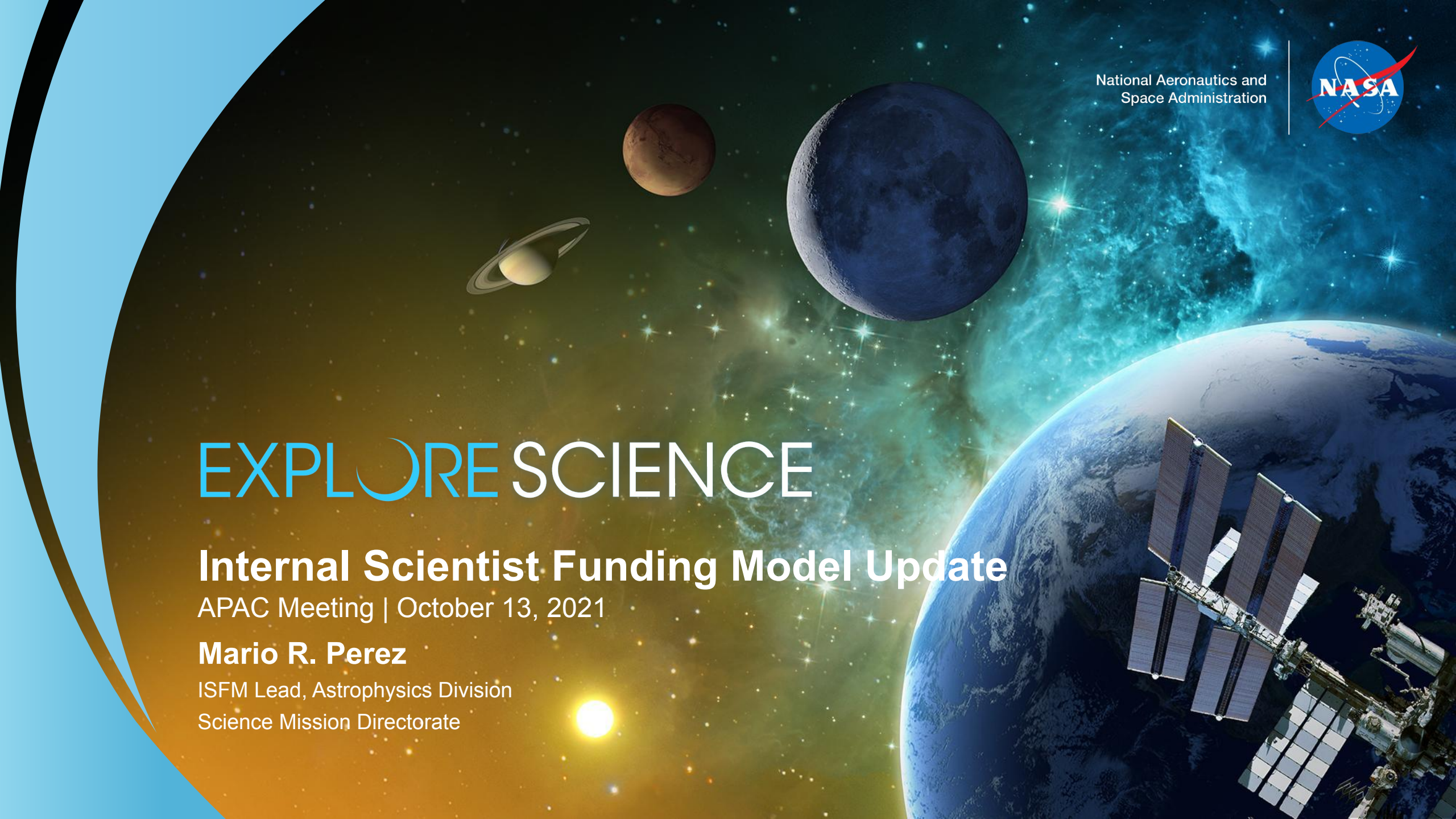
National Aeronautics and Space Administration



