EXPLORE SCIENCE

NASA Town Hall
AAS 235th Meeting | January 5, 2020

Paul Hertz
Director, Astrophysics Division
Science Mission Directorate
@PHertzNASA

Posted at http://science.nasa.gov/astrophysics/documents
Division Director
Paul Hertz
Astrophysics Division Director

Division Deputy Director
Jeff Volosin
Deputy Astrophysics Division Director

Program Executives
E. Lucien Cox
SOFIA, GUSTO
Shahid Habib
COR, ExEP, PCOS Programs
ARIEL, Athena, Euclid, LISA
Jeff Hayes
Astrophysics Operating Missions
David Jarrett
WFIRST, XISM
Mark Sistilli
Astrophysics Explorers Program
IXPE, SPHEREx, Balloons

Cross Cutting
Eric Smith
Chief Scientist
JWST
Jeanne Davis
Associate Director
ASM Program Manager
Mario Perez
Chief Technologist
SAT, RTF
Lisa Wainio
Information Manager

Administrative Support
Kelly Johnson
Administrative Assistant
Not Pictured
Mathew Riggs
Administrative Assistant
Not Pictured
Jackie Mackall
Program Support Specialist
Ingrid Farrell
Program Support Specialist

Program Scientists
Dominic Benford
APRA Lead
WFIRST
Valerie Connaughton
APRA (High Energy)
XRISM
Dan Evans
PCOS Program
APRA (High Energy)
Fermi
Michael Garcia
APRA (UV/Optical), CubeSats/SmallSats
Hubble, Athena
Thomas Hams
APRA (Particle Astro)
Rockets/Balloons
GUSTO
Hashima Hasan
Education/Comms
Astrophysics Archives
Advisory Cttee.
Douglas Hudgings
EJEP Program
ADAP Lead
ARIEL, TESS
Stefan Immler
Astrophysics Research Program
Chandra, XMM

Patricia Knezeck
APRA (UV/Optical)
William Latter
APRA (Lab Astro)
Spitzer, SPHEREx
Mario Perez
COR Program
APRA (UV/Optical)
Rita Sambruna
APRA (Fund. Phys.)
ADAP, LISA, NINTERC, Decadal Studies
Evan Scannapieco
ATP / TCAN Lead
FINNEST, Swift
Kartik Sheth
SOFIA, NHPF
Linda Sparke
Astrophysics Explorers Program
Eric Tollestrup
APRA (IR/Submm)
Euclid, IXPE

Astrophysics Program Abbreviations: ASM – Astrophysics Strategic Missions; COR – Cosmic Origins; ExEP – Exoplanet Exploration Program; PCOS - Physics of the Cosmos
NASA Astrophysics Celebrate Accomplishments
NASA'S CHANDRA X-RAY OBSERVATORY
BY THE NUMBERS

- 23 trillion bytes of data collected
- 14 meters in length—about the size of a school bus
- 3.6 million lines of code written to operate, collect and analyze data
- 2.700 trips around Earth
- 20 years (so far) in operation
- 4,300 scientists around the world use Chandra
- 2.4 billion kilometers traveled
- 63.5 hours to take one trip around Earth

https://chandra.harvard.edu/20th/
After 16.5 yrs of science exploration on the infrared cosmic frontier as one of NASA’s Great Observatories, Spitzer will end its mission on Jan 30, 2020, 2:30 PST.

Spitzer enabled discovery near and far, to the edge of the universe, yielding 8,700+ refereed papers.

- First detection of light from an exoplanet
- First detection of molecules in exoplanet atmospheres
- Measurement of star formation history of the Universe to z>2, looking back >10 Gyr
- Measurement of the stellar mass of the Universe to z>8, looking back ~13 Gyr

www.spitzer.caltech.edu/final-voyage
TESS Completes First Year of Prime Mission, Begins Year 2

1414 planet candidates
  34 confirmed planets
  + many discoveries in astrophysics
36 peer-reviewed publications
  +51 more submitted

Successful Guest Investigators Program
Cycles 1 and 2 for Prime Mission

Extended mission approved!
Cycle 3 proposal deadline 1/16/2020

TESS observed southern hemisphere in Yr 1
Currently observing northern hemisphere for Yr 2
Current Sector: 18 of 26 in Prime Mission
Data from Sectors 1-16 all publicly available at MAST
The Super Trans-Iron Galactic Element Recorder (SuperTIGER) instrument is used to study the origin of cosmic rays and was launched on Dec. 15, 2019. (Photo courtesy SuperTIGER team)

2019-2020 Antarctic Balloon Campaign


Upcoming sounding rocket campaigns: 2020 White Sands Missile Range NM, 2021 Australia
The Astrophysics Division is investing approximately $5M per year in a CubeSat initiative.

