PCOS Program Office Update

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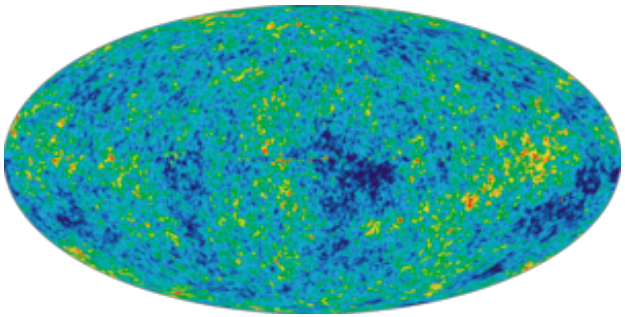
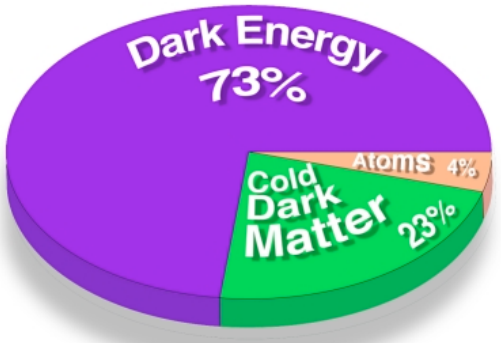
http://pcos.gsfc.nasa.gov

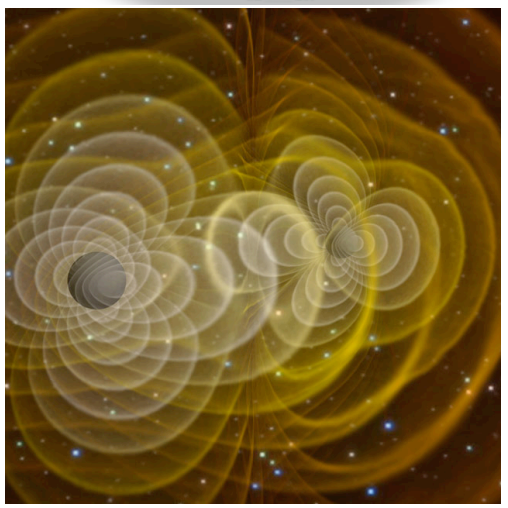
Chief Scientist: Ann Hornschemeier
HQ Program Executive: Lia LaPiana
HQ Program Scientist: Richard Griffiths
HQ Deputy Program Scientist: Wilt Sanders

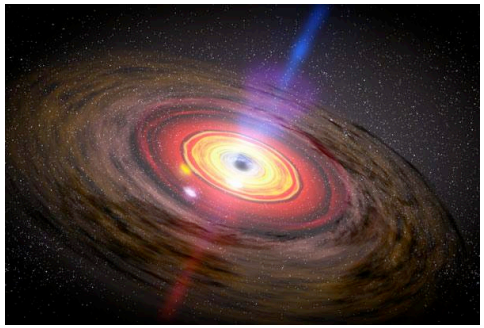


Physics of the Cosmos Science Objectives

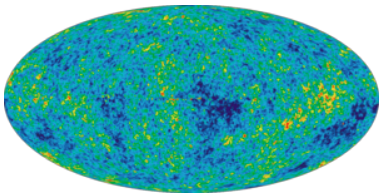


- Expand our knowledge of dark energy
- Precisely measure the cosmological parameters governing the evolution of the universe and test the inflation hypothesis of the Big Bang
- Test the validity of Einstein's General Theory of Relativity and investigate the nature of spacetime
- Understand the formation and growth of massive black holes and their role in the evolution of galaxies