EXPLORE SCIENCE

Internal Scientist Funding Model Update

APAC Meeting | October 13, 2021

Mario R. Perez

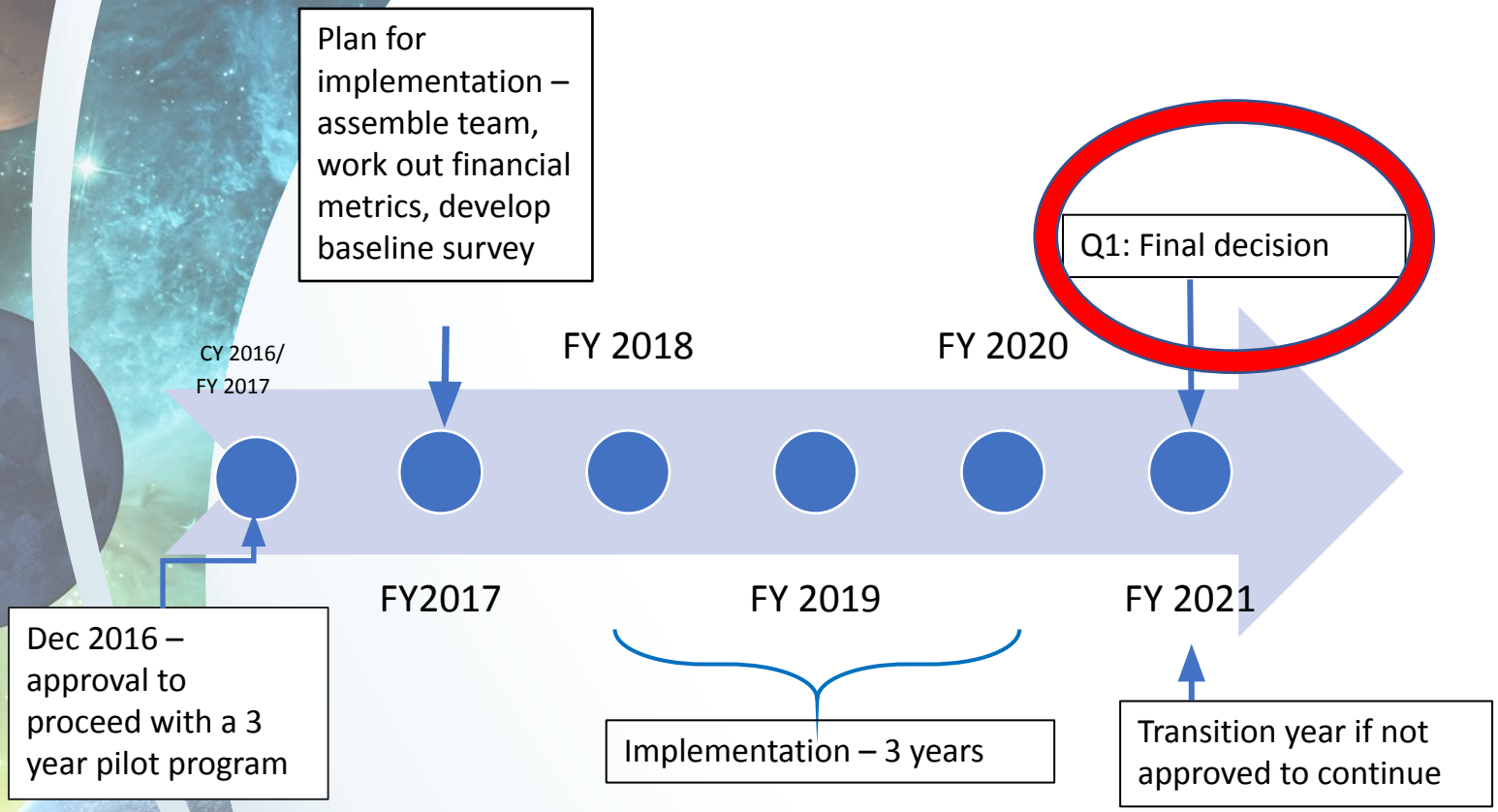
ISFM Lead, Astrophysics Division

Science Mission Directorate

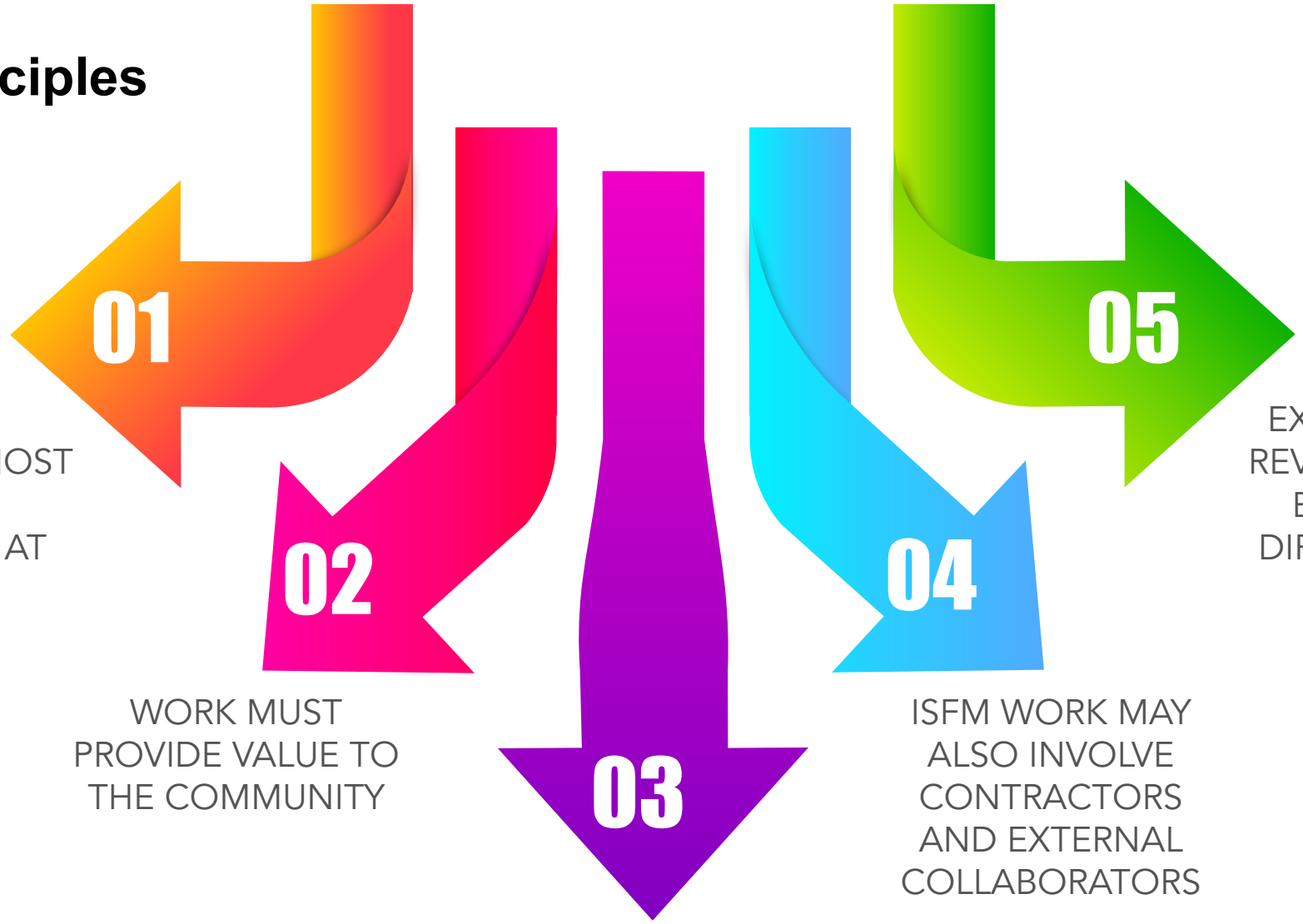
ISFM Brief Overview

(courtesy of Dan Evans)

ISFM Timeline



ISFM Key Principles



Qualities of ISFM Work

Strategic	• Utilizes unique NASA facilities, capabilities and/or skills or is of such duration or scope that the government benefits by NASA doing it in house. • Requires or benefits from long-term stability.
Science enabling	• Provides a service or supports research being done by the scientific community • Other researchers depend/rely on the results of this work.
Forward leaning	• Work is ambitious in nature. • Substantial, not just individual investigator work.
Distinctive	• Does not create new capabilities at Centers in direct competition with capabilities already in existence in external organizations.

Current Astrophysics ISFM Work Packages

Current Astrophysics ISFM Work Packages in FY21

Name of work package	Center	Average funding	Funding approved for
NASA Ames PAH IR Spectroscopic Database	ARC	$1.1M/yr	FY19-21
Tech. Dev. For Exoplanet Imaging In Multi-Star Systems	ARC	$500k/yr	FY18-21
Exoplanet Spectroscopy Technology	GSFC	$1.8M/yr	FY19-21
Gravitational waves	GSFC	$300k/yr	FY18-21
Microcalorimeters	GSFC	$900k/yr	FY18-21
Next-generation X-ray optics	GSFC	$2.5M/yr	FY18-21
Sellers Exoplanet Environments Collaboration(SEEC)	GSFC	$100k/yr (APD contribution only)	FY18-21
Time-Domain Astronomy Coordination Hub (TACH)	GSFC	$600k/yr	FY19-21
Precision Thermal Control	MSFC	$1.1M/yr	FY18-21
Advanced X-ray mirrors	MSFC	$1.3M/yr	FY18-21

All ISFM awards are subject to regular reporting, as well as independent external mid-point peer reviews.

Astrophysics ISFM Work Packages Recent Reviews

Name of work package	Center	Date of last external review
NASA Ames PAH IR Spectroscopic Database	ARC	June 2020 (mid-point)
Tech. Dev. For Exoplanet Imaging In Multi-Star Systems	ARC	June 2019 (SAT Initial review)
Exoplanet Spectroscopy Technology	GSFC	June 2020 (mid-point)
Gravitational waves	GSFC	June 2019 (mid-point)
Microcalorimeters	GSFC	Fall 2020 (PCOS/COR annual external)
Next-generation X-ray optics	GSFC	Fall 2020 (PCOS/COR annual external)
Sellers Exoplanet Environments Collaboration (SEEC)	GSFC	June 2020 (mid-point)
Time-Domain Astronomy Coordination Hub (TACH)	GSFC	June 2020 (mid-point)
Precision Thermal Control	MSFC	Fall 2020 (PCOS/COR annual external)
Advanced X-ray mirrors	MSFC	Fall 2020 (PCOS/COR annual external)

Key ISFM Statistics

- ISFM has not reduced community funding.

25%

RATIO OF CENTER TO ALL OUTGOING RESEARCH DOLLARS BEFORE ISFM (FY15-17)

25%

RATIO OF CENTER TO ALL OUTGOING RESEARCH DOLLARS AFTER ISFM (FY19-20)

ISFM and the Decadal Survey

ISFM and the Astro 2020 Decadal Survey
(or what do we do in FY22?)