- **HaloSat**, PI: Phil Kaaret, U. Iowa
- **Science Objectives**: HaloSat is mapping soft X-ray oxygen line emission across the sky in order to constrain the mass and spatial distribution of hot gas in the Milky Way.
- **Technologies**: BCT S/C, COTS detectors, collimators with no optics.
- **Deployed**: Jul 13, 2018, from ISS
Roman Technology Fellowship Program

- 19 current and recent fellows
- Typically in academia and National Laboratories
- Budget stable at about $1.3 M per year
- $300 K in startup funds for each fellow, over 3 years

2019 Roman Technology Fellows selected in November 2019 (ROSES-2018):

Regina M. Caputo
(Ph.D. 2011), NASA-GSFC, Gamma-ray and Cosmic-ray astrophysics

Sarah N. Heine
(Ph.D. 2014), MIT, Bragg Reflector Optics and Gratings for Polarimetry

Gregory N. Mace
(Ph.D. 2014), UT Austin, Advanced Optics and Spectroscopy Applications

RTF fellows at the RTF Special Session held at the AAS meeting in June 2018: From the left: Erika Hamden (Caltech/U. Arizona), Cullen Blake (U. Pennsylvania), Brian Fleming (U. Colorado), and Abigail Vieregg (U. Chicago)
Astrophysics Community Funding
FY05-FY18 Actual, FY19 Op Plan, FY20-FY24 Request

- R&A Programs
- Postdoc Fellows
- GO Programs
- SAT (technology)
NASA Astrophysics
Committed to Improving
Inspiring Future Leaders

• Achieve excellence by relying on diverse teams, both within and external to NASA, to most effectively perform SMD’s work

• Attract and retain talent by promoting a culture that actively encourages diversity and inclusion and removes barriers to participation

• Encourage development of future leaders, including the next generation of mission principal investigators, through targeted outreach and hands-on opportunities

• Support early-career scientists to build careers working with NASA

• Engage the general public in NASA Science, including opportunities for citizen scientists

So You Think You Want to be a NASA Mission Principal Investigator? – Sun Jan 5 @ 2:00 PM; Room 323A
Science Engagement

Vision: As a part of SMD’s Science Activation (SciAct) program, Astrophysics brings the excitement of the science from its portfolio to provide content to help learners of all ages “do” science.

New NASA Science Engagement Opportunities – Tue Jan 7 @ 1:00 PM; Room 303B

• Hear from National Academy committee members who assessed NASA’s SciAct program and from NASA SMD, including Kristen Erickson, Paul Hertz, and Hashima Hasan

• Find out about NASA’s Universe of Learning and how you can participate in SciAct as a subject matter expert; come to splinter session or contact Denise Smith (STScI)

• Learn about opportunities to propose citizen science projects to NASA; come to splinter session or contact Marc Kuchner (GSFC)

Astrophysics social media sites have been consolidated under @NASAUniverse; cross cutting NASA science is consolidated under @NASAExoplanets, @NASASolarSystem, @NASASun, etc.
Research and Analysis Initiatives

Dual Anonymous Peer Review
• SMD is strongly committed to ensuring that review of proposals is performed in an equitable and fair manner that reduces the impacts of any unconscious biases

High-Risk/ High-Impact (HR/HI)
• To reinforce SMD’s interest in High-Risk/High-Impact research, a special review process will be implemented in ROSES 2020 to review and select HR/HI proposals

Proposal Selection Metrics for ROSES 2018
• Overall, just under 50% of selections featured new PIs
• Majority of division selection rates were between 25 – 30%, and we are continuing to evaluate

https://science.nasa.gov/researchers/dual-anonymous-peer-review
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<thead>
<tr>
<th>Format</th>
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<tbody>
<tr>
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<td>Dual-Anonymous</td>
<td>NuSTAR Cycle 6</td>
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<td>Dual-Anonymous</td>
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Request for Information:

Research That Falls in Gap between current SMD Solicitations

• Release Date: Dec 2, 2019 (Solicitation: NNH20ZDA003L)
• Response Date: Jan 31, 2020
• NASA SMD is soliciting information on research aligned with agency mission and SMD’s Science Plan but falls in a gap between current solicitations, possibly because it’s interdisciplinary or interdivisional
• Responses will be used by NASA to inform decision as to whether portfolio of current program elements in ROSES needs to be modified and/or expanded to provide the proper avenue for such research
• Full text of RFI and response instructions on the NSPIRES website
Strategic Data Management

- SMD will be implementing changes to enable open data, open source code, and open model
- Informed by community input through multiple workshops, RFI, and NASEM reports
- Recognize that this will be a step wise process with the first changes coming in ROSES 2020 and upcoming Senior Reviews
- Periodic evaluation to ensure effectiveness and consistency with current best practices
- Additional information on SMD's data activities is available at: https://science.nasa.gov/researchers/science-data
Keep Informed about NASA

NSPIRES mailing list – information about NASA solicitations
https://nspires.nasaprs.com/