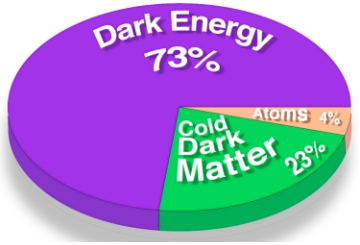




- Explore the behavior of matter and energy in its most extreme environments



Physics of the Cosmos
Activities by Science Discipline



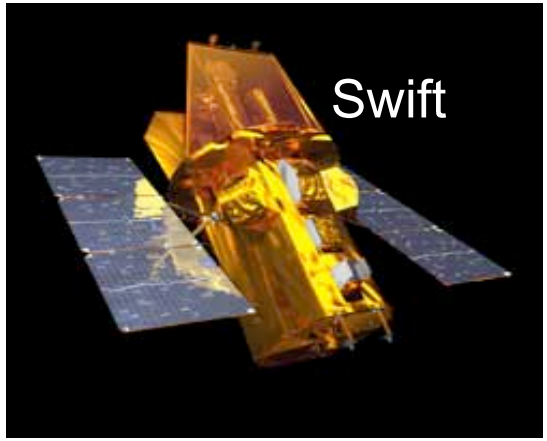
Science Area	Program Activity
Dark Energy	Euclid project Support for WFIRST DE
Inflation/Cosmology	IPSAG + plans for future study
General Relativity	GW Technology Development Plan ST7 and LISA PF + GWSAG
SMBH/Galaxy Evolution	X-ray Technology Development Plan + XRSAG
Behavior of matter under extreme environments	GammaSAG, CosmicSAG white papers in progress

- **Across all disciplines:**
  - Through HQ: TPCOS, the Strategic Astrophysics Technology (SAT) call
  - Technology monitoring and needs prioritization through PCOS Advanced Concepts and Technology Office
  - PAO and EPO activities support the program

PCOS Operating Missions

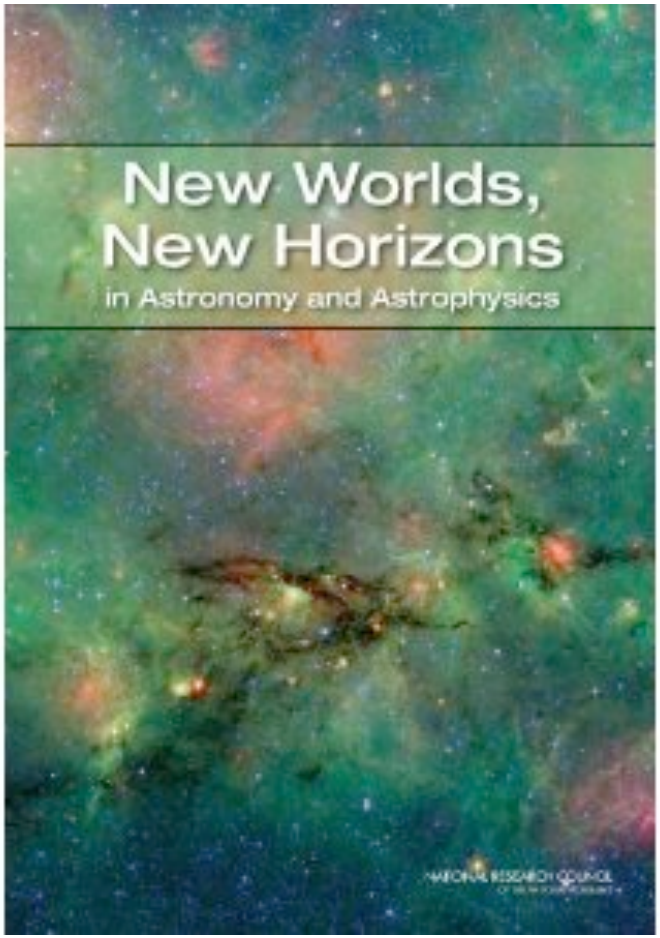
OPERATING

RELATED



Physics of the Cosmos (PCOS): Scientific and Technical Stewardship for future missions