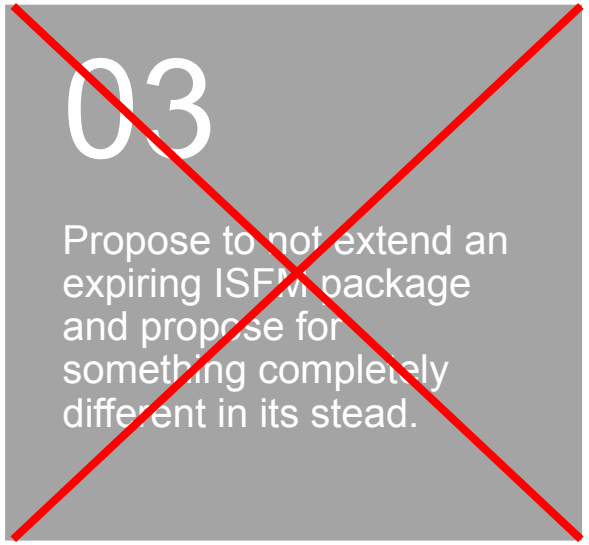
- The Astro 2020 Decadal Survey will inform the broad strategy of NASA Astrophysics for the next decade
- Due to the strategic nature of ISFM investments, NASA will wait until the release of the Decadal Survey report before soliciting the next round of ISFM concepts
- Center options, given that APD does not want to appreciably grow ISFM:

01

Propose to extend an expiring ISFM package at approximately the same budget.

02

Propose to extend an expiring ISFM package with minor increases in scope.



03

Propose to not extend an expiring ISFM package and propose for something completely different in its stead.

What is New?

Success Criteria for ISFM

Office of the Chief Scientist

	Criteria	Goal	OCS Assessment
1	More research work is directed to the centers rather than competed.	Reduce CS FTE in competed R&A by 25%	Achieved (~114 FTE out of ~350)
2	Fewer R&A proposals are submitted, scientists can focus more time on research activities geared toward NASA goals.	Reduce proposals and time spent writing proposals	Achieved – fewer PI & Co-I proposals on average
3	HQ and science capability leads are involved in strategic hiring decisions	Hiring areas are approved by HQ	SMD's decision
4	Positive feedback (via survey) of HQ program managers and center managers, and scientists.	Improve satisfaction	On track – survey results
5	Scientists are able to participate in more review panels without conflict-of-interest issues.	Improve participation	No change
6	NASA scientists continue to publish research in the peer-reviewed literature	Maintain quality	No drop in publications
7	External review panels continue to rate the quality of NASA science as high, initially on a three-year review cycle.	Maintain quality	favorable external reviews*
8	The balance of research funding support to the external community is maintained.	Maintain balance of external/internal funding	Achieved

OCS Recommendations

Office of the Chief Scientist

- NASA should continue with the highly successful ISFM program
- The funding distribution between internal and external research should be rigorously monitored and adhered to by SMD
- SMD should ensure a uniform process for ISFM across all 5 SMD divisions
- Program scientists are expected to invite more CS scientists to serve on review panels

SMD Assessment
(M. New, 02/18/21)

- For the most part, the research and technology development funded through ISFM has been found to be strategic, scientifically sound (external review), science enabling, forward-leaning and distinctive.
  - SMD requests that the ISFM pilot project be converted to a permanent program.
  - SMD intends to fully integrate ISFM into our relationships with the Centers.
  - SMD will continue to monitor and maintain the balance between funding awarded to Centers and funding awarded to the outside community.
  - SMD will continue to monitor the scientific productivity of directed work and the degree to which Directed Work Packages enable new science by the non-NASA community.

Decision

- NASA's Mission Support Council (MSC) met on March 18, 2021 and decided to convert the ISFM to a permanent program, with SMD monitoring for effective balance and scientific productivity.
  - The Office of the Chief Scientist presented data supporting all but one of the success criteria identified in the original EC and MSC decisions. All extended MSC members were asked to comment on the following key themes from these success criteria:
    1. ISFM has yielded an improved focus of NASA civil servant scientists on research, rather than internal competition.
    2. HQ leads, Center leads, and NASA scientists are satisfied with the working environment associated with ISFM.
    3. ISFM has not compromised the quality of NASA science.
    4. ISFM has not compromised the level of research funding provided to the external community.

DECISION: Approve the Internal Scientist Funding Model as permanent. Significant changes to the current model must return to the MSC for decision; proposals to discontinue the current model must return to the EC for decision.

Update

Astrophysics have conducted the mid-term ISFM reviews. ISFMs Showcase on September 14, 2021, from 1-5 PM (EST), sponsored by GSFC. All current ISFM investigations participated.

Due to the delays of the Astro2020 Decadal recommendations, Astrophysics Division decided to extend all the active ISFMs for an additional year (FY22) at the same funding level.

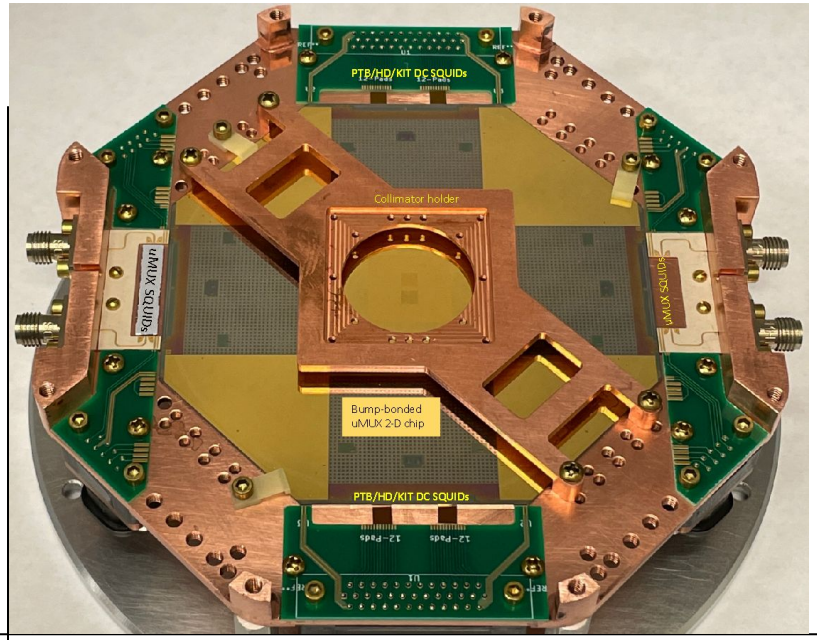
The cross-SMD call for FY23-25 ISFM white papers has been advertised to Centers starting on October 4; deadline for white papers submission is November 19, 2021.

Updated Quad Charts

Advanced X-ray Microcalorimeters – SR Bandler, FS Porter, CA Kilbourne (GSFC)

Description of package:

- Imaging high-resolution X-ray spectroscopy
  - Innovations enabling 100,000 pixels (25 per superconducting or magnetic ther-mometer, distinguished by pulse shape)
- Instruments for lab spectroscopy ~~relevant to space atomic physics~~



Full-scale Prototype Lynx X-ray Microcalorimeter detector array in new testing package

Justification for ISFM direction:

- GSFC invented X-ray micro-calorimeters 37 years ago; is a leader in advancing the capabilities.
- Lab spectroscopy supports data-base community uses to interpret high-res astrophysical X-ray

Personnel counts:

- Average yearly number of FTEs supported by this package = 1.8
- Average yearly number of WYEs supported by this package = 2.9
- Early-career individuals = 3 PhD, 1 masters, 2 minority PhD students

NASA Ames Coronagraph Experiment

A Method to Enable High-Contrast Imaging in Multi-Star Systems

(funded by ISFM, and includes parts 1 and 2 of the project, 2 years each)

PI: Ruslan Belikov/NASA ARC

Description and Objectives:

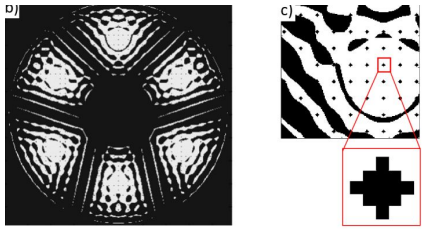
Science: Enable high-contrast imaging surveys for Sun-like binary systems for coronagraphic instruments on upcoming NASA missions (including *Roman, HabEx and LUVOIR*)

Technology: An algorithmic multi-star wavefront control (MSWC) method that can be applied to any existing coronagraph instrument with minimal hardware modifications.

