Connecting with the Program Offices of NASA's Astrophysics Division

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What are the 3 APD Program Offices?

And what is their focus?

Physics of the Cosmos

- *How does the universe work?*
- Science topic includes:
  - Validity of Einstein's General Theory of Relativity and the nature of spacetime
  - Behavior of matter and energy in extreme environments
  - Cosmological parameters governing inflation and the evolution of the universe
  - Nature of dark matter and dark energy.

Cosmic Origins:

- *How did we get here?*
- Science focus includes:
  - Stellar lifecycles and the evolution of the elements
  - Early formation and evolution of planetary systems
  - Archaeology of the Milky Way and its neighbors
  - History and evolution of galaxies and supermassive black holes
  - First light and reionization

Exoplanet Exploration:

- *Are we alone?*
- Focus is on exoplanet science and technology
- Includes NASA Exoplanet Science Institute (NExScI)

The Three APD Program Offices…

- **Serve NASA HQ**
  - Program Offices are HQ functions that reside at the Centers
  - HQ sets the policy and directives, Program Offices implement them
  - Program Offices take direction from HQ (and not from the Centers)
- **Work as conduits for communication between the scientific communities and HQ**
  - Program Offices are facilitators for the science, help enable it
  - Conduct studies and identify strategic capabilities for flagship missions
  - Ensures participation from the diverse community
- **Perform technology management and execute technical and scientific reviews**
- **Possess infrastructure and capabilities that the START/TAG can leverage**

Program Offices
Services and Structures

potentially useful to the START/TAG

But first, a few acronyms…

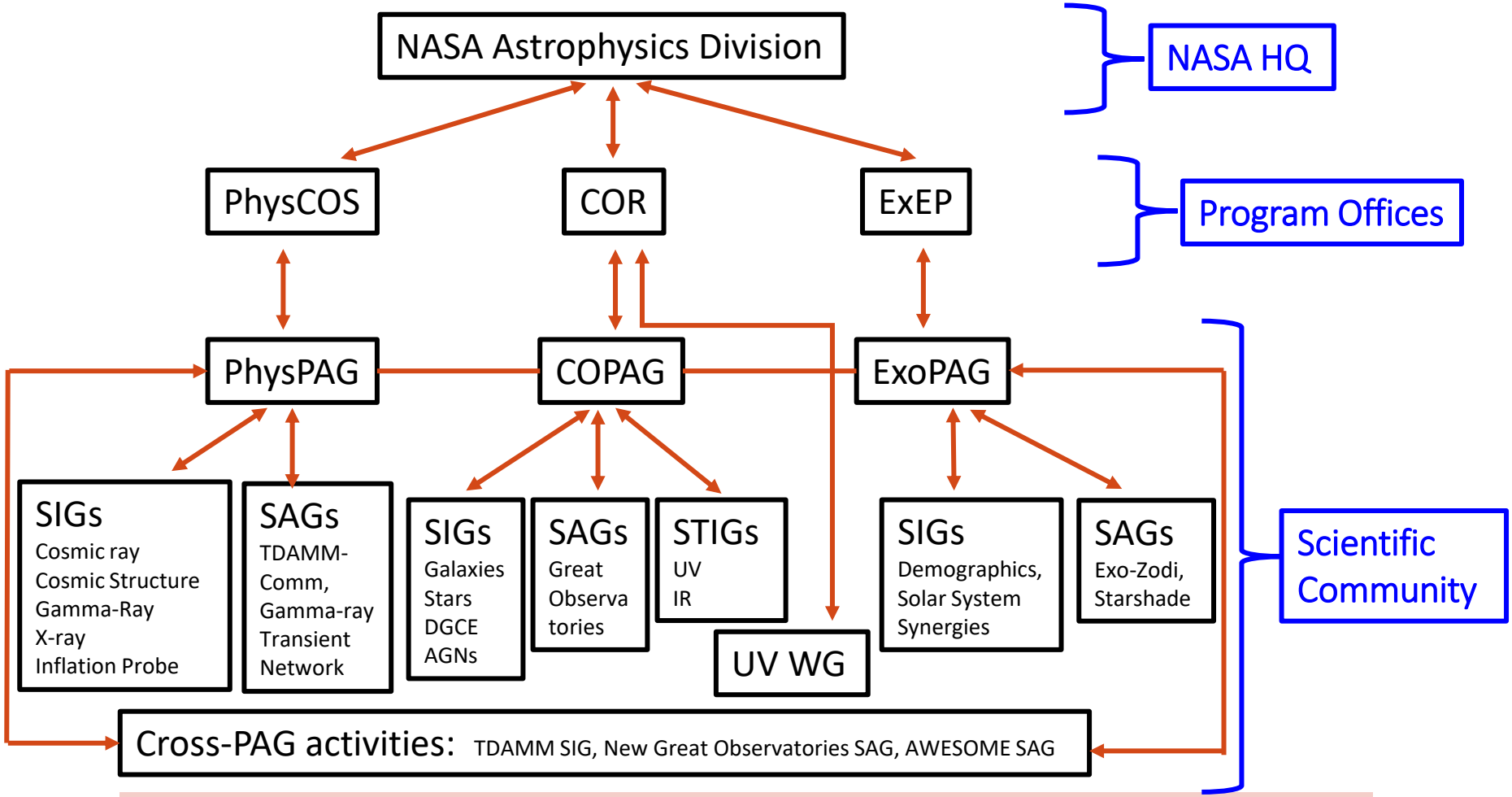
Program Analysis Group (PAG): A PAG is an open community-led group of enthusiastic scientists who are engaged in the development and execution of NASA's programs. As an interdisciplinary forum, it solicits and coordinates community analysis and input in support of the program objectives. It provides findings of analyses directly to the NASA Astrophysics Division Director via the Astrophysics Advisory Committee (APAC).