Cosmic Origins mailing list, Exoplanet Exploration mailing list, Physics of the Cosmos mailing list – information about NASA missions and science
https://exoplanets.nasa.gov/exep/exopag/announcementList/
https://pcos.gsfc.nasa.gov/pcosnews-mailing-list.php

NASA Astrophysics Federal Advisory Committees
Astrophysics Advisory Committee (APAC)
https://science.nasa.gov/researchers/nac/science-advisory-committees/apac
NAS Committee on Astronomy and Astrophysics (CAA)
http://sites.nationalacademies.org/bpa/bpa_048755
Astronomy and Astrophysics Advisory Committee (AAAC)
https://www.nsf.gov/mps/ast/aaac.jsp

Sign up to be a panel reviewer:
https://science.nasa.gov/researchers/volunteer-review-panels
Why Volunteer to Serve on a NASA Peer Review Panel?

• Personal professional development:
  – See how the whole review process works
  – Learn what constitutes excellent proposals
  – Network with your professional colleagues and NASA scientific staff

• Institutional achievement:
  – Improve at competing for NASA money
  – Increase knowledge of NASA's educational programs and research technology

• Investment in the future:
  – Help select the most transformative science
  – Ensure that all proposals receive a fair and competent review

• Sign up to be a panel reviewer:
  https://science.nasa.gov/researchers/volunteer-review-panels
Join the Astrophysics Team at NASA Headquarters

NASA seeks visiting Ph.D.-level scientists to serve as Program Scientists in the Astrophysics Division at NASA Headquarters in Washington, DC. With a budget of $1.5 billion annually, the Division is responsible for the nation’s space-based astrophysics program.

NASA Program Scientists
• Manage scientific research grants programs
• Serve as the Headquarters science lead for missions
• Implement NASA’s response to the 2020 Decadal Survey
• Gain insight into Federal astrophysics policy and programs and the proposal review process
• Run scientific programs with multimillion-dollar budgets

Visiting appointments last two years with renewals up to six years.

Positions are available from June 2020, though the start date is flexible. Applicants should email a curriculum vitae and cover letter as a single PDF file ASAP but no later than March 13, 2020 to hq-astrophysics-ipasearch@mail.nasa.gov. Decisions will be made on a rolling basis. For more information about the position, please contact Dr. Valerie Connaughton at valerie.connaughton@nasa.gov.

Please feel free to speak to any of us from HQ here about this exciting opportunity.

https://jobregister.aas.org/ad/330213f5
NASA Astrophysics Program Update
Astrophysics Research by the NUMBERS

R&A PROGRAMS
>1,000 Proposals Received
26% Success Rate
~$100M Awarded Annually

TECHNOLOGY DEVELOPMENT
~$140M Invested Annually

NEW PIs
>180 Per Year in R&A Prog
>120 Per Year in GO Prog

GO PROGRAMS
>2,000 Proposals Received
19% Success Rate
~$70M Awarded Annually

CUBESATS
6 Current Programs
~1 Launch Per Year

SOUNDING ROCKETS
9 Current Programs
3-4 Launches Per Year

BALLOONS
18 Current Programs
3-6 Launches Per Year
Astrophysics Research Elements

ROSES-20 Programs

Supporting Research and Technology
- Astrophysics Research & Analysis (APRA)
- Strategic Astrophysics Technology (SAT)
- Astrophysics Theory Program (ATP) (biennial, not this year)
- Theoretical and Computational Astrophysics Networks (TCAN) (triennial, this year)
- Exoplanet Research Program (XRP) (cross-div)
- Roman Technology Fellowships (RTF)
- FINESST Graduate Student Research Awards

Data Analysis
- Astrophysics Data Analysis (ADAP)
- GO/GI programs in ROSES for:
  - Fermi
  - NICER
  - NuSTAR
  - Swift
  - TESS

Mission Science and Instrumentation
- Sounding rocket, balloon, CubeSat, and ISS payloads solicited through APRA
- Astrophysics Science SmallSat Studies (occasional, not this year)
- XRISM Guest Scientists (one time)
- Astrophysics Explorers U.S. Participating Investigators (triennial, this year)

Separately Solicited
- GO/GI/Archive/Theory programs for:
  - Chandra
  - Hubble
  - SOFIA
  - Webb
- NASA Hubble Fellowship Program
- NASA Postdoctoral Program
Exoplanet Research Program (XRP)

Changes to the program in ROSES-19:
• Heliophysics and Earth Science joined the program
• Review managed collaboratively by all four divisions
• Selections are funding-blind (i.e. not tied to specific Divisions)
• 20 percent more proposals than last year!