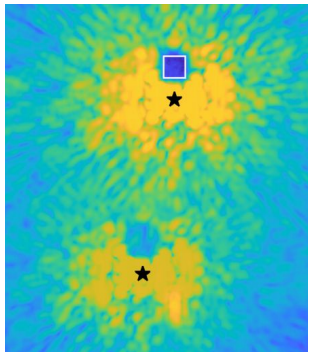
Key Challenge/Innovation:

Challenges: Starlight from both stars must be independently suppressed. Star separation can be outside the controllable outer working region of the Deformable Mirror (DM). Demonstrate compatibility with planned instrument.

Innovations: Deformable Mirror (DM) modes can be used independently for each of the target stars. Quilting pattern on DM or a grating can extend DM's controllable region.



New MSWC mask designed for Roman Coronagraphic Instrument, enabling imaging planets around Alpha Centauri and other binaries



Demonstration of quasi-MSWC in vacuum. Achieved contrast = 8.6×10^{-9} in a 10% band

Approach:

- Use simulated algorithms with validated space coronagraph instrument models to verify multi-star imaging capability
- Use algorithms on a laboratory coronagraph for hardware demonstration of performance
- End-to-end testing on a real instrument on-sky with Subaru's SCEXAO.

Key Collaborators:

- NASA Ames Research Center: Ruslan Belikov, Dan Sirbu, Eugene Pluzhnik, Kevin Fogarty
- JPL: Eduardo Bendek, AJ Riggs, Brian Kern, Camilo Mejia Prada, David Marx
- University of Arizona: Olivier Guyon, Julien Lozi
- LSST: Sandrine Thomas

Development Period:

- 1/2018 – 12/2022 (extended due to covid-19)

Accomplishments and Next Milestones:

Milestone 1.1: complete

- Simulations of high contrast and hardware compatibility with Roman, LUVOIR, HabEx, with and without starshade
- Roman MSWC mask designed and is being considered for flight

Milestone 1.2: Complete (this year)

- Demonstration of full MSWC with *SCEXAO* instrument at Subaru Telescope at mild contrast levels. Order of magnitude performance improvement demonstrated over single-star methods on a commissioned instrument (with internal source)

Milestones 1.3, 2.1, and 2.2: in progress

- Hardware demonstrations with coronagraphs in air at Ames and in vacuum at HCIT at deep contrast levels. 8.6×10^{-9} achieved in broadband in vacuum for super-Nyquist wavefront control, a key component of MSWC

*TRL development: TRLin = **3**, TRLcurrent **= 4**, TRLtarget **= 5***

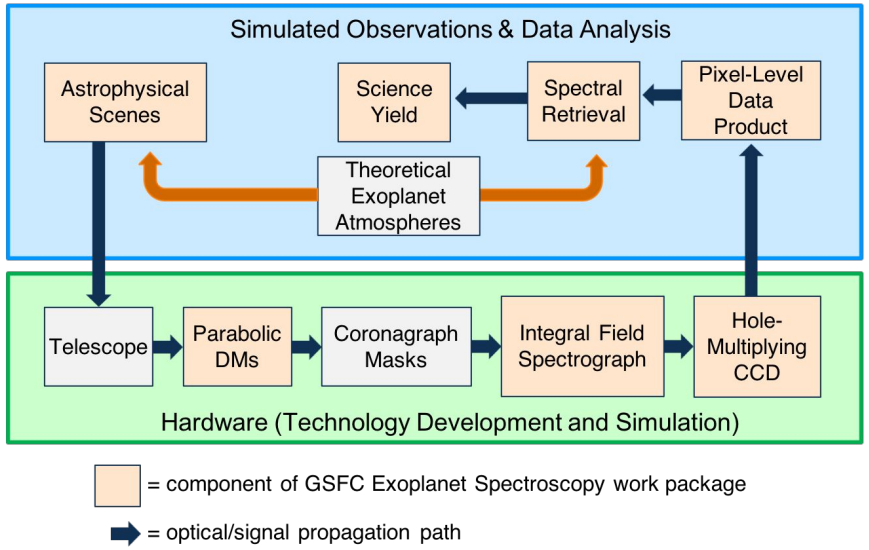
Exoplanet Spectroscopy Technologies
Michael McElwain (PI/GSFC)

Description of package:

- Develop exoplanet spectroscopy technologies, high fidelity end-to-end integrated modeling tools, and spectral retrieval algorithms to define ***science-driven systems level mission requirements***.

<u>Exoplanet Spectroscopy Technology Development</u>

1. High Contrast Integral Field Spectroscopy
2. Photon-Counting Radiation Hard p-channel CCDs
3. Parabolic Deformable Mirrors



Community-enabling aspects:

- Science-driven systems level mission requirements to support the formulation and execution of a large space telescope with the goal of reflected light spectroscopy of ExoEarths.
- Cross-divisional coordination and leverage of the Sellers Exoplanets Environments Collaboration (SEEC) work package led by the Planetary Sciences Division.

Personnel counts:

- Average yearly number of FTEs supported by this package = 6
- Average yearly number of WYEs supported by this package = 5
- Diverse set of early career researchers developed by this package = 12

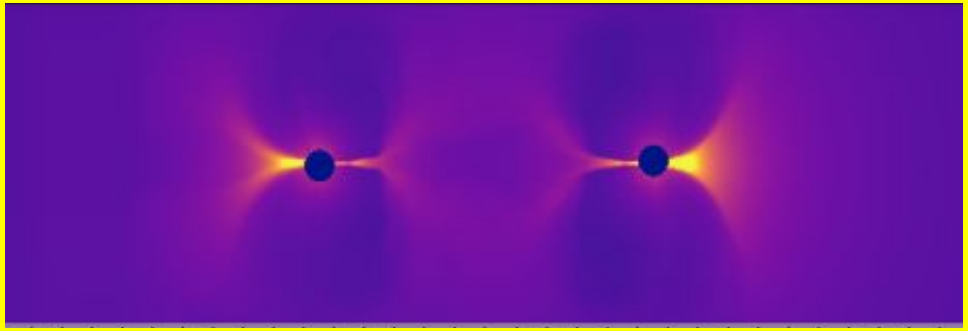
Sub-Leads: Zimmerman . Rauscher . Groff . Mandell . Marley (ARC)

Multi-messenger Source Modeling Work Package

John Baker (PI/GSFC)

Description of package:

- Advance black hole merger + disk EM signal GR+MHD+Radiation modeling
- Study merger/emission physics
- Develop community codes
- Prepare for EM+LISA observing



Orbiting supermassive binary black holes immersed in a uniform magnetized gas cloud. EM emission reaches quasi-steady state.