Science Interest Group (SIG): Community-driven groups that meet to discuss and share scientific results, analysis techniques, and science gaps. SIGs identify data and technology needs that could enable advances in further scientific discovery. They are typically several year activities.

Science Analysis Group (SAG): Community-driven groups that focus on answering specific questions or achieving specific goals. They are typically short-term activities with a final report delivered in ~ 2 years and available to the community.

Science and Technology Interest Group (STIG): Community-driven groups that focus on discussing and exploring specific scientific and technology topics. They are typically several year activities.

Organizational Chart and Relationships

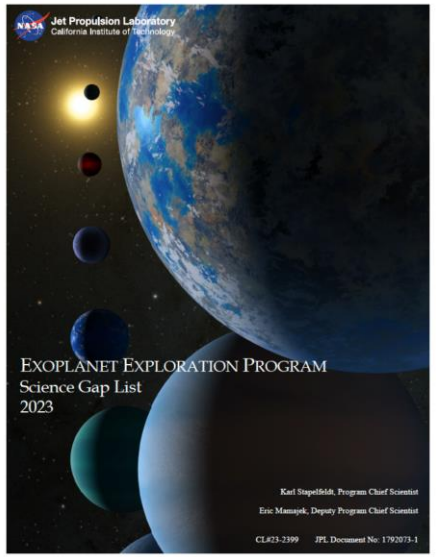


- **The POs provide organizational <u>support</u> to the <u>independent</u> PAGs.**
- **The PAGs are extremely valuable resources in engaging the community to work on NASA mission relevant topics.**

Program Offices and Science

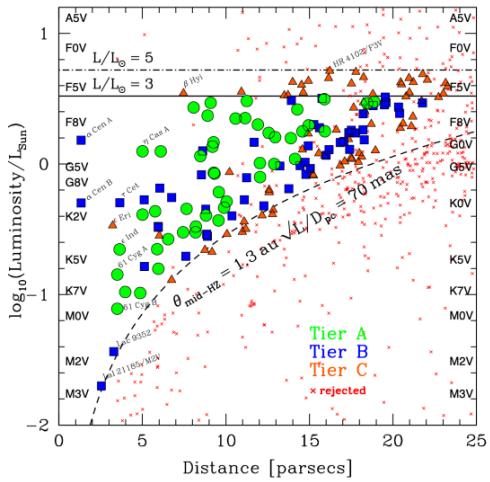
Program Offices and Science

- **Facilitate, review, and maintain Science Gap Lists**
  The difference between knowledge needed to define requirements for specified future NASA missions and the current knowledge.
  - ExEP has a Science Gap List in place
  - PhysCOS/COR are currently soliciting contributions from the community in Preparatory, Precursor, and Non-strategic science gaps



- **Facilitate precursor science activities**
  - Hold workshops and gather community input to HQ to inform Precursor Science ROSES call
  - Encourage community to submit proposals
  - ExEP HWO target star list compiled

