

PhysPAG

24 February 2012
NAC APS Report

Proposals shown in red

S. Ritz

See

<http://pcos.gsfc.nasa.gov/physpag.php>

Includes email sign-up for news and announcements. Reports from previous meetings, links to APS reports, ...

The screenshot shows the NASA National Aeronautics and Space Administration website for the Physics of the Cosmos Program Analysis Group (PhysPAG). The header includes the NASA logo and the text "National Aeronautics and Space Administration" and "Goddard Space Flight Center". Below the header is a navigation menu with tabs for OVERVIEW, PROJECTS, SCIENCE, TECHNOLOGY, STUDIES, and PROGRAM OFFICE. The main content area is titled "Physics of the Cosmos" and "PhysPAG". It features several sections: "Links" with a list of groups like PhysPAG, Inflation Probe Science Analysis Group, Technology Science Analysis Group, NASA Advisory Council, and Astrophysics Subcommittee; "Objective" describing the group's role in supporting the PCOS program; "Program News" with several announcements from October 2011 and September 2011 regarding membership applications and mission concepts; "Upcoming Meetings" for January 2012; "Past Meetings" for January and May 2011; "PhysPAG Announcements" with a sign-up link; "Executive Committee" listing members like Steve Ritz, Jason Rhodes, Shaull Hanany, Roger Brissenden, Liz Hays, and Guido Mueller; "Contact" information for Rita Sambruna; "Project News" with links to Chandra, Fermi, and Planck news; and "Related Missions" for XMM-Newton.

PCOS Science and Missions

- *Physics of the Cosmos spans the fields of high-energy astrophysics, cosmology, and fundamental physics, and includes a wide range of science goals. These include the following:*
 - **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**
 - **Study the origin and acceleration of cosmic rays**
 - **Particle Signals of Dark Matter**

The screenshot displays the NASA website for the Physics of the Cosmos program. At the top, the NASA logo and the text "National Aeronautics and Space Administration" are visible, along with the "Goddard Space Flight Center" and "Science and Exploration Division" and "Astrophysics Science Division" information. A navigation bar includes links for OVERVIEW, PROJECTS, SCIENCE, TECHNOLOGY, STUDIES, and PROGRAM OFFICE. The main heading is "Physics of the Cosmos" with a sub-heading "Projects".

Links

- Documents
- PhysPAG
- COR Program Office
- ExEP Office
- Multimedia Library
- Sign up for PCOS News and Announcements

Operating Missions

- Chandra X-ray Observatory**
Launch date: 23 July 1999
<http://chandra.harvard.edu/>
The Chandra X-ray Observatory, a NASA Great Observatory, provides the most detailed view to date of the X-ray universe. With its exquisite imaging capabilities and high spectral resolution scientists have investigated phenomena as diverse as the spectra of Jupiter's aurora, the effects of dark energy on the growth of galaxy clusters, and the properties of faint x-ray sources in deep fields.
- Fermi**
Launch date: 11 June 2008
<http://fermi.gsfc.nasa.gov/>
The Fermi Gamma-Ray Space Telescope (formerly GLAST) is providing our deepest and most detailed map of the gamma-ray sky. Fermi has recorded high-energy gamma rays produced by supernovae, pulsars, extreme flows of energy from systems powered by black holes, and gamma-ray bursts.
- Planck**
Launch date: 14 May 2009
<http://www.esa.int/SPECIALS/Planck/>
Planck Surveyor is an ESA-led mission that is making a precise, full-sky map of the Big Bang's cosmic microwave background (CMB). By measuring minute fluctuations in the CMB temperature and polarization at all angular scales, Planck will stringently test the theory of inflation, and will provide the most accurate information to date on the overall composition, shape, and early expansion history of the universe.
- XMM-Newton**
Launch date: 10 Dec 1999
<http://xmm.esac.esa.int/>
XMM-Newton, the X-ray Multi-Mirror Mission, is the second cornerstone of the ESA Horizon 2000 program. With high collecting area in the x-ray band, XMM provides vital information for studies of fundamental and relativistic processes from neutron stars and active galactic nuclei, the creation and dispersal of the elements in supernovae, the distribution of dark matter in clusters, groups, and elliptical galaxies, and young active stars to constrain models of the early solar system and star forming regions.