Justification for ISFM direction:

- Prepare for future NASA missions
- Jump-start for theory foundations
- Stimulate community research
- Provide bridge for broader community participation in LISA

Personnel counts:

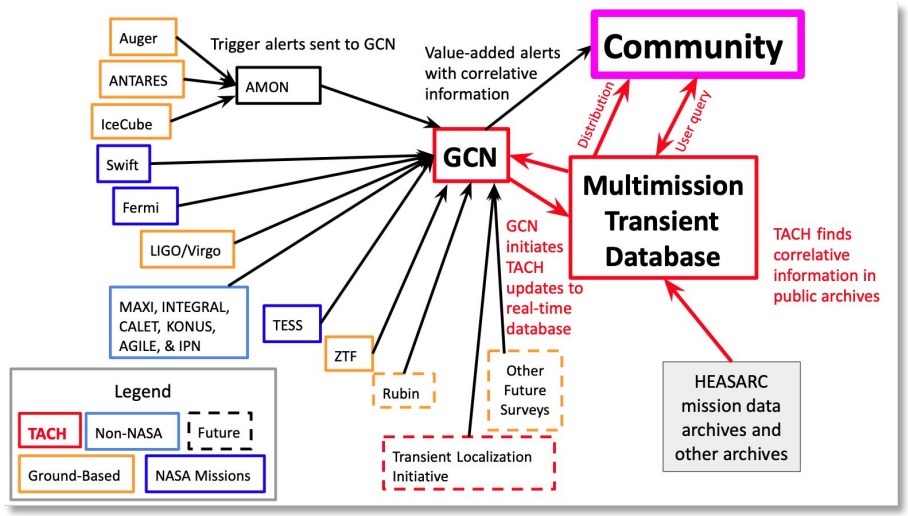
- Average yearly number of FTEs supported by this package = 0
- Average yearly number of WYEs supported by this package = 2

Time Domain Astronomy Coordination Hub (TACH)

Judy Racusin, Scott Barthelmy, Alan Smale (GSFC)

Description of package:

TACH is building upon existing NASA resources (GCN + HEASARC) with new tools to enable rapid alerts from space and ground-based observatories, and follow-up observations in transient and multi-messenger astrophysics



Justification for ISFM direction:

- Enable community coordination in response to astronomical transients
- Modernizing tools and databases in preparation for new facilities added to network
- Adding functionality for coordination between NASA and non-NASA projects

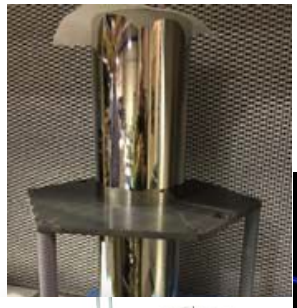
Personnel counts:

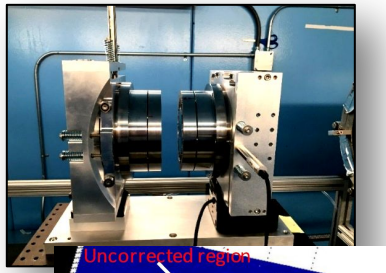
- Average yearly number of FTEs supported by this package = 1.9
- Average yearly number of WYEs supported by this package = 0.9
- Number of early career scientists involved = 5

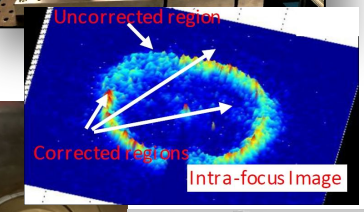
MSFC Advanced X-ray Optics: Formulation to Flight

Description of Package: end-to-end research and implementation designed to achieve light-weight sub-arcsecond full-shell X-ray optics and to enhance the performance of segmented optics for the Astronomy community.

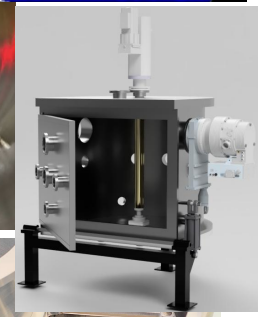
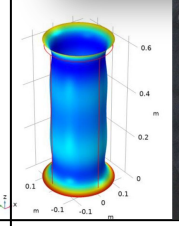
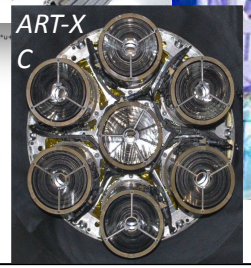
- MSFC's goal is to continue to supply the community with relatively low-cost, moderate-resolution flight mirrors and mirror assemblies ***and*** to develop the next generation of light-weight high angular-resolution mirrors and mirror assemblies for future missions.
- The value to NASA and the community is that MSFC is able to provide a comprehensive capability that involves innovation and the ability to design and deliver flight mirrors that meets multiple missions' requirements.
- Essential and ***unique*** elements that build on decades of previous investments include (blue indicates current ISFM funded areas):
  - Mirror and module design and STOP analysis
  - Metrology
  - Mandrel fabrication
  - Mirror shell replication
  - Mirror direct polishing
  - Low-stress or stress-compensating coatings
  - Post figure correction(s) (Differential Deposition)
  - Modeling and alignment (for single mirror shells and assemblies)
  - X-ray test and calibration

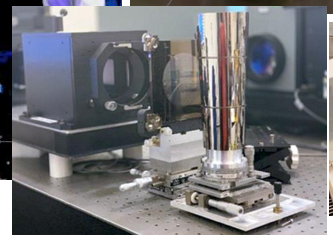






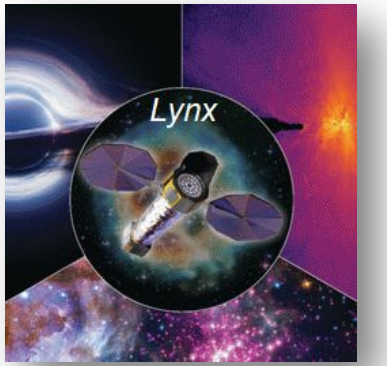




Justification for ISFM Direction :

- MSFC has the ability to design and develop complete mirror assemblies with predictable flight performance for the community, for both suborbital and orbital payloads [we regularly fly full-shell mirror assemblies!]
- Technology developments are relevant to future X-ray missions that use either full-shell or segmented mirrors (e.g. *Lynx*)
- Provides X-ray mirror capabilities to other SMD divisions (Heliophysics) and other government agencies (NIF, NIST, etc.)
- Provides world-class x-ray test and calibration with combined Stray Light Test Facility and X-ray Cryogenic Facility capability for community testing of technologies and flight hardware

Personnel counts:

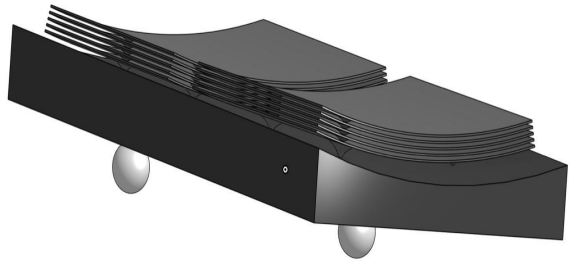
- Average yearly number of FTEs supported by this package = 8.0
- Average yearly number of WYEs supported by this package = 2.0



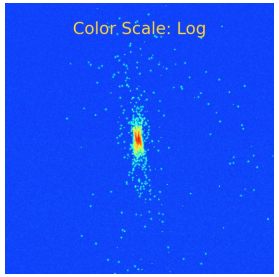
Next Generation X-ray Optics (PI: Will Zhang)

Developing an X-ray mirror technology with following characteristics relative Chandra's mirror technology

- Comparable by 2025 & 3X better PSF by 2030
- >10X lighter
- >10X lower cost
- >10X faster production



Technology Development Module (TDM) containing five primary-secondary mirror pairs co-aligned and bonded



X-ray image with 2.9-arcsec HPD under full illumination with 4.5 keV X-rays

This technology will enable

- Flagship missions like *Lynx*
- Probe missions like AXIS, HEX-P, & TAP
- Explorer missions like STAR-X
- Pioneer missions like PiSOX
- Sub-orbital missions like OGRE

