National Aeronautics and Space Administration

Astrophysics




Internal Science Funding Model Update

Astrophysics Advisory Committee
October 19, 2017

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APAC Letter to Division Director

1. “The APAC would like to understand how the reduction in proposal numbers will be implemented and the metrics and standards that are going to be used to judge whether the new civil servant funding model was a success or not in the three-year review.”

2. “The APAC also requests more information on how setting limits on the number of proposals submitted by NASA Center scientists will be implemented.”

3. “The APAC recommends that the APD continues to ensure that any future directed work is truly best done at the Centers.”

NASA Success Criteria for ISFM

Defined by the NASA Executive Council in March 2016

1. More research work is directed to the centers rather than competed.
2. Fewer R&A proposals are submitted, scientists can focus more time on research activities geared toward NASA goals.
3. HQ and science capability leads are involved in strategic hiring decisions.
4. Positive feedback (via survey) of HQ program managers and center managers, and scientists.
5. NASA scientists are able to participate in more review panels without conflict-of-interest issues.
6. NASA scientists continue to publish research in peer-reviewed literature.
7. External review panels continue to rate the quality of NASA science as high, initially on a three-year review cycle.
8. The balance of research funding support to the external community is maintained.

ISFM Success Metrics

1. More research work is directed to the centers rather than competed.	The core of the implementation plan is a process for Centers and HQ to work collaboratively to identify and fund more directed research. It is anticipated that at least 25% of the FTE now covered by competed R&A will be covered by directed work in the future. Prioritization of new directed work will be identified by Centers and proposed to HQ.
2. Fewer R&A proposals are submitted, scientists can focus more time on research activities geared toward NASA goals.	Fewer PI proposals will be submitted by civil servant scientists as more FTE are covered by directed work, which will include necessary procurements to ensure success. The reduction in time writing proposals will increase productivity, as a consequence of the greater continuity of support and will be monitored by annual surveys of scientists. Proposal submission rates will be tracked through the NSPIRES database.
3. HQ and science capability leads are involved in strategic hiring decisions	Capability Leads/Division Directors will work directly with center science management to coordinate the number, research focus, and initial cost, if necessary, of CS scientists to be hired at the center, to maintain Center/HQ strategic and workforce alignment. Centers are free to hire in strategic fields defined by HQ capability leads/division directors, using Agency workforce guidance from OHCM.
4. Positive feedback (via survey) of HQ program managers and center managers, and scientists.	Whether the feedback is positive or negative will be determined via aggregate scoring at a “satisfactory” level. This will occur at regular intervals, assessed at Agency, Center, and Division levels, beginning 1 year after implementation. SMD and OCS will work to design the survey and assign a POC to assure its transmittal, collection, and analysis. Annually, survey results will be used to address necessary Agency, Center, or Division level changes needed to improve implementation of the plan.
5. Scientists are able to participate in more review panels without conflict-of-interest issues.	Center science management (as reflected by members of this panel) is committed to making the appropriate people available as SMEs for participation on panels. Branch chiefs will keep records of participation on review panels.
6. NASA scientists continue to publish research in the peer-reviewed literature	Directed work should be of high quality and result in peer-reviewed publications; to assure this quality, the external peer review process will be employed. Use of the NASA Technical Reports Server (NTRS) and Pubmed Central (PubSpace) analytics to track publication rates which should at least remain steady. Initially, PubSpace results will be cross referenced with other science indexing sites.
7. External review panels continue to rate the quality of NASA science as high, initially on a three year review cycle.	Directed work will be reviewed for quality, and the work will be modified based on the review. Termination of efforts for poor quality work is a possible outcome. Each center will determine the scope of its review, given its own situation. Discipline scientists have input to review process. Reviews are assumed to take ~ a few days, no longer. Review panels are assembled by the Capability Leads/ Division Directors or their designees. A positive success rating would reflect a review with a “satisfactory” rating (or higher).
8. The balance of research funding support to the external community is maintained.	We will be tracking the overall funding to the external community and internal R&A funding, via RAPTOR and SAP report(s). We note that there is some variation in the level of funding from year to year, but the process is committed to such tracking and maintenance. The process must also be flexible to adjust to budgetary changes, both increases and cuts. External funding should be maintained (at the Agency level) after adjusting for budget changes.

Qualities of Directed 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. • Not just 'me too' research. • 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.