Program News

- 5 January 2012**
Draft Agenda for PhysPAG Meeting at AAS in Austin, Texas, is posted. » [Details](#)
- 21 December 2011**
X-ray Mission Workshop presentations are posted. » [Details](#)
- 1 December 2011**
Second issue of the Physics of the Cosmos Newsletter now available » [Details](#)
- 1 December 2011**
PCOS Program Annual Technology Report (PATR) now available » [Details](#)

Project News

- Chandra News**
17 November 2011
NASA's Chandra Adds to Black Hole Birth Announcement » [Details](#)
- Fermi News**
28 November 2011
In the Heart of Cygnus, NASA's Fermi Reveals A Cosmic-ray Cocoon » [Details](#)
- Planck News**
27 April 2011
Andromeda's coat of many colours » [Details](#)
- XMM-Newton News**
7 October 2011
XMM-Newton AD-11 Solicitation Closed » [Details](#)

Related Missions News

- RXTE News**
28 September 2011
RXTE Special Session at January 2012 AAS Meeting: Abstract Deadline » [Details](#)
- Suzaku News**
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Suzaku AD-7 Proposals Due on Nov 10, 2011 » [Details](#)
- Swift News**
25 October 2011
Now There's an App for NASA's Swift Observatory » [Details](#)

Previous Missions

Executive Committee

- Jay Bookbinder (CfA) **Nominee for NAC APS approval**
 - Shaul Hanany (Minnesota)
 - Liz Hays (GSFC)
 - Guido Mueller (UFL)
 - Jason Rhodes (JPL)
 - Steve Ritz (UCSC), chair
- PhysPAG is much, much more than the EC!
- MANY THANKS to Roger Brissenden for all his work on PhysPAG and the TechSAG!
 - Also many thanks to Jean Cottam Allen, and welcome to Ann Hornschemeier Cardiff.

physpag-ec@bigbang.gsfc.nasa.gov

8 January AAS Meeting Agenda

- Reports from HQ and the PCOS Program Office
- SAG reports and discussions
- Two Community Special Focus Sessions:
 - X-ray Opportunities in a Changing Landscape
 - GW Opportunities in a Changing Landscape
- New PhysPAG work
 - Gamma-ray SAG
 - X-ray SAG
 - GW SAG
- Where/when should PhysPAG be meeting?
 - continue to expand community participation
 - PCOS is not “a community”
- What’s missing?

Links

- [PhysPAG](#)
- [Inflation Probe Science Analysis Group](#)
- [Technology Science Analysis Group](#)
- [NASA Advisory Council](#)
- [Astrophysics Subcommittee](#)