Personnel counts:

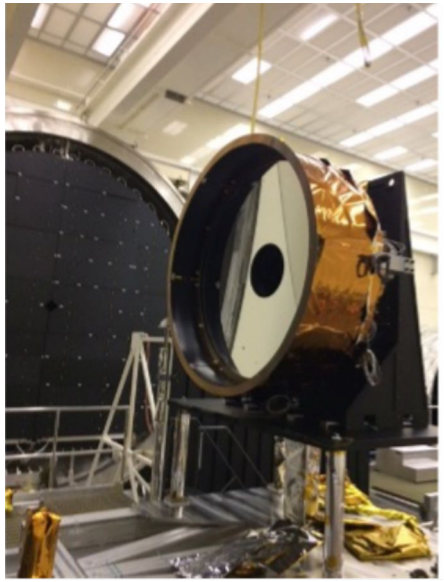
- Average yearly number of FTEs supported by this package = 4
- Average yearly number of WYEs supported by this package = 9

Precision Thermal Control (PTC) to enable Thermally Stable Telescopes

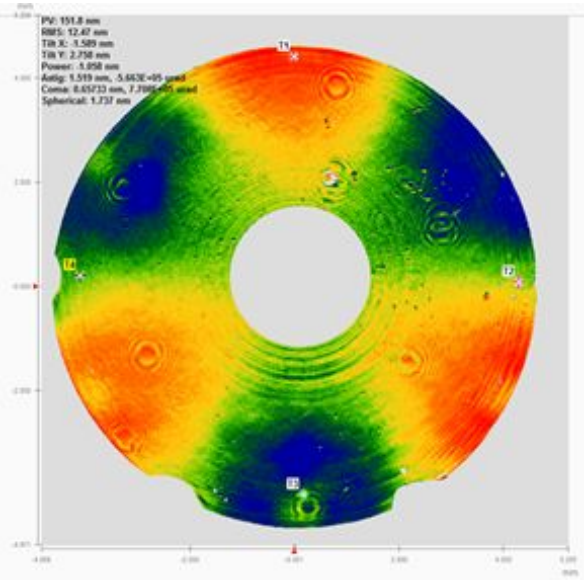
PI: H. Philip Stahl / MSFC; Co-I Thomas Brooks / MSFC

Description:

- Thermally stable space telescopes enable the desired science of potential coronagraphic science missions.
- Derived thermal system stability specifications for HabEx from science-driven wavefront-stability requirements
- Designed and built an integrated model-based multi-zonal thermal control technology.
- Mature towards TRL-6 by demonstrating ability of multi-zonal thermal control system to achieve required thermal stability in a relevant thermal-vacuum environment with a 1.5-m ULE© mirror.



Achieved 2K accuracy with 2mK stability of 1.5-m AMTD-2 ULE© mirror



Able to imposed 150-nm of trefoil, demonstrating ability to thermally shape mirror.

Justification for ISFM Direction:

- Unique Test capabilities at MSFC: Personnel & XRCF
- Unique Optical Subject Matter Expertise
- PI is consistent SAT awardee – PTC was 3rd award

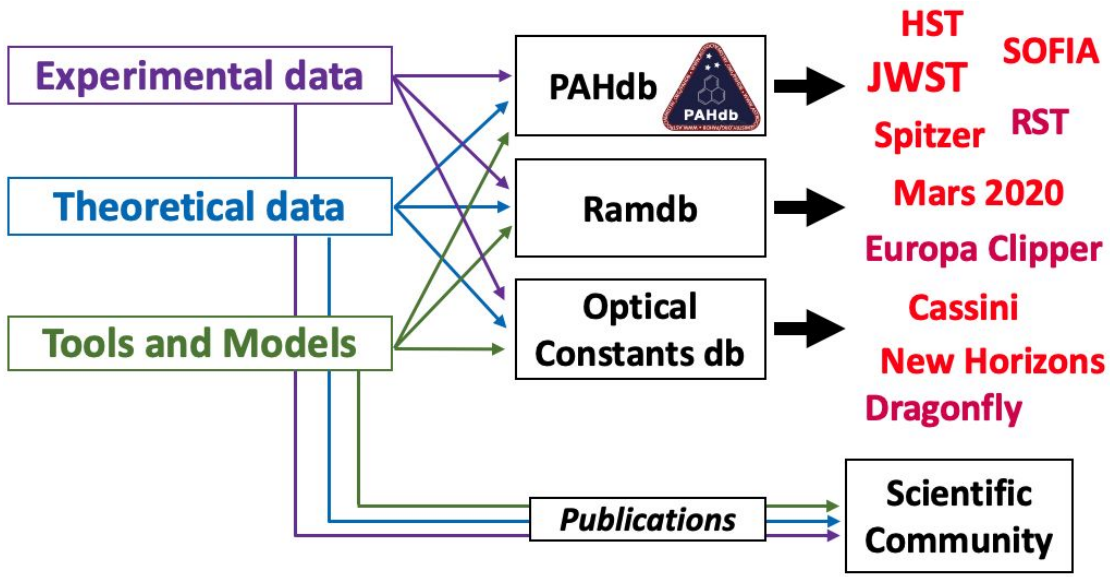
Personnel Support:

- Average Annual FTE = 5.5
- Average Annual WYE = 2.3

NASA Ames PAH IR Spectr

ISFM purpose and objectives:

- **Provide spectral data (experiment + theory) and data analysis tools** to interpret observations, maximizing the science return from many NASA missions (*cf. figure*)
- **Coordinate synergistic inter-laboratory research efforts** leveraging Ames' unique expertise (lab+theory+observation)
- **Expand the content and impact** of the publicly available NASA Ames Polycyclic Aromatic Hydrocarbon Infrared (IR) spectroscopic database (PAHdb)
- **Develop sister databases (**Raman, Optical Constants)



This year's accomplishments are summarized in the lower left quadrant

FY2021 accomplishments + highlights:

- **PAHdb expansion**: □ **85 lab spectra** (70 PAH clusters+15 PAHs)
  - □ **1,030 theoretical spectra** (1,030 PAH clusters)
  - □ **software analysis tools** and **dedicated online repository**
- **Sister databases created**: □ Raman database (**Ramdb**) nearly finished, □ Optical Constants database (**OCdb**) structure defined
- **Lab expansion and upgrade**: new operating plan+last IR CRDS parts (**COSmIC**), new IR detector+vacuum pumps (**ICEE**), UV lamp part (**MIOCI**)
- **Data analysis** (theory + experiments) and interpretation of observational data using PAHdb resulted in the publication of

Next steps:

Important for JWST

- **PAHdb** will allow the scientific community to **interpret astronomical PAH IR spectra**
  - □ *Team involved in ERS + awarded Cycle 1 observing time*
- **Tools** will be **released** for quick JWST PAH data analyses
- **Theory libraries** will be **completed**
- **Laboratory milestones** will be **completed** (they have been on hold due to labs closing during the COVID-19 pandemic)
  - □ IR spectra of gaseous PAHs, PAH Raman spectra, optical constants...
- **Ramdb** will be **online** early FY2022
- **OCdb infrastructure** will be **completed**