Astrophysics ISFM Principles

1. The Astrophysics Division is intentionally adopting a cautious approach to its 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. APD 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 intends to direct relatively little work in terms of number of awards, meaning we expect only modest reductions in the number of proposals submitted.**

Astrophysics Directed Work Packages Beginning in FY18

Center/Package	$/yr	Extend existing work? New commitment?	Signed?	Anticipated reduction in proposals per year
GSFC				
X-ray mirrors	2.4M	Extends FY19-20	✓	0.5
X-ray calorimeters	0.9M	Extends FY18-FY20	✓	1
Gravitational waves	0.3M	New FY18-FY20	✓	0.5
SEEC Exoplanets	0.1M	New FY18-FY20	✓	0.3
MSFC				
Advanced X-ray optics	1.9M	Extends FY18-FY20	✓	3
Precision thermal control	1.2M	Extends FY20	✓	0.3
ARC				
Multi-star imaging	0.4M	New FY18-FY19	✓	2
Speckle exoplanets	0.4M	New FY18	✓	3

Managing Civil Servant Proposal Numbers

Central coordination between APD and Centers	• Close communication between APD leadership and Center leadership. • Ensures a high bar for work package concepts.
Structure of APD work package descriptions	• Work package descriptions are required to state which current award(s) a work package will replace, and the number of proposals that will not be written should the work package be awarded.
HQ Program Officer monitoring	• Small number of APD work packages makes it easy for APD Program Officers to track NSPIRES submissions by existing work package awardees.
Center implements internal controls	• APD has written responses from Centers regarding limiting ROSES proposals. • See subsequent slides for details.

Managing Civil Servant Proposal Numbers: Responses from Centers

Response from GSFC
J. Centrella, M. Eckart, J. Hill-Kittle, D. Leisawitz

Background: All ROSES proposals with GSFC CS PI or Co-I are submitted via GSFC's Science Proposal Support Office (SPSO), led by Dave Leisawitz. SPSO uses an Electronic Routing process (E-Router) to route a draft proposal and budget for each proposal. The E-Router is circulated for review through GSFC Astrophysics Science Division Management (Branch Management then Division Management) and finally routes to SPSO for final approval. SPSO staff also review the complete version of each proposal submitted to NSPIRES and request changes from institutional leads if needed.

- SPSO will now require APRA/XRP/ATP/ADAP/SAT proposal leads to upload an extra page to the E-Router that gives assurance that the new proposal is not in conflict with existing GSFC work packages, by providing the following information:
  - Are you currently supported by a GSFC work package? (yes/no)
  - Is any work in this proposal related to a GSFC work package? (yes/no)
  - If yes, justify why the proposed work is distinct from the work already funded via the work package.
- During the E-Router approval process, a single Astrophysics Division Manager (Director or Deputy) will be responsible for reviewing all responses.
- Proposals with overlap will not be approved. They will either be modified or rejected. The Astrophysics Division will signal rejection by disapproving the E-Router, and indicate a need to modify a proposal with a comment entered into the E-Router.
- SPSO will provide a final check-point for overlap with GSFC work packages. SPSO only submits proposals that have been approved by Division Directors or their alternates. SPSO will verify that the Astrophysics Division's modification requests, if any, are addressed in the proposal submitted through NSPIRES.
- Currently this policy has been put together by Astrophysics Division Management in collaboration with SPSO. We expect in the future there will be a standard Science-Directorate-wide process at GSFC; we will implement the above process until a unified process is in place.

Response from MSFC
J. Terek

Background: The MSFC Science Research and Projects Division (SRPD) Science and Technology Office (STO) and its science branches (Astrophysics, Earth Science, Heliophysics, & Planetary Science) will work in cooperation with SMD Division Managers, Program Managers and Program Executives to reduce/minimize the number of proposals (to ROSES and AOs) written by personnel who are already covered (fully or partially FTE) by ISFM work packages.

- Track proposal submissions by PI/Co-I and by ROSES thematic areas. The MSFC database is intended to provide MSFC Science and Technology Office managers a better understanding of which HQ solicitations their PI/Co-Is propose to and the frequency (Branch level).
- Implement a gate review process to review proposed new work for potential relationship to existing work packages (SRPD Senior Leadership Team).
  - Primary gate is at the MSFC branch level.
  - Secondary gate is at the MSFC division level.
- Internal review and discussions of all planned proposal submissions PIs/Co-Is to ensure that they do not over-subscribe their time or conflict with work packages (Branch level/SRPD Leadership Team).