Changes coming in ROSES-20:
• Consolidation of exoplanet proposals into XRP
  o Within Astrophysics (Appendix D): Exoplanet-related proposals from ADAP, ATP, etc. will move into XRP
    o Funding will move between programs to enable this
    o Exoplanet-related proposals will still be permitted in TCAN
  o Within Planetary Science (Appendix C): Exoplanet proposals in Habitable Worlds will move into XRP (better definition of the line between the two)
• Additional cross-divisional collaboration encouraged (Heliophysics and Earth Science participation, in particular)
Transition of NASA Astrobiology Institute (NAI) into Research Coordination Networks (RCNs)

The NAI concluded at the end of 2019; five RCNs will focus on different interdisciplinary science questions. Researchers may elect to become a member of one or more RCNs once they have received funding for a relevant project.

New ROSES funding opportunity: Interdisciplinary Consortia for Astrobiology Research (ICAR)

Proposals that describe a multi-million dollar, five-year project with an interdisciplinary approach to a single, compelling question in astrobiology.

For projects larger than the scope of the individual research programs, but within the scope of the Research Coordination Networks.

Cycle 1 RCNs: NExSS, PCE3, ECM

See ROSES-19, Appendix C.23

Step 1 proposals due – January 31, 2020
Step 2 proposals due – April 3, 2020

Selected proposals will become part of the Research Coordination Network.

Calls will occur every two years and will stagger RCN topics.

Research Coordination Networks

- Exoplanet System Science - NExSS
- Life Detection - NfoLD
- Prebiotic Chemistry and Early Earth Environments - PCE3
- Network for Ocean Worlds - NOW
- Earliest Cells to Multicellularity- ECM
Database of Astrophysics technology projects: [http://www.astrostrategictech.us/](http://www.astrostrategictech.us/)
Graduate Student Research Awards

NASA Earth and Space Science Fellowship (NESSF) program name is changing to Future Investigators in NASA Earth and Space Science and Technology (FINESST) in 2019 to more accurately capture the nature of awards.

Historically Astrophysics has funded 24 NESSF / FINESST fellows at any given time. With 150-200 proposals received annually, the selection rate has been ~6%.

Community input has led to us doubling the Astrophysics NESSF / FINESST program effective in 2019.

Astrophysics will now be funding 45-48 NESSF / FINESST Fellows at any given time. The selection rate will be ~10%.
It has been thirty years since the first Hubble Fellows were selected. Fellows are asking for the assurance of parental leave and the option of saving for their eventual retirement with the assistance of their employer.

- Fellows who are employees of their host institutions typically have these benefits.
- Stipendiary fellows do not receive employee benefits even though the NHFP is willing to pay the full cost of the employee benefits package.

The Space Telescope Science Institute (STScI) and NASA are proposing a change to the requirements for NHFP host institutions.

Starting with academic year 2022-2023, in order to host new NASA Hubble Fellowship Program (NHFP) Fellows, host institutions must offer their NHFP Fellows the opportunity to be employees. Employee status is being required to afford NHFP Fellows the same leave, vacation, retirement and health benefits (as applicable) given by these institutions to their postdoctoral fellows hired on grants or contracts as employees. Host institutions are also encouraged, but not required, to offer Fellows the option of choosing to be a stipendiary fellow rather than an employee if that is a better match to the Fellow’s needs.

STScI is soliciting comments from host institutions. Direct any questions or comments on this policy to nhfp@stsci.edu by March 18, 2020.
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<td>10/23/2020</td>
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<tr>
<td>D.4 Astrophysics Theory Program</td>
<td>Not solicited this year</td>
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<tr>
<td>D.5 Neil Gehrels Swift GI Cycle 17</td>
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<tr>
<td>D.6 Fermi GI Cycle 14</td>
<td>N/A</td>
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<tr>
<td>D.7 Strategic Astrophysics Technology</td>
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<td>D.13 U.S. Participating Investigator</td>
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<td>D.14 Theoretical and Computational Astrophysics Networks</td>
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The XRISM Guest Scientists and U.S. Participating Investigator programs are new this year.

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XRP has been expanded to include all exoplanet research. Exoplanet research is no longer solicited in ATP and ADAP.
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**ATP is not being solicited this year.**

**TCAN is being solicited this year.**
## Astrophysics ROSES-20 Due Dates

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APRA and RTF have new due dates in the Fall.
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The dates and constraints for SAT have not yet been determined.
**Astrophysics ROSES-20 Due Dates**

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**ADAP and the GO/GI programs will be conducted using dual anonymous peer review.**
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<tr>
<th>Mission</th>
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<tr>
<td>Hubble Space Telescope</td>
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<td>NASA Strategic Mission</td>
</tr>
<tr>
<td>Chandra X-ray Observatory</td>
<td>7/99</td>
<td>NASA Strategic Mission</td>
</tr>
<tr>
<td>X-ray Multi Mirror - Newton</td>
<td>12/99</td>
<td>ESA-led Mission</td>
</tr>
<tr>
<td>Spitzer Space Telescope</td>
<td>8/03</td>
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**Mission ending Jan 30, 2020**

**Mission Complete!**
Senior Review 2019

All missions were extended for three years. The next Senior Review for Astrophysics Operating Missions will be in 2022.