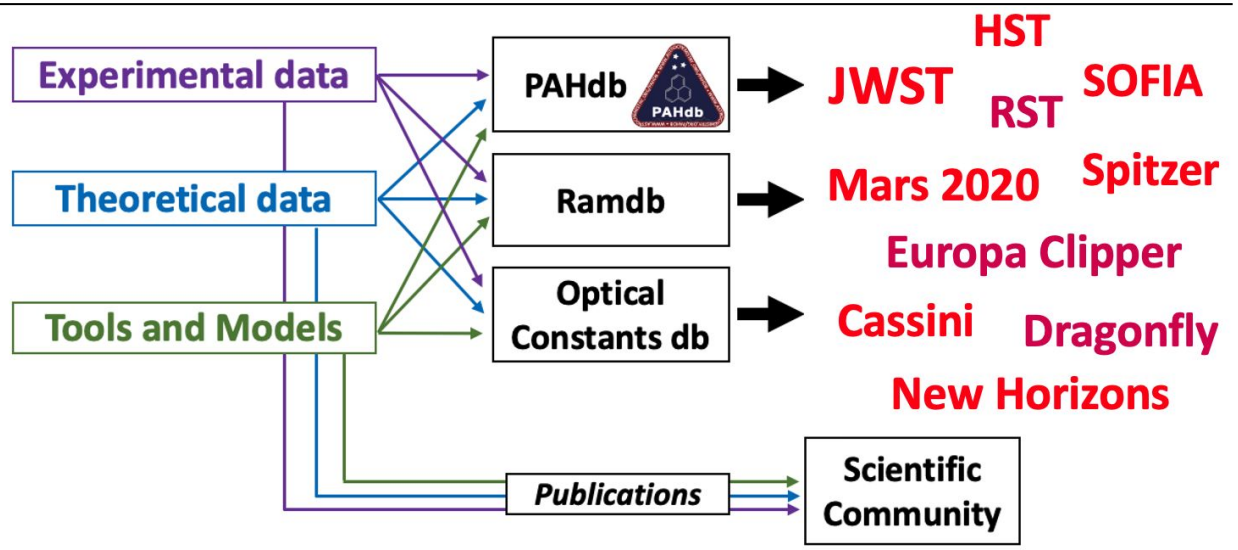
support wide range of NASA missions

NASA Ames PAH IR Spectroscopic Database and Sister Databases

Ella Sciamma-O'Brien, Lou Allamandola, Salma Bejaoui, Christiaan Boersma, Jesse Bregman, Lisseth Gavilan, Andy Mattioda, Alexandros Maragkoudakis, Najeeb Punnakayathil, Emmett Quigley, Alessandra Ricca, Claire Ricketts, Joe Roser, Farid Salama, Pasquale Temi, David Dubois

Description of package:

- **Provide spectroscopic data (experiment + theory) and data analysis tools** to interpret observations, maximizing the science return from many NASA missions (*cf. figure*)
- **Coordinate inter-laboratory research efforts** (5 sub-groups)
- **Expand the content and impact** of the publicly available NASA Ames Polycyclic Aromatic Hydrocarbon Infrared (IR) spectroscopic database (PAHdb)
- **Develop sister databases** (Raman, Optical Constants)



Justification for ISFM direction:

- Unique synergistic effort that leverages Ames' **laboratory facilities, computational resources** and **scientific** expertise
- **PAHdb**'s continuously expanding (1,115 new spectra in FY21) spectroscopic content, and software analysis tools **allow the scientific community to interpret astronomical PAH IR spectra.** **Major role for *JWST* data analysis**
- New **Raman** (**Ramdb**) and **Optical Constants** (**OCdb**) sister databases will **support a wider range of NASA missions**

Personnel counts:

- Average yearly number of FTEs supported: *1.0*
- Average yearly number of WYEs supported: *4.9*

Backup

ISFM History

NASA's Internal Scientist Funding Model (ISFM) was created as a result of a 2015 internal study performed by the Agency Competition Team, created by then Associate Administrator, Mr. Robert Lightfoot. The NASA Mission Support Council found that:

- Approximately 350 of the 1000 Agency Civil Servant (CS) scientists are partially funded through competitively won Research and Analysis (R&A) grants (the total funding from R&A is ~150 FTE);
- Unlike Other Government Agencies (OGAs), internal (NASA CS) and external scientists (e.g., university researchers) compete for the same funding;
- NASA spends significant resources competing for already appropriated research funding dollars;
- Early Career scientists have a hard time competing with older, more established researchers, and face a system that doesn't nurture them;
- Scientists spend too much time writing proposals that only cover a small fraction (0.1 FTE) of their time, forcing them to write many proposals; and,
- There has previously been no strategic hiring of scientists. Hiring decisions have been made at Centers without HQ consultation and, therefore, without any NASA-wide planning.

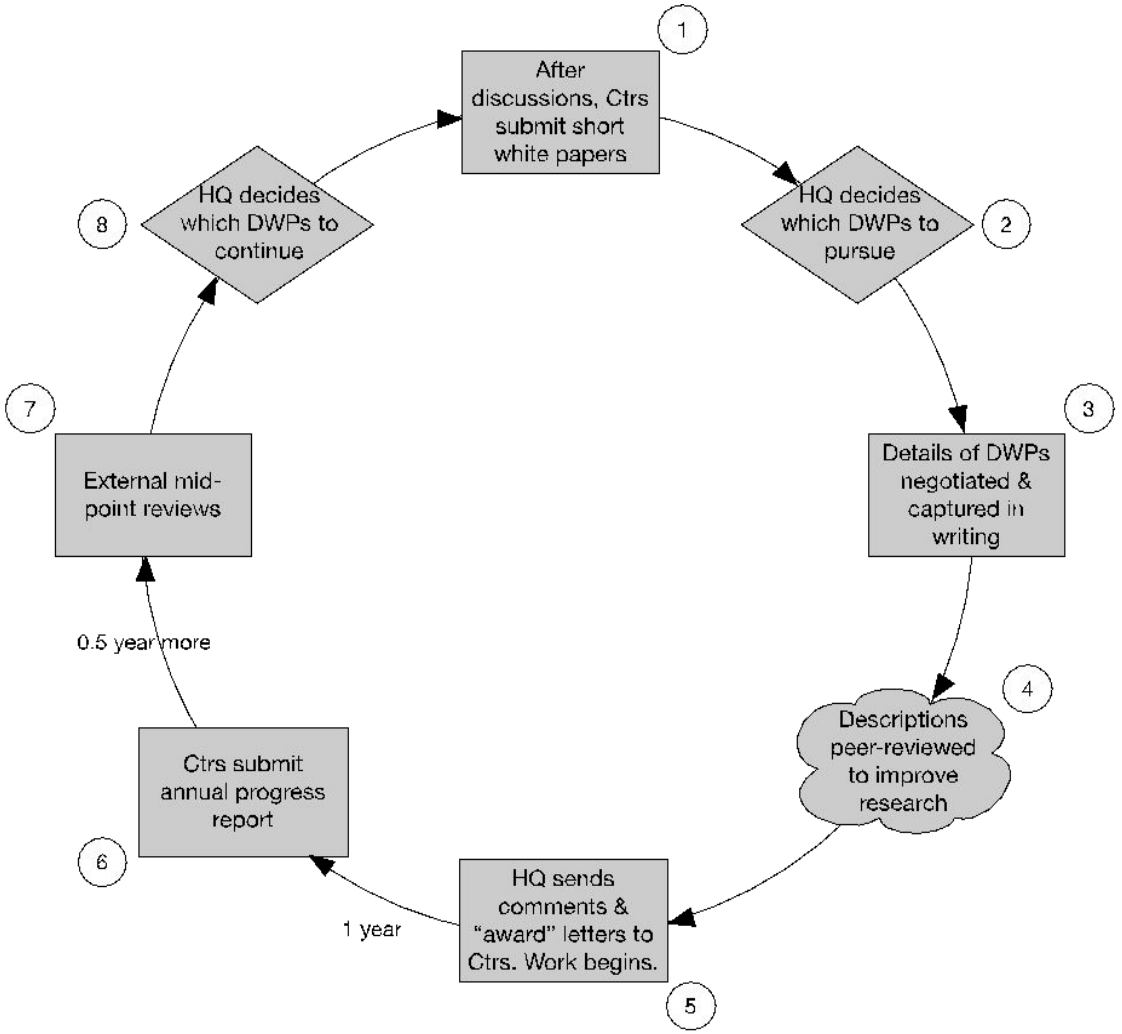
Astrophysics ISFM Work Packages Are…

- Strategically focused investments, which bring to bear the unique capabilities offered by a Center.
- Able to include the skills and labor offered by contractor support (i.e., they are not to solely fund Civil Servants). However, Civil Servants will provide the strategic leadership of each Work Package.
- Collaborative with / complementary to community efforts, and not competitive.
- Performed with service to the community and the Nation in mind.
- Aligned to the strategic goals of NASA, SMD, and the Astrophysics Division.