Response from ARC
M. Bicay, S. Howell, J. R. Spackman

Background: Implementation of ISFM will affect researchers in three Branches in the Space Science and Astrobiology Division (Astrophysics, Planetary Systems, Exobiology) and in two Branches in the Earth Science Division (Biospheric Sciences, Atmospheric Sciences). All ROSES proposals submitted by ARC-based Principal Investigators are reviewed and approved by Branch Chiefs. Large proposals exceeding $1M life cycle costs and/or involving multiple Divisions at the Center must further be reviewed and approved by Division Chiefs.

- ARC Science management and supervisors (Division Chiefs, Branch Chiefs) are committed to actively reducing the number of R&A proposals submitted by civil servant researchers by one-third by FY20.
- ARC Science supervisors will annually negotiate ISFM work packages with HQ/SMD sponsors, focusing on large and intellectually coherent activities that maximize the alignment of Center capabilities with HQ/SMD needs.
- Reductions in proposals will result from active regulation by supervisors and as a consequence of the ISFM construct.
  - Supervisors will regulate ROSES proposals by not permitting submission of proposals that seek to replicate activities being performed via a negotiated work package.
  - Civil servant researchers integrated into ISFM work packages will likely have significant fractions of their labor time covered, reducing the need for those scientists to submit many ROSES proposals to cover small fractions of their labor.

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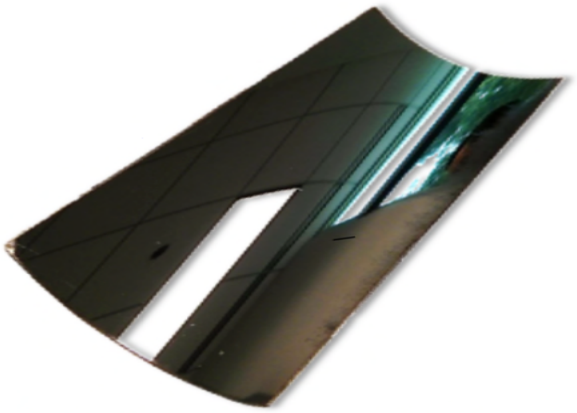
Backup

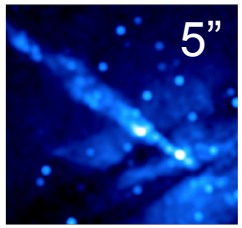
GSFC: X-ray Mirrors

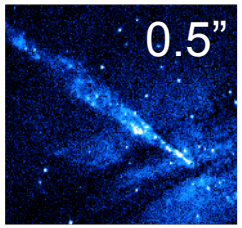
Description of package

Develop X-ray mirror technologies to surpass Chandra by orders of magnitude in terms of angular resolution, collecting area, and cost.

PI: W. Zhang







Single-crystal Si mirror segment

Importance of package

- Enabling technology for Lynx and almost all future medium and flagship X-ray missions.
- Supports and enables complementary university-based efforts to improve mirror angular resolution.

Justification for direction

- Work uniquely performed at a NASA Center.
- Leverages substantial Center resources and capabilities.
- Serves as a resource to enable the wider X-ray optics community.

$2.4M/year for FY18-20

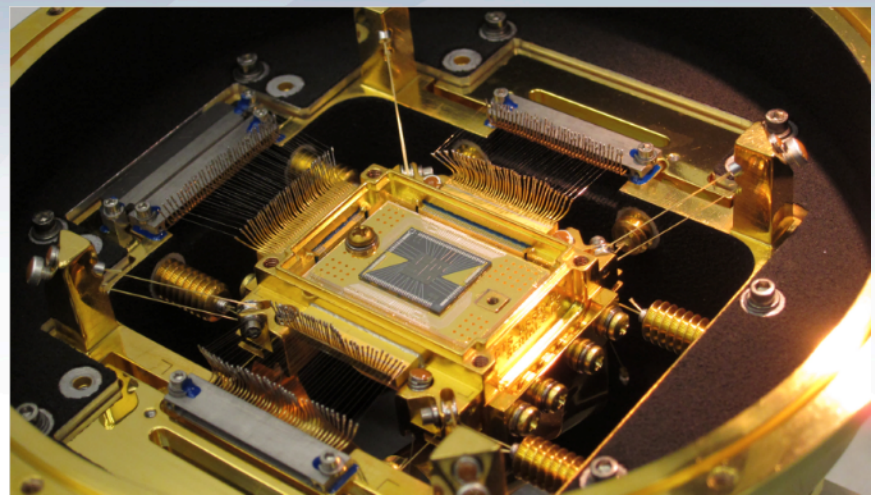
GSFC: Next-gen X-ray Microcalorimeters

Description of package

Three tasks:

1) TES Microcalorimeters
2) Magnetically Coupled Calorimeters
3) Laboratory Spectroscopy for Space Atomic Physics

PI: C. Kilbourne



Importance of package

- Small-pixel, high-count rate detector development with unprecedented energy resolution in the X-ray band.
- Detector support for Sounding Rocket programs.
- Provide atomic physics data for currently operating and future X-ray missions.

Justification for direction

- Transition-edge sensors and magnetically coupled microcalorimeters are key technologies for future X-ray missions (e.g., Lynx).
- NASA should continue to develop GSFCs leadership role in these key technologies.

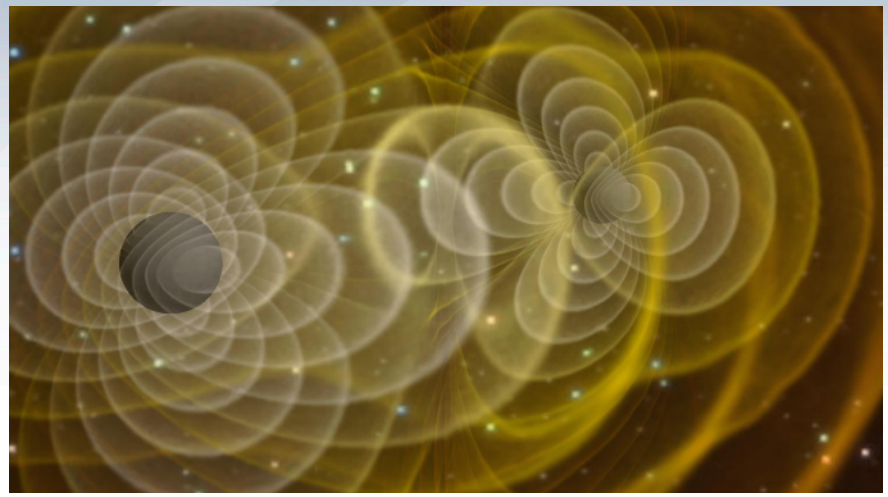
$0.9M/year for FY18-20

GSFC: Gravitational Waves

Description of package

Lay the groundwork for US LISA science. Clarify the prospects for multi-messenger astronomy observations through a variety of electromagnetic and gravitational wave simulations of merging black holes.

PI: J. Baker



Importance of package

- Provides a basis for building the US LISA science community.
- Stimulates new university research related to novel upcoming NASA capabilities in mHz gravitational-wave astrophysics.
- Package likely to grow over the coming years in response to NASA engagement with LISA.

Justification for direction

- Work best done at a Center, in order to maintain close connections with LISA development.
- Enables the wider US community to participate in future LISA science center.

$0.3M/year for FY18-20

GSFC: Sellers Exoplanet Environments Collaboration (SEEC) – with PSD

Description of package

- Development of exoplanet structure and atmosphere models.
- Development of observational tests for exoplanet theories.
- Creation of a community-coordinated modeling database and analysis portal.

PI: S. Domagal-Goldman

Importance of package

- Future exoplanet advances require cross-discipline expertise from astrophysics, planetary atmospheres and astrobiology.
- APD and PSD R&A programs are feeling the pressure of a community reinventing wheels.
- Community would benefit from tool standardization – to focus on science over tool development.

Justification for direction

- GSFC provides heritage and leadership in mission support, data centers, and data analysis tools.
- GSFC has invested in exoplanet labs and a culture that fosters cross-disciplinary science.
- GSFC has considerable roles in the missions this package will support – JWST, WFIRST, and decadal concept studies.