- Hubble: No change to budget guideline
- Chandra: Selected overguides: Audit fees, labor & GO (inflation)
- TESS: Extended mission w/ full funding & continued GO program
- Swift: Selected overguides: New tools for Targets of Opportunity and Ultraviolet-Optical Telescope
- Fermi: Operations w/ out Department of Energy
- NICER: Extended mission w/ reduced ops & new GO program
- NuSTAR: Phase out legacy science and replace with GO science
- XMM-Newton: No change

Not in 2019 Senior Review: Kepler, SOFIA, Spitzer
SOFIA
Stratospheric Observatory for Infrared Astronomy

• SOFIA’s 5-year prime mission ended at the end of FY19 (Sep 30, 2019)
• NASA conducted two reviews of the SOFIA project in 2019 aimed at increasing the science productivity of SOFIA in FY20 and beyond
  o Review of SOFIA’s maintenance and operations paradigm
  o Review of SOFIA’s science progress and science prospects
• Summary of reviews and NASA response posted at: https://science.nasa.gov/astrophysics/documents
• Based on the reviews, SOFIA project is making change to improve productivity:
  o 8 hour flights for Cycle 8 for the months when the observing conditions are poor (Spring, Fall).
  o A larger fraction of observing time doing legacy programs – 5 diverse “pilot legacy” programs selected. If successful, project may do more and larger legacy programs.
  o Maximizing and emphasizing collection of high-quality data.
    • Efforts include: maximizing time in the stratosphere, strict/robust technical evaluation, prioritizing collection of large, and homogeneous data sets, exploring different operational models for SOFIA to maximize observing during the time of the year when observing conditions are optimal.
  o Starting Cycle 8, SOFIA will adopt a policy for finishing priority 1 & 2 programs, once started.
• HIRMES, the next SOFIA science instrument, continues development
  o After a continuation review in Dec 2018, delivery anticipated Dec 2020.
Astrophysics Missions in Development

**Webb**
NASA Mission
James Webb
Space Telescope

**IXPE**
NASA Mission
Imaging X-ray
Polarimetry Explorer

**GUSTO**
NASA Mission
Galactic/Extragalactic ULDB
Spectroscopic Terahertz Observatory

**XRISM**
JAXA-led Mission
NASA is supplying the SXS
Detectors, ADRs, and SXTs

**Euclid**
ESA-led Mission
NASA is supplying the NISP
Sensor Chip System (SCS)

**SPHEREx**
NASA Mission
Spectro-Photometer for the History of
the Universe, Epoch of Reionization,
and Ices Explorer

**WFIRST**
NASA Mission
Wide-Field Infrared
Survey Telescope

**ARIEL**
ESA-led Mission
NASA is supplying the CASE
fine guidance instrument
Science program defined through peer-review, including future key projects
Observations spanning a wide variety of Astrophysics are already in the works through the Guaranteed Time Observers programs and the Early Release Science program
The James Webb Space Telescope

- Science payload completed three months cryogenic testing at end of 2017
- Spacecraft and sunshield integration completed January 2018
- Spacecraft element including sunshield completed environmental testing May 2019
- Science payload and spacecraft integration completed August 2019
- Test deployment of sunshield completed November 2019
- Environmental testing of full observatory in Spring 2020
- Webb overrun covered using offsets from Astrophysics Probes
Wide-Field Infrared Survey Telescope

Science Program

• Cosmology: Dark energy and the fate of the universe – wide field surveys to measure the expansion history and the growth of structure

• Exoplanet Demographics: The full distribution of planets around stars through a microlensing survey

• Astrophysics: Wide-field infrared surveys of the universe through General Observer and Archival Research programs

Technology development for the characterization of exoplanets through a Coronagraph Technology Demonstration Instrument
WFIRST: Wide-Field Infrared Survey Telescope

WFIRST is fully funded in FY20

Nov 2019 — Completed Preliminary Design Reviews

Early 2020 – Complete Confirmation Review and begin Implementation (Phase C)

2020: Flight hardware being developed: mirror being figured, detectors being fabricated, spacecraft subsystems being delivered, coronagraph demo unit in testbed

2021 – Complete Critical Design Reviews

Mid-2020s – Launch

WFIRST field-of-view is 100x Hubble field-of-view

WFIRST is 100 to 1500 times faster than Hubble for large surveys at equivalent area and depth
WFIRST is for You

All WFIRST observing time is available through open competition

- Some WFIRST observing time will be used for the core dark energy and exoplanet surveys mandated by the Astro2010 Decadal Survey
- Some WFIRST observing time will be used for additional GO-driven key projects using WFIRST’s unique wide-field imaging, spectroscopic, and time domain capabilities
- Some WFIRST observing time will be used for smaller, individual GO programs
- Some WFIRST observing time will be used for the Coronagraph technology demonstration
- All data will be available to the community with no period of limited access