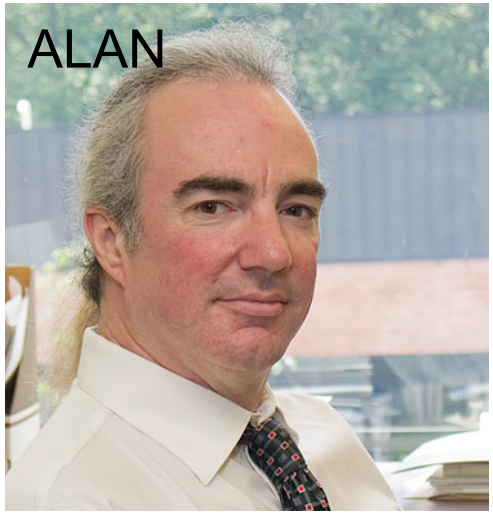
- **Provide scientific and technical stewardship for decadal-survey recommended missions…**
  - Of the six highly-ranked medium and large-scale space-based priorities in NWNH, THREE fall within the PCOS science program:
    - Inflation Probe (medium-scale)
    - LISA
    - IXO
    - NOTE: WFIRST is located within the Exoplanet Program and the science of dark energy is within PCOS
- **…within the framework of the NASA's Astrophysics Implementation Plan**



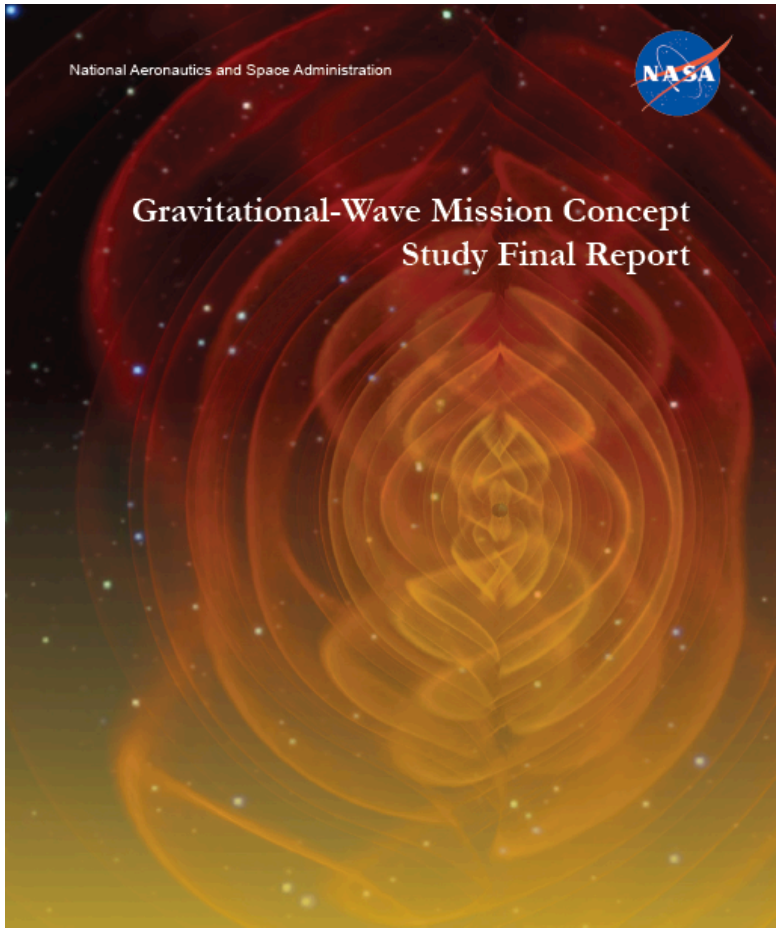
PCOS Program Office Leadership

- ** Program Manager: Mansoor Ahmed a.k.a. Mooni)
- ** Deputy PM: Tom Griffin
- ** Deputy PM: Mark Brumfield
- Chief Scientist: Ann Hornschemeier
- Deputy Chief Scientist: Alan Smale
- ** Chief Technologist: Mark Clampin
- ** ACTO Chief Technologist: Thai Pham

**** = Shared with COR, Cosmic Origins**



Gravitational Wave Study Report (Study scientist: Tuck Stebbins, Gravitational Wave Community Science Team co-chairs: Rai Weiss & Ned Wright)