$100k/year for FY18-20

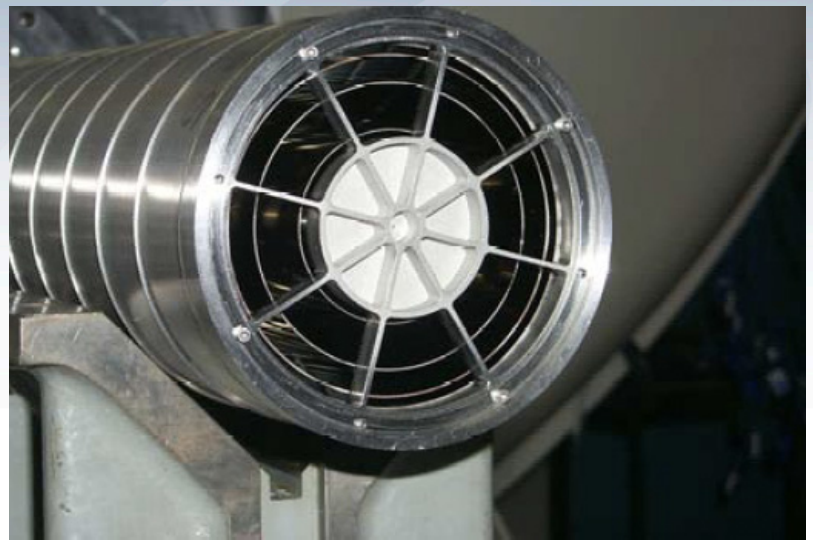
MSFC: Advanced X-Ray Optics

Description of package

Five subtasks:

1) Fabrication of X-ray mirror shells
2) Polishing of mandrels
3) Differential deposition figure correction
4) Mirror coatings
5) X-ray testing and calibration

PI: B. Ramsey



Importance of package

- MSFC leads X-ray mirror shell development and testing efforts.
- MSFC provides NASA and the nation with performance characterization test capability facilities (XRCF, SLF).

Justification for direction

- MSFC provides unique test facilities support for both internal and external X-ray optics systems (XRCF, SLF).
- Agency needs to invest in developing, qualifying, and maintaining such capabilities in the national interest.

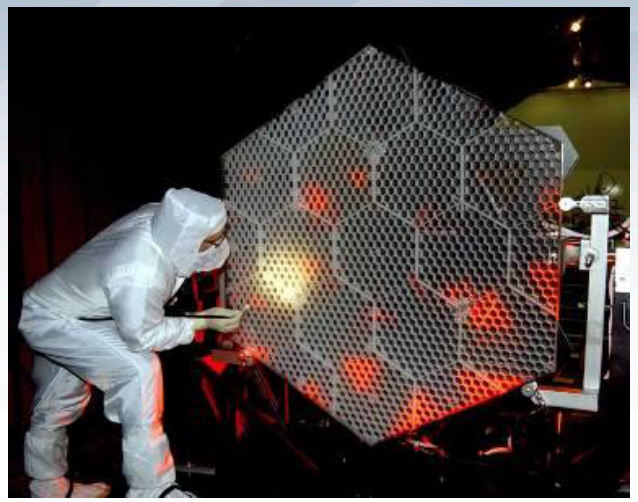
$1.9M/year for FY18-20.

MSFC: Predictive Thermal Control (PTC)

Description of package

- Multiyear effort to develop, demonstrate and mature a thermally stable telescope towards TRL6.
- Validate models that predict thermal optical performance of real mirrors.
- Derive thermal system stability specifications from wavefront stability requirement.

PI: P. Stahl



ULE® 1.4m AMSD Mirror

Importance of package

- Demonstrate the utility of a Predictive Control (PTC) thermal system for achieving thermal stability necessary for coronagraphy and other applications.
- PTC validates the model by testing a flight traceable 1.5 meter ULE® mirror in a relevant thermal vacuum environment in the MSFC X-ray and Cryogenic Facility (XRCF) test facility.

Justification for direction

- Strategic and forward-leading step to ensure dimensional stability of large spaceborne telescopes to the picometer level.
- Uniquely done at a NASA Center, and well-aligned with MSFC core capabilities.