- **Provide opportunities for early career scientists**
  - Cosmic Explorers Student SIG (new initiative)
  - ExoExplorers
  - ExEP postdocs embedded in PO



ExEP HWO Target Star List

Program Offices and Science

- **Lead or facilitate special studies**
  - Exoplanets Metrics Working Group (for HWO)
  - Extreme Precision Radial Velocity Working (EPRV) Group
  - White paper on UV technology for HWO (COR UV working group)
  - Technosignatures Survey
  - TDAMM Astrophysics Cross-Observatory Science Support (ACROSS)
  - Fornax cloud-based science platform
  - LISA mission studies

- **Provide access to ground observatories to support community science efforts**
  - Manage NASA's ⅛ share of Keck (through NExScI)
  - NASA-NSF Exoplanet Observational Research (NN-EXPLORE) program
    - Advancing Extreme Precision Radial Velocity capabilities
    - WIYN access, including NEID precision radial velocity instrument
    - Solar data processing and archiving (NEID and other facilities)
    - High resolution imaging (Gemini, WIYN)
    - LBTI survey of exozodi emission

- **Includes NASA Exoplanet Science Institute (NExScI)**
  - NASA Exoplanet Archive
  - Sagan Summer School
  - ExoFOP (Exoplanet Follow-up Observing Program)

Program Offices and Technology

Program Offices and Technology

- **Facilitate technology prioritization**
  - Technology Gap List
  - Astrophysics Biennial Technology Report
- **Provide technology development oversight**
  - SAT, Internal Scientist Funding Model
  - Support flight projects with early technology development
    - Athena, LISA, Roman CGI
  - Starshade technology
- **Manage and support research facilities**
  - High Contrast Imaging Testbed facility
    - ❖ 3 coronagraph testbeds in vacuum; 1 in-air
  - Deformable Mirror Characterization Testbed
  - Starshade Lab

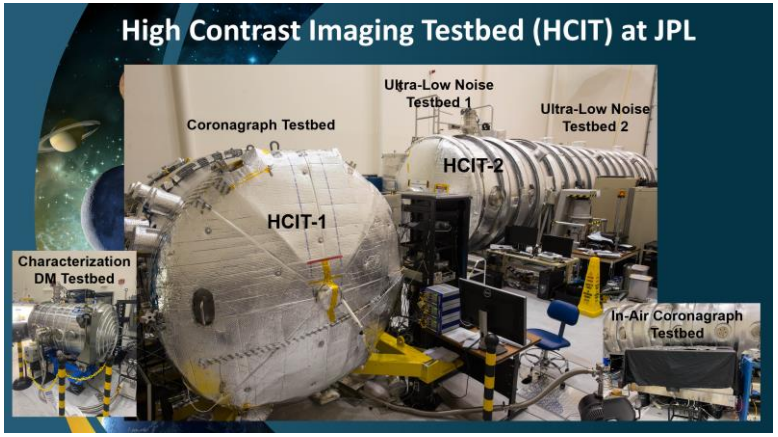
Tier 1 Technology Gaps

Advanced Cryocoolers	Large Cryogenic Optics for the Mid IR to Far IR
Coronagraph Contrast and Efficiency	Large-Format, High-Resolution Focal Plane Arrays
Coronagraph Stability	Large-Format, Low-Darkrate, High-Efficiency, Photon-Counting, Solar-blind, Far- and Near-UV Detectors
Cryogenic Readouts for Large-Format Far-IR Detectors	Large-Format, Low-Noise and Ultralow-Noise Far-IR Direct Detectors
Heterodyne Far-IR Detector Systems	Long-Wavelength-Blocking Filters for X-ray Micro-Calorimeters
High-Performance, Sub-Kelvin Coolers	Low-Stress, High-Stability, X-ray Reflective Coatings
High-Reflectivity Broadband Far-UV-to-Near-IR Mirror Coatings	Mirror Technologies for High Angular Resolution (UV/Vis/Near IR)
High-Resolution, Large-Area, Lightweight X-ray Optics	Stellar Reflex Motion Sensitivity – Astrometry
High-Throughput Bandpass Selection for UV/VIS	Stellar Reflex Motion Sensitivity – Extreme Precision Radial Velocity
High-Throughput, Large-Format Object Selection Technologies for Multi-Object and Integral Field Spectroscopy	Vis/Near-IR Detection Sensitivity