Draft PhysPAG Meeting Agenda

Sunday 8 January 2012

Location: Room 10AB, Austin Convention Center

- 9:00 Room opens
- 9:30 Informal discussions, slides and wireless setup, etc.
- 10:00 Meeting start, introductions, etc. - Steve, all [PDF]
- 10:05 News from HQ - Rita et al (10+15) [PDF]
- 10:30 TechSAG
- + update - Roger (5) [PPTX]
 - + how TechSAG and IPSAG technology inputs are being used - Jackie (5) [PPTX]
 - + discussions, next steps - Roger, Jackie, all (10)
- 10:50 IPSAG
- + update and statement of issues- Jamie Bock (10)
 - + IP technology needs for mid-decade and overlap with x-ray, optical and sub-mm astrophysics - Kent Irwin (15) [PDF]
 - + discussion actions, statements - Jamie, all (10)
- 11:25 GammaSAG proposal and first steps - Liz, Julie McEnery, all (15) [PPT]
- 11:40-12:00 PCOS Program Office report, use of RFIs, etc. - Mooni (10+10) [PPTX]
- 12:00-13:00 break for lunch, informal discussions
- 13:00 Focus topic: X-ray opportunities in a changing landscape
- + NASA study, report from the December Workshop, and the X-ray mission landscape - Rob Petre (25+25)
 - + ATHENA plans - Nick White (20+5)
 - + Summary, actions, statements - Roger, all (15)
- 14:30-14:45 break
- 14:45 Focus topic: GW opportunities in a changing landscape
- + mHz GW Science as a function of sensitivity - Tyson Littenberg (20+5)
 - + Status of eLISA/NGO - Karsten Danzmann (20+5)
 - + Report on the RFI responses, workshop, and future plans - Tuck Stebbins (20 + 5)
 - + Summary, actions, statements - Guido, all (15)
- 16:15 AOB
- 16:30 Meeting summary, plans for next meetings - Steve, all [PDF]
- 17:00 adjourn

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Also held AAS 3-PAG Town Hall on 10 February

X-ray Study

X-ray Concepts Study



- **Objectives**
 - Determine the range of science objectives of IXO that can be achieved at a variety of lower cost points
 - Explore mission architectures and technical solutions that are fundamentally different from the heritage designs
 - Fully engage the community and ensure that all voices are heard, all perspectives considered
 - Create data for a report to the CAA that describes options for science return at multiple cost points for X-ray astronomy
- **Deliver final report to NASA HQ that:**
 - Describes and analyzes trade space of science return vs. mission cost
 - Summarizes the mission concepts developed during the study and how they relate to the trade space and other mission concepts that were not developed in a design lab
 - Summarizes the RFI responses and the workshop and describes how they were folded into the whole study

Talk by Rob Petre. Also talk on ATHENA by Nick White

January 8, 2012

PhysPAG - X-ray Concepts Study

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Town Hall Tuesday evening

Study Phases



- ✓ **Request for Information (RFI):** solicit ideas for missions and enabling technology. **29 responses received.**
- ✓ **Community Science Team (CST):** 10 members of the community selected by NASA HQ to serve as the study science team.
- ✓ **Workshop:** provide the community a forum to comment on concepts and technology and identify concepts for further study.
- ✓ **Notional Mission Selection:** Define up to three mission concepts at different cost points.
 - **Design Labs:** Study team develops concepts through mission design lab runs. Focus is on identifying the technical and cost drivers of each concept.
 - **Final Report:** Summarizes study activities and results for HQ and CAA. **Due to NASA HQ on June 7, 2012**

January 8, 2012

PhysPAG - X-ray Concepts Study

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Gravitational Wave Study



Goals of the Study

- Develop mission concepts that will accomplish some or all of the LISA science objectives at lower cost points.
- Explore alternative mission architectures and technical solutions (e.g., instrument concepts, enabling technologies).
- Assess the technical readiness and risk of the mission concepts, instruments and technologies.
- Report the options for science return at multiple cost points .

RFI Responses

- 17 responses total
 - 12 for mission concepts
 - 3 for instrument concepts
 - 2 for technologies
- Four natural groups
 - Non-drag-free concepts (2)
 - Geocentric orbits (4)
 - LISA-like (5)
 - Other (2)

Talk by Tuck Stebbins. Also talks on eLISA/NGO by Karsten Danzmann, and GW science by Tyson Littenberg

Summary



- Studying architecture choices and science and cost consequences to find lower alternate mission concepts.
- In the context of
 - The long history of LISA
 - The activities taking place today in Europe and the U.S., notably LISA Pathfinder
 - Decadals, NRC studies and reviews, past and future
 - The near term funding prospects
- The Core Team, Science task force, CST and Team-X are analyzing candidate mission concepts.
- **Town Hall: Tuesday, 8 pm, Room 18A**

Gravitational Wave Study

GW Science vs. mission requirements (Littenberg):