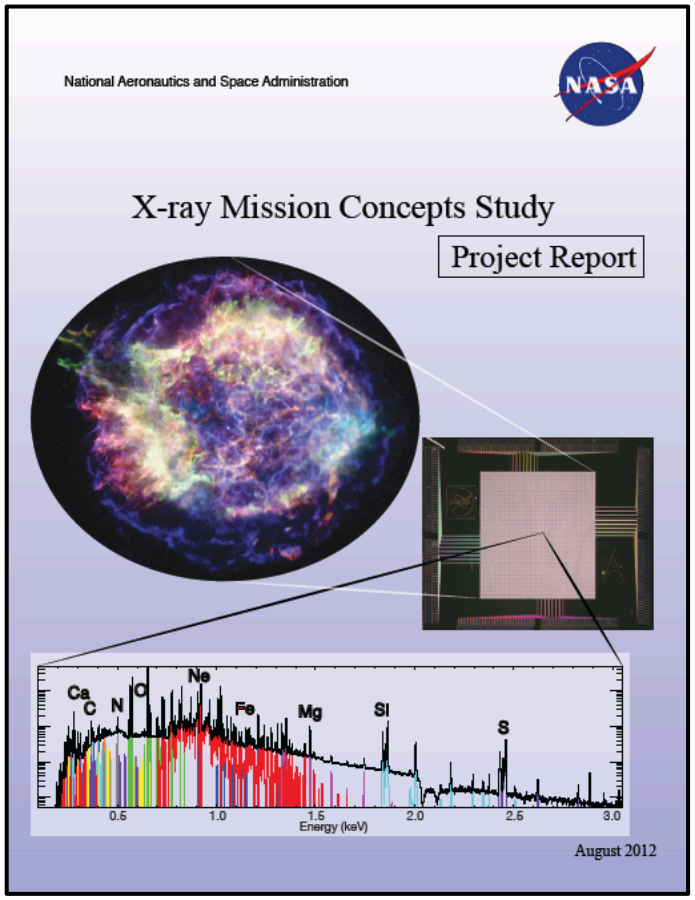


NB: Gravitational waves likely will be detected by LIGO before JWST launches

GENERAL FINDINGS

1. **Study did not uncover any new technologies that can make dramatic reductions in cost or risk**
2. **No concepts were found near or below $1B**
3. **A sustained and significant program supporting technology development and science studies is needed if the US is to participate in the first space-based gravitational mission.**

X-ray Mission Concepts Study Report (Study scientist: Rob Petre; X-ray Community Science Team Chair: Joel Bregman)



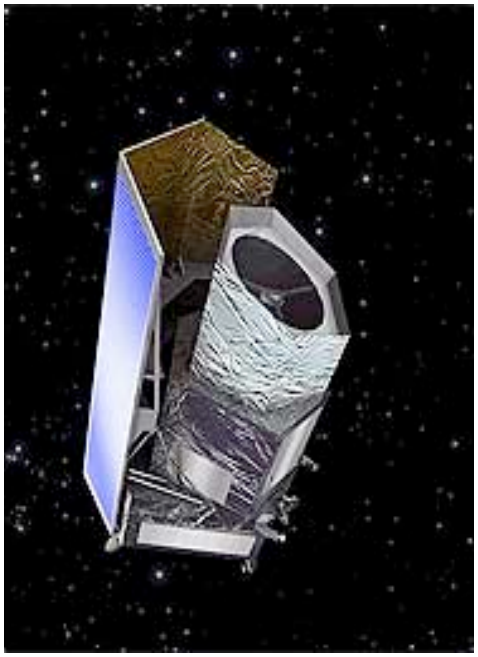
Report Bottom Line:

X-ray observatories in the $1B class that address all or most of the IXO science objectives are feasible for start within this decade, but only if technical risk is controlled through advance development of key technology to TRL-6

The notional missions that were studied were all in this cost range -- less than the current X-ray flagship missions (*Chandra, XMM*) -- yet will greatly outperform current missions in critical ways, producing breakthrough science around which the *IXO* concept was developed.