WFIRST observing program will be based on community input

- Both NASA and STScI will be convening community groups to provide input on balance among observing programs and on trades during development, integration, and test

WFIRST General Observers / Archival Researchers Program

- Use WFIRST for conducting wide-field infrared surveys of the universe
- Use data from WFIRST legacy surveys to conduct compelling astrophysics investigations
- Calls for proposals to be issued before launch and subsequently

WFIRST Coronagraph Participating Scientist Program

- Develop observing plans for demonstrating coronagraph capabilities
- Work with instrument team to process data from tech demo observations
- Call for proposals to be issued well before launch
Spectro-Photometer for the History of the Universe Epoch of Reionization and Ices Explorer (SPHEREx)

- PI: James Bock (Caltech)
- Launch: 2023
- Prime Mission: 2 Years

Science Highlights include:
- Survey the entire sky every 6 months
- Optical and infrared survey mission (96 bands/pixel)
- Observe hundreds of millions of galaxies
  - Measure redshifts to probe the statistical distribution of inflationary ripples
  - Measure spatial fluctuations in the Extragalactic Background Light to support studies of the origin and history of galaxy formation.
- Survey Galactic Molecular Clouds for water and organic molecules (H₂O, CO, CO₂, CH₃OH)
Contribution to ARIEL Spectroscopy of Exoplanets
PI Mark Swain (JPL)

CASE detectors and electronics would provide fine guidance for ARIEL; blueward data (0.5μm-2μm) enables studies of aerosols (clouds and hazes) which are important for the energy budget of the atmosphere.

ARIEL: ESA M4 mission for Infrared Spectroscopy of Exoplanet Atmospheres
PI Giovanna Tinetti (UK)

Launch in 2028 to L2 for 4-yr mission; primary mirror 1.1m x 0.7m; CASE photometry complements AIRS spectroscopy 2μm-8μm.

ARIEL is next step beyond Kepler and TESS; will obtain spectra of hundreds of warm transiting exoplanets to study atmospheric chemistry and energy budget.
FY20 Appropriation

- FY20 appropriation for NASA Astrophysics (including Webb Telescope) is $1.73B; up by $233M from FY19 appropriation and by $532M from FY20 President’s Budget Request
- Fully funds Webb for replan to March 2021 launch readiness date
- Fully funds WFIRST through KDP-C and into Phase C
- Specifies funding levels for Hubble, SOFIA, and the Astrophysics Research Program
- Provides adequate funding to continue with the rest of the planned Astrophysics programs and projects including:
  - Operating missions with GO programs as planned following the Senior Review
  - Development of Explorers missions (IXPE, GUSTO, SPHEREx) and international contributions (Euclid, XRISM, ARIEL, Athena, LISA)
  - Initiation of Phase A studies for selected SMEX and MO proposals from the 2019 Announcement of Opportunity
  - Continued technology development for the future
Artemis Phase I: To the Lunar Surface by 2024

Artemis I: First human spacecraft to the Moon in the 21st century

Artemis II: First humans to orbit the Moon in the 21st century

Artemis Support Mission: First high-power Solar Electric Propulsion (SEP) system

Artemis Support Mission: First pressurized module delivered to Gateway

Artemis Support Mission: Human Landing System delivered to Gateway

Artemis III: Crewed mission to Gateway and lunar surface

Commercial Lunar Payload Services
- CLPS-delivered science and technology payloads

Large-Scale Cargo Lander
- Increased capabilities for science and technology payloads

Lunar South Pole Target Site

Early South Pole Mission(s)
- First robotic landing on eventual human lunar return and In-Situ Resource Utilization (ISRU) site
- First ground truth of polar crater volatiles

Humans on the Moon - 21st Century
First crew leverages infrastructure left behind by previous missions

2020

2024
Astrophysics and Artemis

All science opportunities enabled by Project Artemis will include astrophysics

• Commercial Lunar Payload Services (CLPS)
  o 14 U.S. companies selected to bid on specific task orders to deliver NASA payloads to Moon’s surface
  o All payload calls include astrophysics; two astrophysics payloads selected to date
    • Internal NASA call: Low-frequency Radio Observations from the Near Side Lunar Surface instrument (PI: Robert MacDowall, GSFC)
    • ROSES call: Next Generation Lunar Retroreflectors (PI: Douglas Currie, University of Maryland)
    • Both are among five payloads manifest on Intuitive Machines Lander for NET July 2021

• Astrophysics Explorers Missions of Opportunity
  o 2019 AO included opportunities enabled by Project Artemis
    Future calls will solicit proposals that leverage Artemis capabilities, such as Gateway as a platform and cis-lunar communications infrastructure, to conduct compelling astrophysics investigations

Most important criterion for all proposals that leverage Artemis remains the astrophysics science merit
Decadal Survey Planning

- NASA’s highest aspiration for the 2020 Decadal Survey is that it be ambitious
- The important science questions require new and ambitious capabilities
- Ambitious missions prioritized by previous Decadal Surveys have always led to paradigm shifting discoveries about the universe
Medium Mission Concepts (Probes)

Probes are strategic missions that have had a strong impact on astrophysics, either through a focused investigation or as a broadly-capable observatory.