- Discussed the gain (or loss) of science with moderate mission changes
- MBH parameter estimations are fairly robust
 - Both polarizations (3 arms) are critical for
 - sky localization
 - luminosity distance (growth history)
- EMRIs have very little margin

GW mission study (Stebbins):

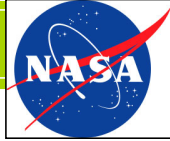
- Main goals:
 - Develop mission concepts
 - Explore alternative architectures to do some (all?) of the LISA science at lower cost points.
- RFI Responses:
 - 12 mission concepts, 3 instrument concepts, 2 new technologies
 - Now studied by Core Team, Science Task Force, CST, and Team X

Situation in Europe (Danzmann):

- LISA Pathfinder progresses well
 - Launch 2014
- eLISA/SGO mission concept:
 - Reduced arm length (factor 5)
 - Only 2 arms
 - Different orbit & different launcher
 - Shorter minimum mission lifetime
 - Reduce cost by re-using LISA Pathfinder

Strongly emphasized the possibility for a future collaboration





The Inflation Probe Science Analysis Group

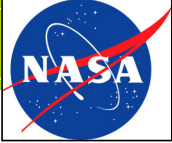
Technology Plan for the 2010-20 Decade

Jamie Bock (JPL/Caltech)
Kent Irwin (NIST)

With contributions from

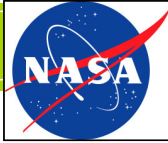
Todd Gaier (JPL)
Shaul Hanany (U. Minnesota)
Adrian Lee (UC Berkeley)
Steve Meyer (U. Chicago)
Harvey Moseley (GSFC)