Tier 2 Technology Gaps

Broadband X-ray Detectors	Large-Format, High-Spectral-Resolution, Small-Pixel X-ray Focal-Plane Arrays
Compact, Integrated Spectrometers for 100 to 1000 μm	Polarization-Preserving Millimeter-Wave Optical Elements
Far-IR Imaging Interferometer for High-Resolution Spectroscopy	Precision Timing for Space-Based Astrophysics
Far-IR Spatio-Spectral Interferometry	Rapid Readout Electronics for X-ray Detectors
Fast, Low-Noise, Megapixel X-ray Imaging Arrays with Moderate Spectral Resolution	Starshade Deployment and Shape Stability
High-Efficiency X-ray Grating Arrays for High-Resolution Spectroscopy	Starshade Starlight Suppression and Model Validation
High-Resolution, Direct-Detection Spectrometers for Far-IR Wavelengths	UV Detection Sensitivity
Improving the Calibration of Far-IR Heterodyne Measurements	
Large-Aperture Deployable Antennas for Far-IR/THz/sub-mm Astronomy for Frequencies over 100 GHz	

APD Technology Gap List (Tiers 1 and 2)



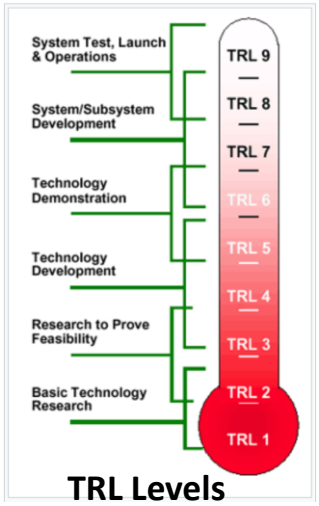
Program Offices and Technology

- **Lead or facilitate special technology studies**
  - **GOMAP Technology Roadmap Working Groups**
    - DMs, Coronagraph Designs, Coronagraph Technologies, Ultra-Stable Observatories
  - Deformable Mirrors Survey
  - in-Space Assembled Telescopes
  - Cost and analysis studies/reviews
- **Offer consensus and fact-finding facilitation**
  - Coronagraph options for Roman
  - Starshade demonstrations
  - HabEx, Lynx
  - Deformable Mirror Survey
- **Perform and facilitate independent TRL assessments**
  - Science & Technology Design Teams
  - SAT/Internal Scientist Funding Model program

Kepner Tregoe Trade Matrix

Decision Statement				Option 1		Option 2		Option 3	
Description	Feature 1								
	Feature 2								
	Feature 3								
Evaluation	Musts								
	M1			✓		✓		✓	
	M2			✓		?		?	
	M3			✓		✓		✕	
	Wants	Weights							
	W1	w1%		Rel score		Rel score			
	W2	w2%		Rel score		Rel score			
	W3	w3%		Rel score		Rel score			
		100%	Wt sum =>	Score 1		Score 2			
	Risks			C	L	C	L	C	L
	Risk 1			M	L	M	L		
	Risk 2			H	H	M	M		
Final Decision, Accounting for Risks									

C = Consequence, L = Likelihood



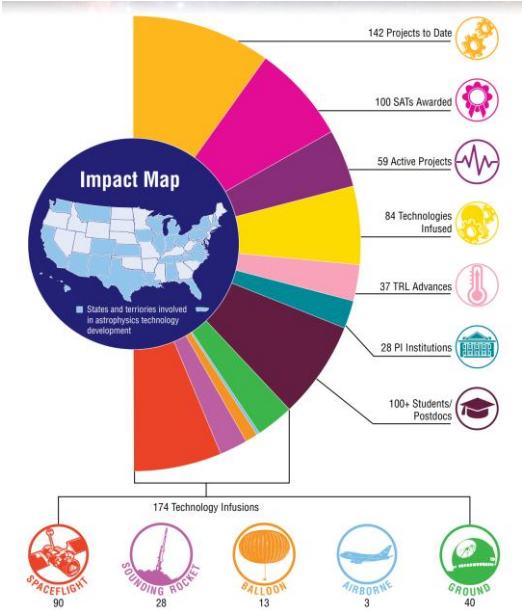
TRL Levels

Program Offices and Technology

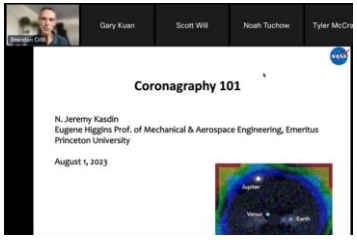
- **Simulation/Modeling Tools**
  - Segmented Coronagraph Design and Analysis working group
    - ❖ Error budget modeling for coronagraphs
  - Exoplanet yields (EXOSIMS)
  - Starshade imaging simulation tool