Astrophysics ISFM Principles

1. The Astrophysics Division intentionally adopted a cautious approach to its ISFM Directed Work Packages.
2. Only work that is clearly in the national interest will be directed.
3. Rolling up existing ROSES awards into a larger work package will only be accepted if it is demonstrated that the combined package exceeds the sum of its parts.
4. Simply requesting that an existing research award be directed is unlikely to succeed unless there is a strong reason to do so.
5. The Astrophysics Division is unlikely to accept work packages with substantial cost growth unless there is a compelling reason to do so.
6. Astrophysics work packages must be proposed from Center Division leadership and negotiated with HQ Division leadership. This ensures appropriate coordination.
7. **Result: Astrophysics has directed relatively little work in terms of number of awards, meaning we expect only modest reductions in the number of proposals submitted.**

Major Steps in the ISFM DWP Life Cycle



FISCAL YEAR	QUARTERS	CALENDAR YEAR	QUARTERS	MONTH	ISFM Event (for 1 generation of DWPs)
FY (N-1)	FY Q1	CY (N-2)	CY Q4	OCT	
				NOV	
				DEC	White papers due. #1 in Fig. 1.
	FY Q2	CY (N-1)	CY Q1	JAN	1. HQ negotiates with Centers. #2 and 3 in Fig. 1. 2. FY (N) funding adjustments made during PPBE(N+1). 3. DWP descriptions submitted to external review. #4 in Fig. 1. 4. DAAR certifies funding balance. 5. Funding memo/award letters sent to Centers. #5 in Fig. 1.
				FEB	
				MAR	
	FY Q3		CY Q2	APR	
				MAY	
				JUN	
	FY Q4		CY Q3	JUL	
				AUG	
				SEP	

FY (N)	FY Q1	CY (N)	CY Q4	OCT	DWPs start first year.
				NOV	
				DEC	
	FY Q2		CY Q1	JAN	
				FEB	
				MAR	
	FY Q3		CY Q2	APR	
				MAY	
				JUN	
	FY Q4		CY Q3	JUL	
				AUG	
				SEP	Annual Progress Reports due. #6 in Fig. 1.

FY (N+1)	FY Q1	CY (N+1)	CY Q4	OCT	DWPs start second year.
				NOV	
				DEC	
	FY Q2		CY Q1	JAN	
				FEB	
				MAR	External mid-point Review. #7 in Fig. 1.
	FY Q3		CY Q2	APR	
				MAY	Go/No-go/Tweak decisions made & communicated. #8 in Fig. 1.
				JUN	
	FY Q4		CY Q3	JUL	
				AUG	1. Annual Progress Reports due. 2. Final Reports from terminated DWPs due.
				SEP	

FY (N+2)	FY Q1	CY (N+2)	CY Q4	OCT	DWPs start third year.
				NOV	
				DEC	
	FY Q2		CY Q1	JAN	
				FEB	
				MAR	
	FY Q3		CY Q2	APR	
				MAY	
				JUN	
	FY Q4		CY Q3	JUL	
				AUG	
				SEP	Final Reports due.
FY (N+3)	FY Q1		CY Q4	OCT	
				NOV	
				DEC	

Centers' Public Presentations of Astrophysics ISFMs

Showcase on September 14, 2021

September 14, 2021, 1:00-5:00pm EST

1:00 ***Introduction***

1:05 **Title: "Next Generation X-ray Optics: High Resolution, Light Weight, and Low Cost" Will Zhang**

1:25 **Title: "Astrophysics Contributions to the Cross-Divisional Sellers Exoplanets Environments Collaboration" Padi Boyd, Elisa Quintana**

1:45 **Title: "The ExoSpec ISFM: Preparing for the next generation of exoplanet instrumentation" Michael McElwain**

2:20 **Title: "Multi-Star Wavefront Control: A Method to Enable Direct Imaging of Exoplanets Around Binary Stars" Ruslan Belikov, Eduardo Bendek, Dan Sirbu**

2:40 **Title: "MSFC Advanced X-Ray Optics: Formulation to Flight" Jessica Gaskin, Jeff Kolodziejczak, Wayne Baumgartner, Stephen Bongiorno, Jackie Davis, David Broadway, Nicholas Thomas**

3:00 **Title: "Advanced X-ray Microcalorimeters" at the ISFM showcase. Simon Bandler, Stephen Smith**

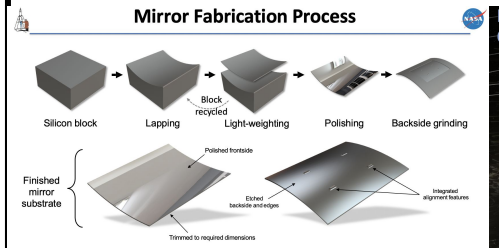
3:20 **Title: "Time-domain Astronomy Coordination Hub (TACH)" Judy Racusin**

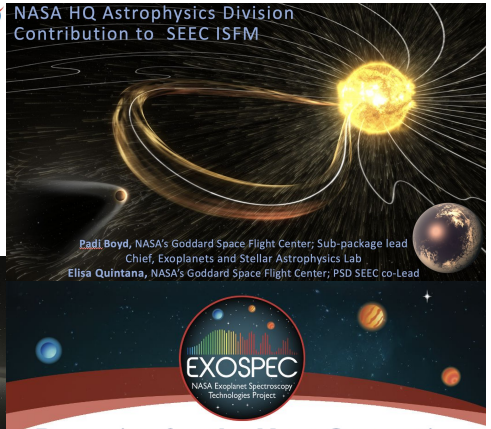
3:55 **Title: "The NASA Ames Polycyclic Aromatic Hydrocarbon IR Spectroscopic Database (PAHdb) and Sister Databases" Ella Sciamma-O'Brien**

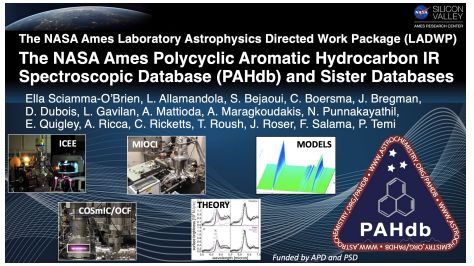
4:15 **Title: "Multimessenger Source Modeling: Enabling future missions through theory and computation" John Baker, Bernard Kelly, Jeremy Schnittman, and Scott Noble**

4:35 **Title: "Precision Thermal Control & UVO/Far-IR Mirror Technology" H. Philip Stahl**

4:55 ***Conclusion***







Time-domain Astronomy Coordination Hub (TACH)

Judy Racusin (GSFC, Code 661)
on behalf of the TACH Team

ISFM Showcase, September 14, 2020