NASA funded probe studies are available at [https://science.nasa.gov/astrophysics/2020-decadal-survey-planning](https://science.nasa.gov/astrophysics/2020-decadal-survey-planning)

NASA’s independent assessment of probe studies by the Probes Cost Assessment Team (PCAT) is available at [https://science.nasa.gov/astrophysics/2020-decadal-survey-planning](https://science.nasa.gov/astrophysics/2020-decadal-survey-planning)

Options for 2020 Decadal Survey

• Do not recommend a medium mission in Astro2020
• Recommend specific probe(s) as medium-size strategic missions
• Recommend several specific science concepts for an AO (similar to New Frontiers)
• Recommend an unconstrained AO (i.e., Super-Explorer)
Why Flagships

Flagships enable paradigm shifting science
Flagships drive US capabilities and contribute to US leadership
Flagships create stakeholder support that drives the NASA budget

“NASA should continue to plan for large strategic missions as a primary component for all science disciplines as part of a balanced program.”
– Powering Science: NASA’s Large Strategic Science Missions (NASEM, 2017)
Flagship Fraction of Astrophysics Budget

All dollars inflated to FY18$. Development only, no ops.

- Large mission fraction (left scale)
- Inflation adjusted Astrophysics budget (right scale)
- Current planning budget (without WFIRST beyond FY19)
- What if WFIRST is funded as needed on top of FY20 President’s Budget Request?
Large Mission Concepts

“NASA should ensure that robust mission studies that allow for trade-offs (including science, risk, cost, performance, and schedule) on potential large strategic missions are conducted prior to the start of a decadal survey. These trade-offs should inform, but not limit, what the decadal surveys can address.” – Powering Science: NASA’s Large Strategic Science Missions (NASEM, 2017)
NASA’s independent assessment of large mission concept studies by the Large Mission Concept Independent Assessment Team (LCIT) is available at https://science.nasa.gov/astrophysics/2020-decadal-survey-planning.

Links to the concept study reports are posted at https://science.nasa.gov/astrophysics/2020-decadal-survey-planning and at https://www.greatobservatories.org/
NASA Astrophysics Budget

- FY24 FY26 FY28 FY30 FY32
- R&A, Technology, Operating Missions, Explorers, Infrastructure
- $5B/decade for strategic initiatives
- $7B/decade for strategic initiatives
- Average of recent* $1.8B appropriations plus inflation
- Average of recent* appropriations
- Runout of FY20 Budget Proposal
- Current program including Webb operations and 4 Explorers/decade
- * Does not include FY20 appropriation

**Average of recent** $1.45B appropriations

**Runout of FY20 Budget Proposal**

**Current program including Webb operations and 4 Explorers/decade**

**$0.9B**

**$1.1B**

**$1.6B**

**$1.8B**

*Does not include FY20 appropriation*
The Future

This is an exciting time for Astrophysics – we are pursuing the answers to the biggest questions

- How did the universe begin and evolve?
- How did galaxies, stars, and planets come to be?
- Are we alone?

Astrophysics is multiwavelength and multimessenger

- NASA has 10 operating astrophysics missions*
- NASA is developing 11 astrophysics missions*

The community will select NASA’s future observatories through the 2020 Decadal Survey and through peer review of competed missions (like Explorers)

NASA is ready to realize the community’s priorities

* includes partner-led missions
Friday, January 3
- NASA ExoPAG – 8:30 AM; Hilton Hawaiian Village - Coral Ballroom

Saturday, January 4
- NASA ExoPAG – 8:30 AM; Hilton Hawaiian Village - Coral Ballroom
- NASA Joint PAG – 1:00 PM; Hilton Hawaiian Village - Coral Ballroom
- NASA PhysPAG – 3:00 PM; Hilton Hawaiian Village – Rainbow Room
- NASA COPAG – 3:00 PM; Hilton Hawaiian Village - Coral Ballroom

Sunday, January 5
- Webb Proposing: Integral Field Unit – 9:30 AM; Room 307B
- NASA Great Observatories SAG – 9:30 AM; Room 323A
- NASA Town Hall – 12:45 PM; Ballroom AB
- Lynx X-ray Observatory – 1:00 PM; Room 303A
- Parker Solar Probe – 2:00 PM; Room 313 C
- So You Think You Want to be a NASA Mission Principal Investigator? – 2:00 PM; Room 323A
- James Webb Space Telescope Town Hall – 6:30 PM; Room 313A