Euclid – NASA Contribution

HQ Program Executive: Lia LaPiana
HQ Program Scientist: Richard Griffiths



- NASA's contribution to ESA's Euclid mission:
  - Near Infrared Spectrograph and Photometer (NISP) flight subassemblies (detector + ASIC + cryo-cable = 'triplet') that meet ESA's requirements for testing & characterization.
  - NASA SMD DPMC Review on Dec 21st 2012 authorized Euclid Project to proceed into Phase B.
- NASA-ESA MOU expected to be signed early 2013.
- Euclid Project has been assigned to JPL under NASA's PCOS Program:
  - JPL Euclid Project Manager – Ulf Israelsson
  - JPL Euclid Project Scientist – Michael Seiffert
- PCOS Program Office: provides programmatic insight and oversight; worked with NASA HQ on tailoring NPR 7120.5 for Euclid; appointed the Independent Review Team; and provides the Euclid Mission Manager (Tom Griffin).
- NASA has nominated members to the Euclid Consortium. ESA will appoint them after the MOU is signed.

PCOS SAT Technologies Selected for Development Starting in FY12 for 2 Years

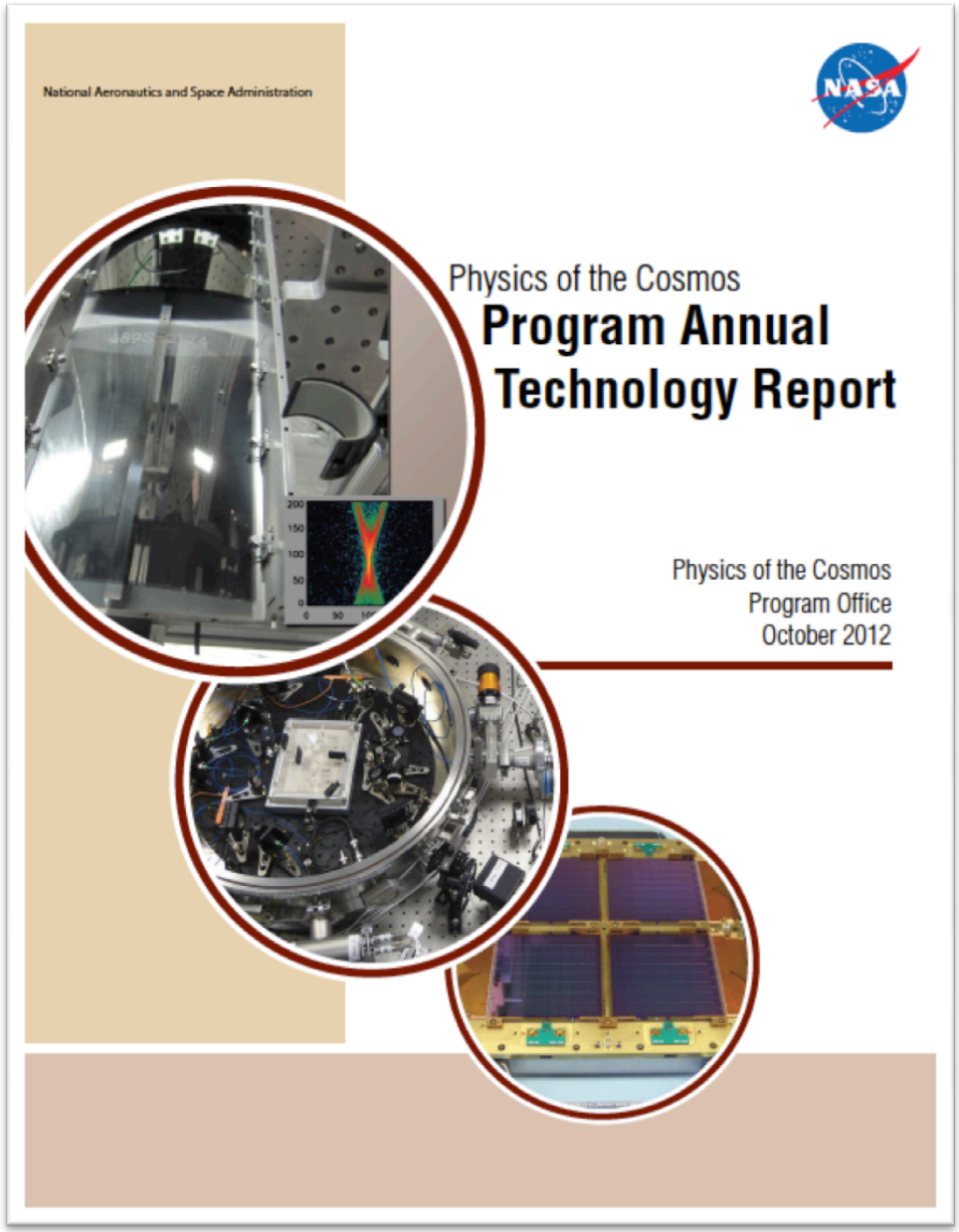
Title	PI	Institution	Area
Development of Fabrication Process for Critical-Angle X-ray Transmission Gratings	M. Schattenburg	MIT	X-ray
Antenna-Coupled Superconducting Detectors for Cosmic Microwave Background Polarimetry	J. Bock	JPL/ Caltech	Inflation
Directly-Deposited Blocking Filters for Imaging X-ray Detectors	M. Bautz	MIT	X-ray
Off-plane Grating Arrays for Future Missions	R. McEntaffer	University of Iowa	X-ray
Development of Moderate Angular Resolution Full Shell Electroplated Metal Grazing Incidence X-ray Optics	P. Reid	SAO	X-ray