PhysPAG Meeting, AAS @ Austin, TX
8 January 2012

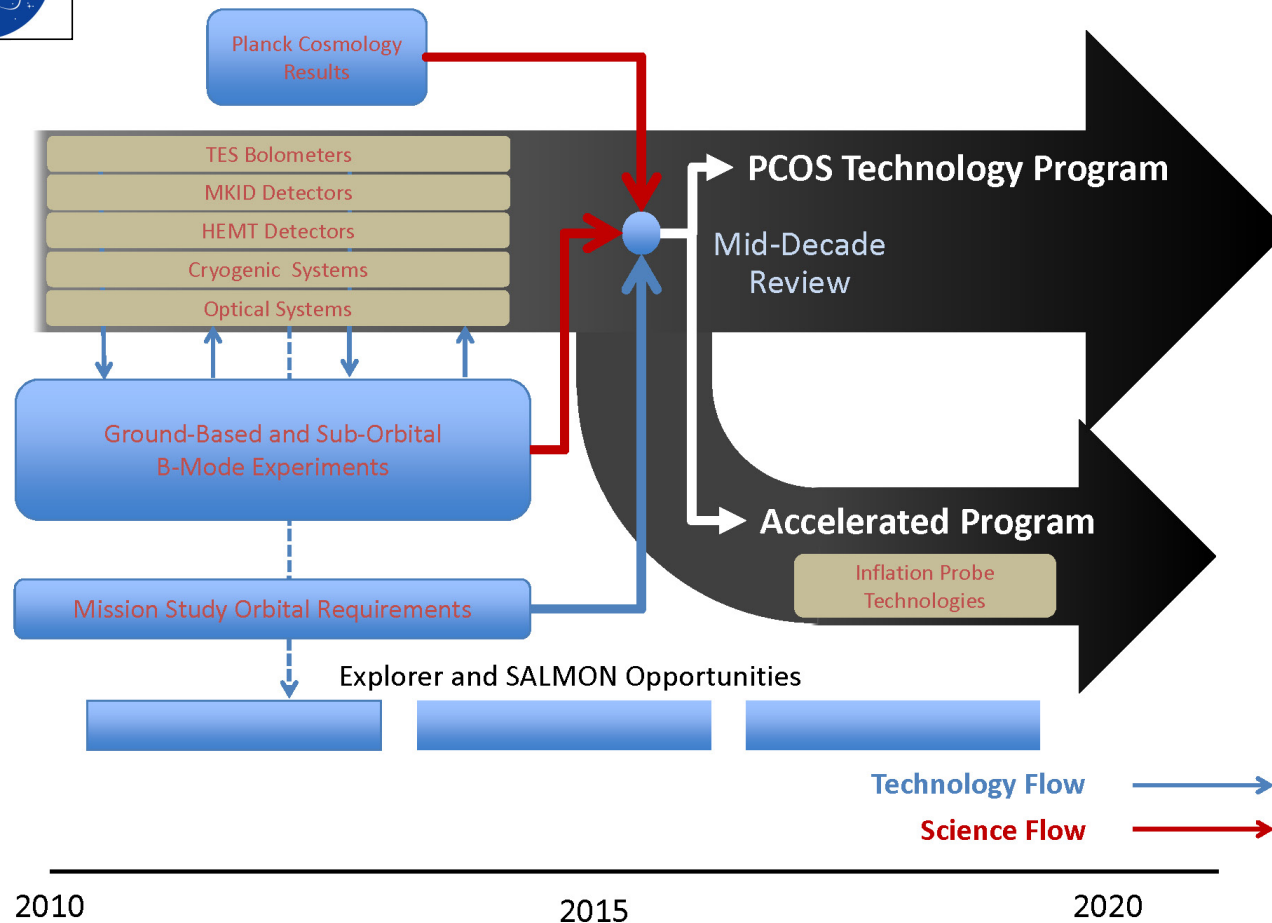


The Inflation Probe Science Analysis Group

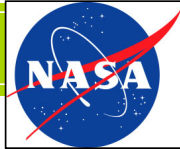
- Participation:** Open to all members of the astrophysics community
Currently 50 registered plus 10 unregistered participants
Includes Astro2010 Inflation Probe study team members
Reports to the PhysPAG via Shaul Hanany
Active participation from NASA's PCOS office
- Role:** Open community input to Inflation Probe planning
- science goals following developments in the field
 - mission planning for foreground removal, systematic errors
 - technology development and prioritization
- Communication:** Open invitation issued March 2011
Email list
Website: <http://pcos.gsfc.nasa.gov/sags/ipsag.php>
Telecons to date: April and November 2011
- Planning Docs:** *CMB Technology Roadmap for the NASA Inflation Probe*, Sept. 2011



Timeline for the Decade



CMB community plan presented to the Decadal → Reflected in Astro2010 report



The Inflation Probe Technology Roadmap

Technology	Priority	Timescale	Candidates	TRL
Detector Arrays	High	Current experiments	TES+SQUID+Antenna HEMT / MMIC	4-5
Optics	Medium	Current experiments	Polarization modulators AR coatings	2-5
Coolers	Low	Develop for space	Passive+mechanical+sub-K	3-9
Advanced Arrays		Develop for simplified space implementation. Connects to X-ray, far-IR and optical astronomy	MKID+RF resonator TES+RF resonator	3

- Time is short to the mid-decadal review, and significant work remains
- Ground-based and suborbital missions are critical to probe for an inflationary B-mode signal, and to mature technology options.
- However, significant advances specific to a satellite are needed: sensitivity, wavelength coverage, statistics and systematics, and cosmic-ray rejection.
- An additional concerted effort is required now to be prepared for the detection of hints of B-modes, and the likely high prioritization of a satellite that would follow.

8 January Meeting Results (1)

- IPSAG

- *The PhysPAG very much appreciates the excellent work on the science and technology developments necessary for defining the Inflation Probe mission featured in the NWNH Decadal Survey. The NWNH report recommended a mid-decade review to evaluate the evolving scientific case and technology readiness of the Inflation Probe mission. The current budget situation endangers readiness for this review.*

8 January Meeting Results (2)

- Overall statement to NAC APS:
 - *Scientifically and technically, PCOS opportunities continue to be extremely exciting. In all areas of PCOS science discussed, the very limited and uncertain budget situation severely reduces the program developed in connection with the NWNH Decadal Survey. New focal points are needed for community organization, beyond the current studies.*
 - *Proposing new SAGs (see following slides)*
- **TechSAG and Communication SAG work moves to new SAGs.**
 - The EC will coordinate across groups as needed, including for the annual refresh of the tech plan and to help ensure completeness in areas not covered by the SAGs.