Monday, January 6
- Origins Space Telescope – 9:00 AM; Room 307B
- Webb Proposing: Grism Observing – 9:30 AM; Room 303B
- Spitzer’s Scientific Legacy – 10:00 AM; Room 320
- CubeSats and SmallSats – 2:00 PM; Room 317B
- LUVOIR Surveyor – 2:00 PM; Room 301A
- TESS Town Hall – 5:30 PM; Room 306AB
- STScI Town Hall – 7:00 PM; Room 313A

Monday, January 6
- NASA Postdoctoral Program Meet and Greet – 7:00 PM; Sheraton Waikiki - Kohala/Kona Room

Tuesday, January 7
- NASA PhysPAG Gravitational Wave SIG – 9:30 AM; Room 303A
- NASA COPAG IR SIG/OST – 9:30 AM; Room 304AB
- Webb Proposing: NIRSpec Micro-Shutter – 9:30 AM; Room 323A
- NASA Univ of Learning & Education Efforts – 10:00 AM; Room 321A
- NASA PhysPAG MMA SAG – 1:00 PM; Room 303A
- NASA Science Engagement Opportunities – 1:00 PM; Room 303B
- Habitable Exoplanet Observatory – 1:30 PM; Room 306AB
- LISA Preparatory Science – 2:00PM; Room 323B
- NASA Cosmic Dawn SAG – 2:00 PM; Room 323C
- SOFIA Molecular Clouds and ISM Science – 2:00 PM; Room 324
- Visualization of Research Data for the Public Presented by NASA’s Universe of Learning – 5:30 PM; Room 307B
- SOFIA Town Hall – 7:00 PM; Room 313B

Wednesday, January 8
- NASA PhysPAG X-ray SIG – 9:00 AM; Room 303A
- Plenary Lecture: The Future of Infrared Astronomy in the Context of Spitzer, SOFIA, and JWST – 11:40 AM;
- Multi-Messenger Astrophysics Town Hall – 12:45 PM; Room 313 A
- NASA PhysPAG Gamma Ray SIG – 1:00 PM; Room 303A
- The NASA Decadal Studies – 2:00 PM; Room 318A
Quick Summary
Community support: 20%
Operating missions: 20%
Building missions: 55%
Management: 5%

$1.496 BILLION FY19

MANAGEMENT
INCL. STEM ACTIVATION
5%

RESEARCH
(ADAP, APRA, ATP, ETC.)
7%

TECHNOLOGY
(SR&T, ATHENA, LISA, ETC.)
7%

INFRASTRUCTURE
(BALLOON PROGRAM, ARCHIVES, ETC.)
4%

OP. MISSIONS
(INCL. GO PROGRAMS)
19%

EXPLORERS
(CURRENT AND FUTURE, INCL. GO)
11%

DEVELOPMENT
(WEBB, WFIRST)
46%
### Astrophysics Program Content (FY20 Request)

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<th>Request FY 20</th>
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SMD Organization Chart

Associate Administrator (AA)
Thomas Zurbuchen

Deputy AA
Dennis Andruczyk

Chief Technologist
Michael Seaborn

Assistant Deputy AA - Management
Karen Flynn

Deputy AA - Programs
Sandra Connelly

Deputy AA - Research
Michael New

Deputy AA - Exploration
Steve Clarke

Policy Branch
Chief
Jens Winley

Administration Branch
Chief
Ellen Gersten

Resource Management Division
Director
Craig Tupper

Deputy
Kate Wolf

Science Engagement & Partnerships Division
Director
Kristen Edens

Earth Science Division
Director
Sandra Cauffman
Deputy
Paula Bontempi

Flight
Charles Web

Applid Science
Lawrence Friedl

Research
Jack Kaye

Technology (GSFC)
Pam Millar

Notes
Also reported to
NASA AA
* Acting
** Reporting to GSFC

Joint Agency Satellite Division
Director
John Lee
Deputy
John Gagostan

Heliophysics Division
Director
Nicky Fox
Deputy
Peg Luce

Planetary Science Division
Director
Lori Glaze
Deputy
Eric Kean

Flight
Joan Salata
Mars Exploration
Jim Watkin
Planetary Research
Stephen Riceheart
Planetary Defense Office
Lindley Johnson

Astrophysics Division
Director
Paul Hertz
Deputy
Jeff Volcksn

James Webb Space Telescope Program Office
Director
Greg Robinson
Program Scientist
Eric Smith
Project Manager (GSFC)
Bill Ochs

NASA Management Office
Director
Marcus Watkins
Deputy
Andrea Razzaghi

Legislative & Intergovernmental Affairs
Gabrielle Adler

Public Affairs
Gray Hautlaufoma

Updated: December 12, 2019