$1.2M/year for FY18-20

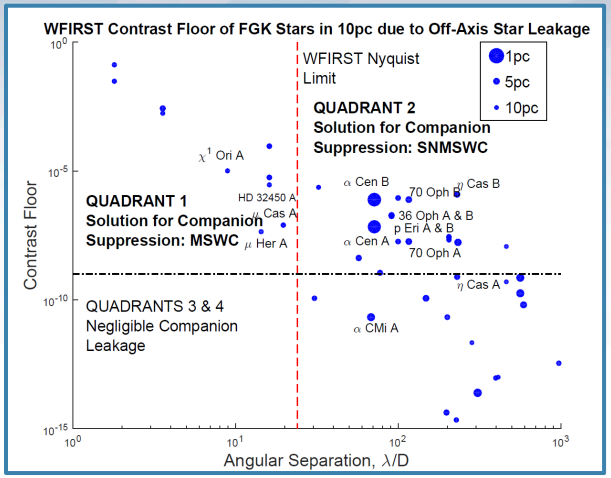
ARC: Enabling Direct Imaging of Exoplanets Around Binary Stars with WFIRST (Preliminary, to be updated)

Description of package

- Increase the exoplanet science yield of WFIRST/CGI by developing a technique to enable imaging of exoplanets around binary stars.
- Evolved Multi-Star Wavefront Control (MSWC) algorithm tuned for WFIRST.
- Raise maturity of key technologies to TRL-4 in NASA ARC test bed. Develop infusion plan for WFIRST.

PI: R. Belikov

New targets potentially enabled by MSWC



- 70 FGK stars within 10pc
- 43 multiples
- 28 need multi-star suppression, enabled by MSWC
- **67% increase in available star targets for WFIRST**

Importance of package

- Has the potential to increase the number of available targets for WFIRST/CGI by as much as 67% using the existing hardware configuration.
- MSWC could enable WFIRST/CGI to observe the α Cen A/B system.
- Provides the opportunity for WFIRST to detect potentially habitable planets.

Justification for direction

- Strategic and forward-leaning package to provide major steps forward for WFIRST, HabEx, and LUVOIR.
- MSWC was developed by the team at ARC; no other teams are pursuing approaches for high-contrast imaging exoplanets in multi-star systems.
- Timely given the WFIRST schedule.

$TBD for FY18. Augmented package expected next year.

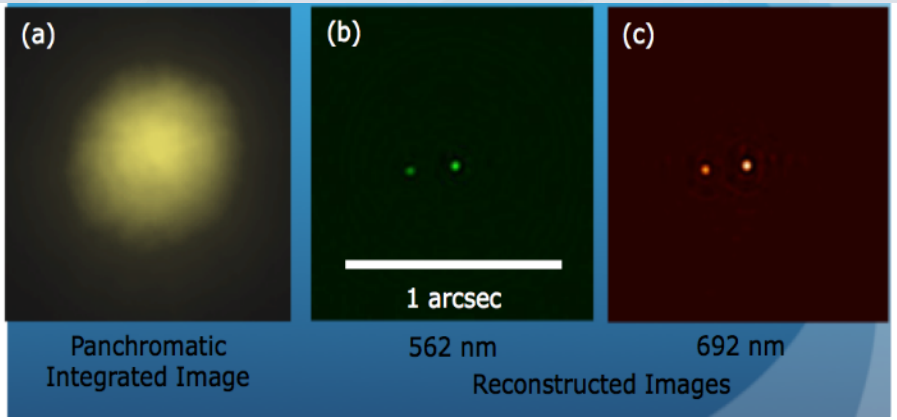
ARC: High-Resolution Imaging of Exoplanet Candidates (Preliminary, to be updated)

Description of package

- Provide validation and characterization of K2 and TESS exoplanet candidates for the community.
- Observations necessary to establish planet radius, mean density, incident flux, system architecture.
- Observational capability crucial for follow up of exoplanet candidates identified in TESS full frame images.

PI: S. Howell

Speckle Imaging of Exoplanet Candidate Stars exceeds the spatial resolution of AO observations.



Importance of package

- Speckle observations (conducted at visible wavelengths) provide significantly better spatial resolution than AO observations.
- The speckle instrument developed and led by the NASA Ames team are the only such instruments that are dedicated to exoplanet candidate follow-up.
- All observations are fully reduced and delivered to the ExoFOP archive for public access.

Justification for direction

- Instruments are unique to NASA, both in their capability and in their mission to provide follow up of exoplanet candidates identified by NASA missions.
- Enables the scientific success of the community.
- Crucial for follow up of exoplanet candidates identified in the TESS full frame images.

$TBD for FY18. Augmented package expected next year.