- **Technology State of the Field Reviews**
  - "Progress in Technology for Exoplanet Missions"
  - Metric tracking such as infusion into technology missions
  - Publish papers and technology reports (ABTR)

- **Technology Colloquia, Webinars**
  - ExEP Technology Colloquium Series
  - QUEST series and YouTube channel (UVSTIG)



Technology Impacts from ABTR report



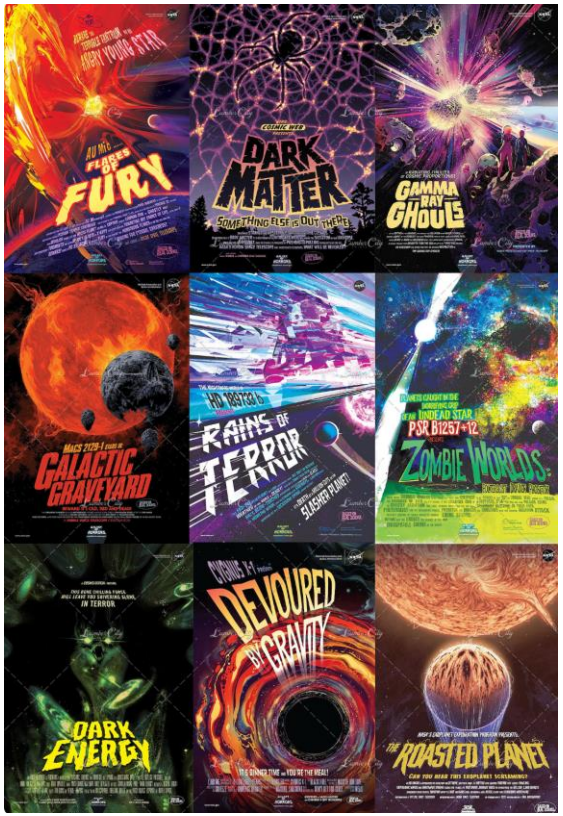
ExEP Technology Colloquium Series

QUEST YouTube Channel

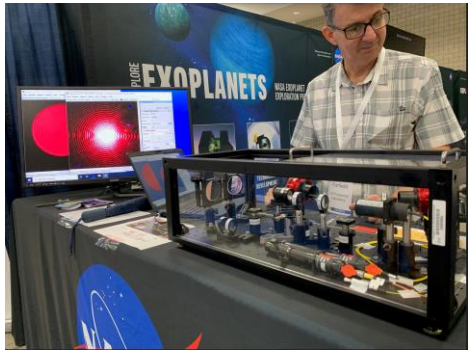
Program Offices and Communications

Program Offices and Communications

- **Access to artists/multimedia support**
  - Thematic posters
  - Explainer videos
  - Animations



- **Science communications**
  - Interview/presentation support
  - Social media
  - Science articles



- **Event support**
  - AAS booth/coronagraph demonstrations
  - Comic-Con, South x Southwest, Coachella
  - Public school talks/event material

- **Generate newsletters and announcements**
  - inform community about science events, research, and funding opportunities

[COR-News] Cosmic Origins News Announcements

GR Gamble, Ronald S. (GSFC-660.0)[UNIV OF MARYLAND COLL
To cor-news@lists.nasa.gov
Wed 9:32 AM

You forwarded this message on 10/18/2023 11:23 AM.