8 January Meeting Results (3)

- **X-ray SAG Proposal**

- Role: Enable community discussion and input for future X-ray mission planning, with a focus on the capabilities to meet NWNH objectives. Ensure timely community-NASA communication.
- Timing: operating on the timescale of the completion of the current study, to ensure a smooth transition, and as planning for the European-led ATHENA mission progresses.
- Tasks:
 1. Track and analyze science goals and requirements in X-ray astrophysics in a rapidly evolving international scientific and programmatic landscape.
 2. Provide an active communication forum for X-ray astrophysics via regular telecons, a wiki/website, and (at least) annual town halls and workshops in well-attended venues.
 3. Foster mission concept studies and discussions, considering missions and capabilities at a variety of cost points.
 4. Analyze and prioritize X-ray astrophysics technology development. Post online for comment and provide to PCOS Program Office.

8 January Meeting Results (4)

- **GW SAG Proposal**

- Role: Enable community discussion and input for future GW mission planning, with a focus on the capabilities to meet NWNH objectives. Ensure timely community-NASA communication.
- Timing: operating on the timescale of the completion of the current study, to ensure a smooth transition, and as planning for the European-led eLISA/NGO mission progresses.
- Tasks:
 1. Track and analyze science goals and requirements in GW astrophysics in a rapidly evolving international scientific and programmatic landscape.
 2. Provide an active communication forum for GW astrophysics via regular telecons, a wiki/website, and (at least) annual town halls and workshops in well-attended venues.
 3. Foster mission concept studies and discussions, considering missions and capabilities at a variety of cost points.
 4. Analyze and prioritize space-based GW astrophysics technology development. Post online for comment and provide to PCOS Program Office.

New Gamma SAG Proposal

- Provide an assessment to NASA HQ and the PCOS program office of the current status and the current and future needs of the gamma-ray astrophysics community.
- Act as a focal point and forum for the gamma-ray community.
- Deliverables
 - White paper briefly surveying current state-of-the-art capabilities, major open science questions, reasonable possibilities for leaps in capabilities over the next 10-15 years, and possible science return corresponding to those capabilities. The paper would separately cover the techniques used in each gamma-ray band and both balloon and satellite platforms. A summary of ground-based very-high energy instruments will be included to set context.
 - List of technology development needs based on the white paper discussions with possible timelines
 - Suggestions to help support the specific needs of this community: organizational, scientific, funding.

Next Meetings

- additional community outreach at relevant meetings
- informational presence at April APS this year only
- planning a three-day jamboree meeting in D.C. that includes reports from the X-ray and GW study teams, followed by face-to-face/startup meetings of the three new SAGs. Additional special focus sessions under discussion, including space-based Dark Energy studies. *Likely time is the week of 13 August.*
- Looking forward to 2013:
 - meet again at January AAS
 - American Physical Society Meeting and HEAD meeting: a full PhysPAG meeting at one and a more targeted town hall at the other, TBD.
 - SAG meetings and further community outreach
- Will also continue to help with PCOS outreach materials, including regular newsletter and flyers.

Thanks

- *Thanks to all SAG members for their hard work and the PCOS office for their support*
- *Thanks to all the speakers and organizers for the productive January meeting*

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Discussion, Q&A

- Proposals:
 - New EC member
 - New X-ray, GW, and Gamma SAGs
 - TechSAG activities to move to new SAGs, with cross-group coordination for annual PCOS technology input coordinated by the EC
- Two statements to note (slides 12 and 13)