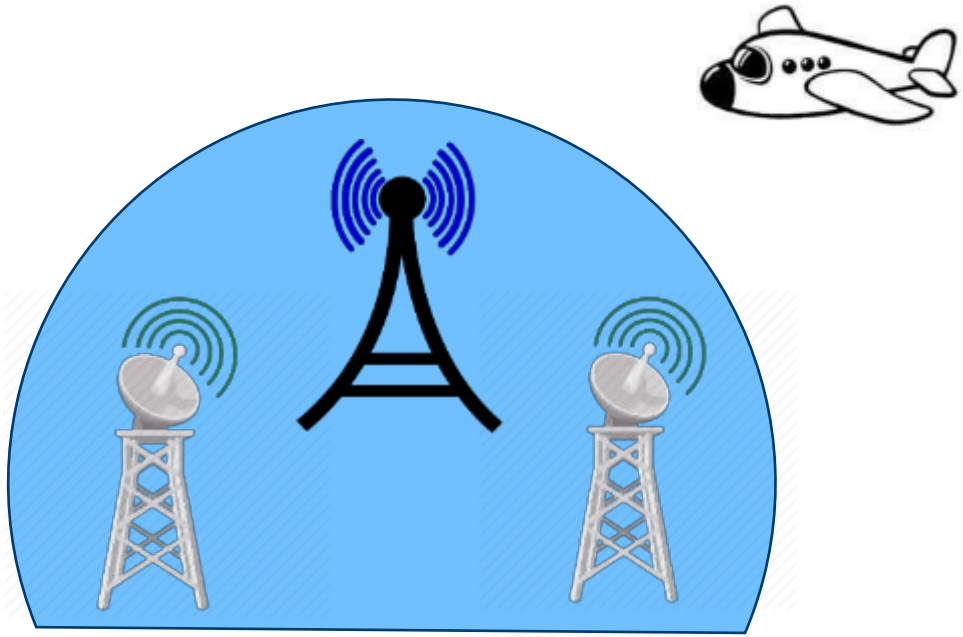


News: "IAU Centre for the Protection of the Dark and Quiet Sky from Satellite Constellation Interference"; launched in April; NOIRLab is a partner

National Radio Dynamic Zones (NRDZ)

- Pilot innovative approaches for transmission/reception at various frequencies of interest
- Cognitive machine-to-machine frequency coordination leading to dynamic allocation and improved efficiency

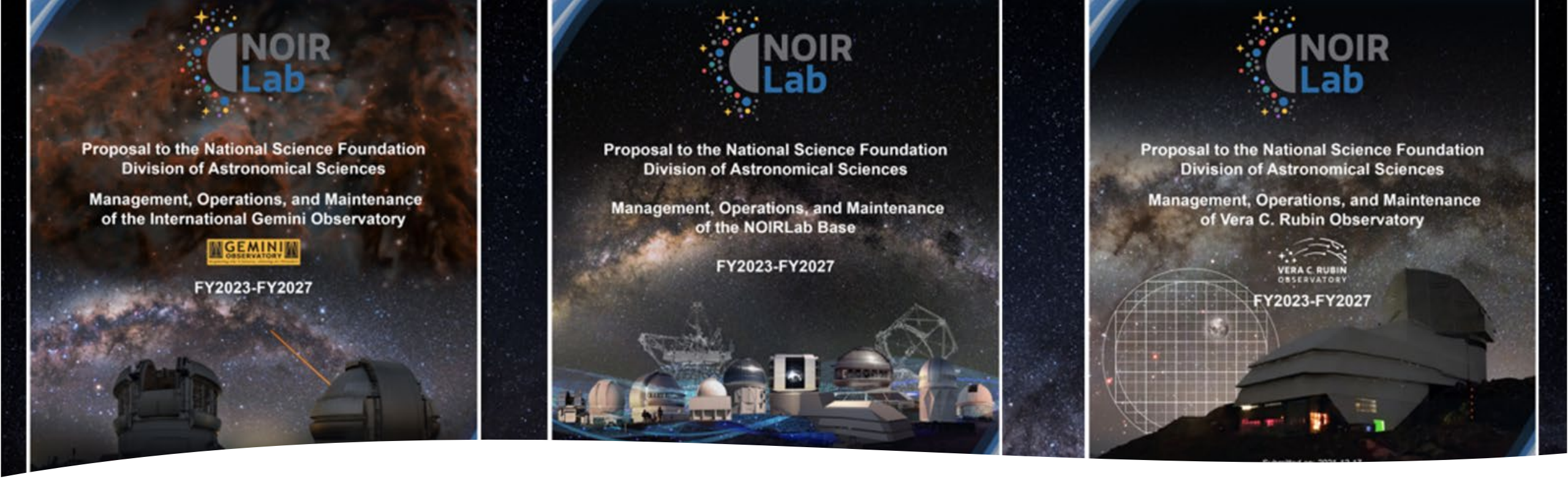




DCL NSF 22-579

Proposals due 21 June

Major Observatories Updates



NOIRLab Renewal

NOIRLab 5-year Renewal Panel Review held February 2022

- NSF's plan is based on proposal content, panel feedback, consideration of Astro2020, and AST strategic priorities
- Engagement with National Science Board has begun
  - Context Item presented to NSB A&F Committee end of April
  - Action seeking approval to proceed with renewal in July