COPAG_AAS_schedule.pdf 1 MB
QUESTtalk011.pdf 12 MB

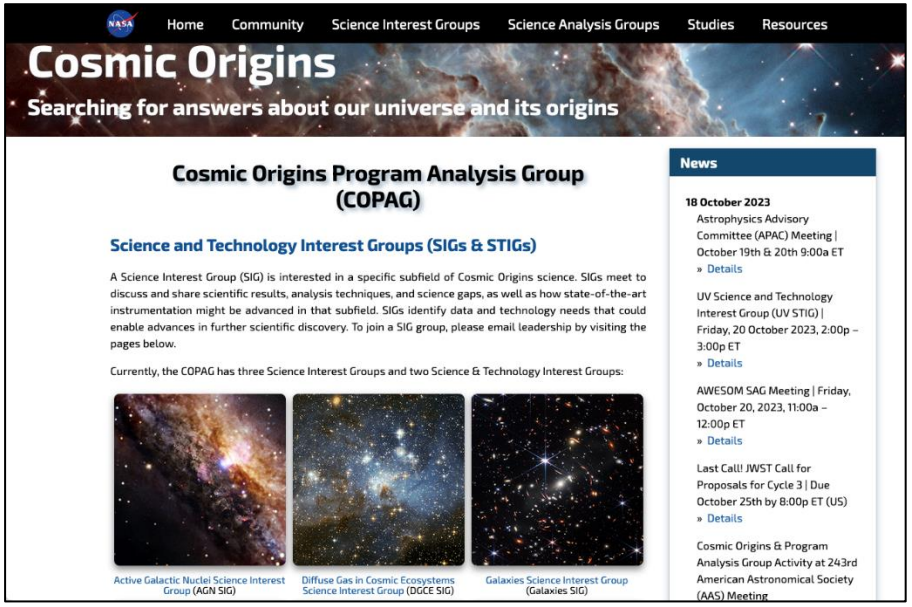
Greetings Cosmic Origins Community!

Please find our latest news items of note below and be sure to check out our attached flyers highlighting upcoming activities for the Cosmic Origins community.

Program Offices
and
Programmatic Support

Prog Offices and Programmatic Support

- **Develop, maintain, and update websites**
- **Coordinate workshops and splinter sessions**
  - Starlight Suppression Workshop
  - AAS High Contrast Imaging Splinter
  - Sagan Summer School
- **Arrange sub-contracts**
  - Sub-contract for SMEs and industrial partners
  - Provide technical oversight



AAS High Contrast Imaging Splinter in Seattle

In Summary

Potential support to the START and TAG…

- Program offices are **conduits for communication** between the community and HQ
- PAGs are a **valuable resource** for soliciting community inputs on science and technology on a **wide range of relevant topics**
  - HQ Program Scientists are the Executive Secretaries of the PAGs
- SIGs and SAGs are **very useful structures in place** to interface with the broad scientific community
  - Not affected by immediate funding or budget delays
- Program offices can **facilitate and coordinate**:
  - Precursor science activities
  - The formation and management of working groups to conduct special studies
  - Fact-finding activities
  - Workshops and splinter sessions
- Program offices have **existing infrastructure for:**
  - Conducting coronagraph- and starshade-related technology **demonstrations**
    - **Simulation** and **modeling** tools available
  - Disseminating new science and technology information and opportunities through **websites, newsletters,** and **webinars**

And in Conclusion…

We are APD's Program Offices …
… and we're here to help!

APD Program Mananagement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Additional Slides

Relevant Links

- Physics of the Cosmos https://pcos.gsfc.nasa.gov/
- Cosmic Origins https://cor.gsfc.nasa.gov/
- Exoplanet Exploration https://exoplanets.nasa.gov/exep/
- PhysPAG https://pcos.gsfc.nasa.gov/physpag/physpag.php
- COPAG https://cor.gsfc.nasa.gov/copag/community.php
- ExoPAG https://exoplanets.nasa.gov/exep/exopag/overview/
- Technology Database https://www.astrostrategictech.us/

Program Offices and Structures

Access to the science community

PO's provide organizational support to the independent Program Analysis Groups (PAGs)

- The PAGS are extremely valuable resources in engaging the community to work on NASA mission relevant topics
- Support SIGs, SAGs, STIGs
  - **SIGs (Science Interest Groups):** Galaxies, Stars, AGNs, Diffuse Gas in Cosmic Ecosystems, Cosmic Ray, Cosmic Structure, Gamma-Ray, Gravitational Wave, Time Domain and Multi-messenger (cross-PAG), Inflation Probe, X-ray, Exoplanets Community Plan, Exoplanet Demographics, Exoplanet/Solar System Synergies
  - **SAGs (Science Analysis Groups):** TDAMM comm, gamma-ray science, exo-zodiacal dust impact, complementary science value of starshade observations
  - **STIGs (Science & Technology Interest Groups):** UVSTIG, IRSTIG
- Support Cross-PAG SAGs
  - AWESOM (Astrophysics with Equity: Surmounting Obstacles to Membership)
  - New Great Observatories
- Support and advertise PAG meetings and events