PCOS SAT Technologies Selected for Development Starting in FY13 for 2 Years

Title	PI	Inst.	Area
Next generation X-ray Optics: High Resolution, Light Weight, and Low Cost (	W. Zhang	GSFC	X-ray
Demonstrating Enabling Technologies for the High-Resolution Imaging Spectrometer of the Next NASA X-ray Astronomy Mission	C. Kilbourne	GSFC	X-ray
Colloid Microthruster Propellant Feed System for Gravity Wave Astrophysics Missions	J. Ziemer	JPL	GW
Telescope for a Space-based Gravitational Wave Mission	J. Livas	GSFC	GW
Advanced Laser Frequency Stabilization Using Molecular Gasses (co-funded with OCT GCTP)	J. Lipa	Stanford	GW

Technology Prioritization

- The PCOS Program Annual Technology Report (PATR) describes the Program's technology management activities
- **The PATR defines priorities for technology investments for the upcoming year.** The technology needs are prioritized using a set of criteria (described in the report).
- The PCOS Program Analysis Group (PhysPAG) is the main conduit for collecting technology needs identified by the community. Technology needs were submitted following a community call in June 2012.



PCOS Technology Needs Prioritization From 2012 PATR (top 2 of 4 priorities)

Priority	PCOS Technology Needs	Science
1	Large format Mercury Cadmium Telluride CMOS IR detectors, 4K x 4K pixels	Dark Energy
	High-resolution X-ray microcalorimeter: central array (~1,000 pixels): 2.5 eV FWHM at 6 keV; extended array: 10 eV FWHM at 6 keV.	X-ray
	Dimensionally stable optical telescope: stringent length (pm) and alignment (nrad) stability with low straylight	Gravitational Wave
	Metrology laser: 10 yr life, frequency-stabilized , 2W, low noise, fast frequency and power actuators	Gravitational Wave
	Lightweight, replicatable x-ray optics	X-ray
	High resolution X-ray gratings (transmission or reflection)	X-ray
	Large format (1,000-10,000 pixels) arrays of CMB polarimeters with noise below the CMB photon noise and excellent control of systematics	Inflation
	Micronewton thrusters: 10 yr. life, low contamination, low thrust noise	Gravitational Wave
	Lightweight precision mirror mounting structure	X-ray
2	High throughput anti-reflection coatings with controlled polarization properties	Inflation
	Stable and continuous sub-Kelvin coolers for detectors	Inflation
	High-throughput, light, low-cost, cold, mm-wave telescope operating at low backgrounds	Inflation
	Polarization modulating optical elements	Inflation