Windows on the Universe Center for Astronomy Outreach (McMath-Pierce Solar Telescope)

- Renovation work nearly complete
- Anticipated opening mid/late 2023
- Planned components
  - Science-on-a-Sphere
  - Planetarium
  - NSF facilities exhibits (virtual control rooms?)
  - MMA/TDA
  - Solar telescope demos
  - Classrooms

Rubin status

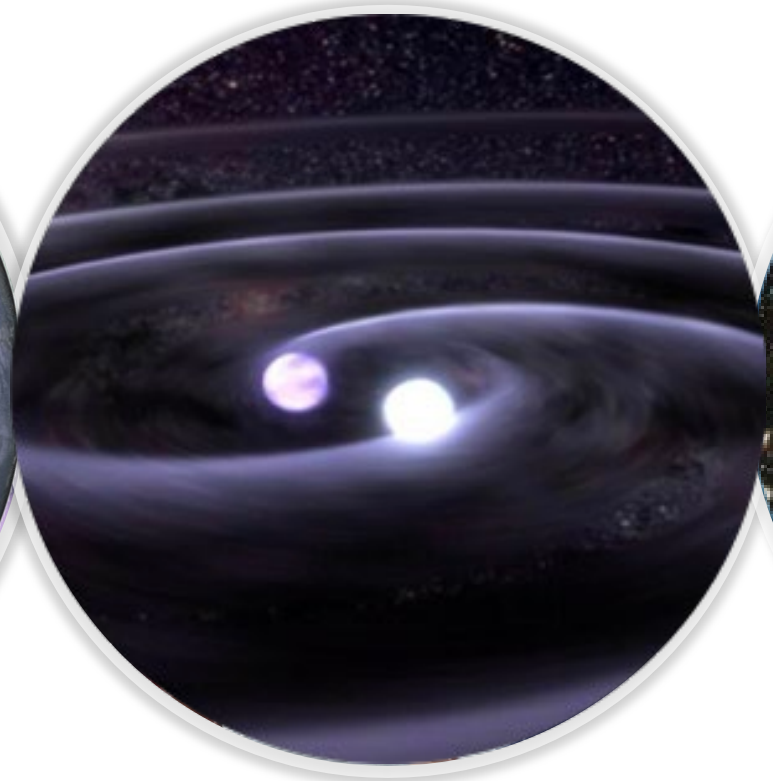
- In December 2021, National Science Board authorized new project baseline of $571 million, including $20 million in NSF-held management reserve.
- Re-baseline funding actions pending final cost analysis.
- Uncertainties of additional COVID impacts remain.
- Telescope mount and dome construction good progress.
- Camera's original vapor compression refrigeration system to be replaced with a pumped coolant system.
- Full impacts on construction and operations still to be determined.
- NSF-DOE Review of Rubin Operations proposal and long-term plan generally very positive.

Decadal Survey Responses

Astro 2020 Science:

Three science themes addressing fundamental and profound questions for humanity and for understanding our place in the space and time of the Cosmos.

A step-by-step path to discovering habitable worlds and life elsewhere.



Time-domain multi-messenger astrophysics to trace the earliest stages of the observable universe

Formation and evolution of stars and galaxies from the Big Bang to today

Support for exoplanet science:

- NSF funding for public access on the WIYN / NEID spectrograph (NN-EXPLORE) to measure RVs with precision of ~30 cm/s.
- NSF funding for the Keck Planet Finder with public time contribution and open-access time through NASA.
- NSF funding for the EXtreme PREcision Spectrograph with RV precision of 30 cm/s at Lowell Observatory.
- NSF's Gemini telescopes: MAROON-X visitor instrument, GPi high contrast imaging.
- ALMA – studying protoplanetary disks and chemistry

Support for Time-Domain Multi-Messenger Astronomy:

- NSF Windows on the Universe program supports TD/MMA is a partnership between PHY, AST and other NSF divisions
- Zwicky Transient Factory
- Rubin telescope (partnership with NSF / DOE) will be commissioned in 2024 and will scan the southern hemisphere sky every 4 days.
- Many PI-led programs

Support for Understanding Cosmic Environments:

- OIR and Radio facilities: Gemini (N and S), VLA, VLBA, ALMA, GBO, ngVLA
- PI led research (observations, theory, simulations)

Formulating Responses to Various Recommendations from Decadal Surveys, AAAC, etc

- AST-level DEI working group working with NSF/OIA and MPS
- Lab Astro – NASA/NSF discussions started
- Data Centers – NASA/NSF discussions started; Close consultations with our observatories; WoU-MMA implementation group in discussions with NSF/CISE (IDEAS Lab?)
- Instrumentation and Technology – NSF Working Group being formed; will reach out to potential partners; Workshop being planned; Centers of Excellence?
- Planning for a Portfolio Review of some kind, perhaps in FY23


NSF