2013 PCOS Technology Prioritization

- **For the 2012 PATR, 92 technology needs across the five scientific areas of PCOS were received from the PhysPAG.**

- **For 2013 the PCOS TMB and Program Office is conducting an evaluation of the process, incorporating lessons learned.**
  - The goal is to simplify the evaluation criteria and gain better definition of technologies.
  - The PCOS TMB and the Program Office will work with the SAGs and PhysPAG in this process.
  - More on this in Thai Pham's presentation later this morning: "Technology Input Process and Issues."

Communicating with NASA Astrophysics via the Program Analysis Groups (PAGs)

- The Physics of the Cosmos Program Analysis Group (PhysPAG) serves as a forum for soliciting and coordinating input and analysis from the scientific community in support of the PCOS program objectives.
- The Program Analysis Groups (PAGs) include all members of the community interested in providing input to NASA on issues of strategic importance via analysis studies.
- PAGs hold regular public meetings to provide their members the opportunity to hear about their work and voice their input.
- PAGs report to NASA via the NAC's Astrophysics subcommittee.
- PhysPAG Executive Committee (EC) members: S. Ritz (Chair), J. Bookbinder, S. Hanany, G. Mueller, E. Hays, J. Rhodes, A. Olinto.
- NB: The PhysPAG is more than the EC!

PhysPAG and SAGs

- **The PhysPAG identifies specific, well-defined topics for further detailed studies, and sets up taskforces of volunteers to perform the analysis – Study Analysis Groups (SAGs)**

- **PhysPAG has five SAGs in operation:**
  - Inflation Probe SAG (Chair: Shaul Hanany)
  - Gravitational Wave SAG (Chair: Guido Mueller)
  - X-ray SAG (Chair: Jay Bookbinder)
  - Gamma ray SAG (Chair: Liz Hays)
  - Cosmic Ray SAG (Chair: Angela Olinto)

PCOS/COR Education and Public Outreach

Award-winning Team

- Team members have won numerous awards, including NASA Exceptional Public Service Medal (2011), NASA Honor Awards (2009, 2011), Goddard Team Award for Outreach (2008), Goddard Honor Award for Outreach (2011) and ASD Peer Awards (2011, 2012)

Substantial Achievements

- AfterSchool Universe Program: 12-session astronomy program for middle-schoolers, has reached >12,000 children in 3 yrs; 900+ facilitators in 44 states + DC and Puerto Rico; 58 certified trainers
- Big Explosions & Strong Gravity: day-long Girl Scouts event has reached thousands of girls
- Blueshift Podcast/Blog: behind the scenes look at PCOS/COR science, missions, news, has 15,500+ Twitter followers; 3,000+ Facebook fans

Strong Future

- Continuing involvement/expansion of the above, plus:
- Space Forensics: the new cornerstone project of PCOS/COR EPO; presents astronomical mysteries in the style of crime scene investigations
  - Piloted in 2007 – Four cases currently under development – Standards-based classroom packages developed 2013-2014
  - Interactive website, traveling museum kiosk planned for future years
- Multiwavelength Universe Tour: video clips + online interactive photo studio to provide the public with a multiwavelength view of astronomical objects

Upcoming PCOS Community Interaction Opportunities

- **Here at the Long Beach AAS**
  - Monday: NASA PCOS Gravitational Wave and X-ray Astronomy Town Hall, 12:45-1:45pm, Room 104B
  - Monday: Poster session 153: NASA's PCOS Studies on Gravitational Wave and X-ray Mission Concepts
  - Wednesday: Session 310: Reports from NASA's Program Analysis Groups, 10:00-11:30am, Room 102C
  - PCOS Booth – drop by!
- **April 2013, HEAD meeting in Monterey**
  - PhysPAG/PCOS Town Hall
- **April 2013, APS (DAP) meeting in Denver**
  - PhysPAG/PCOS Town Hall
- **MORE INFO: pcos.gsfc.nasa.gov/physpag**