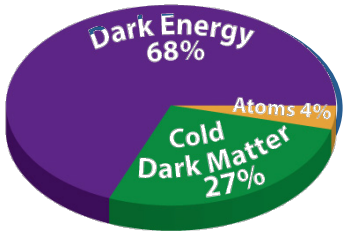
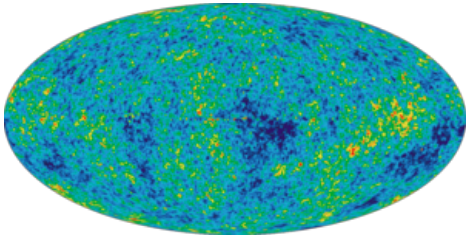
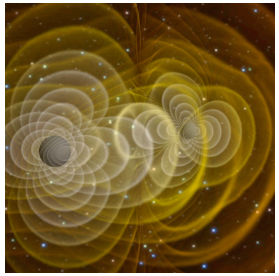
Overview

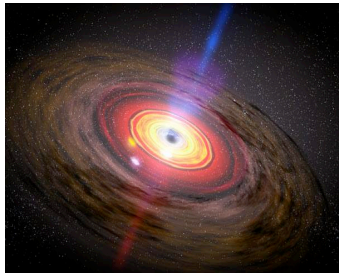
- **Introduction to PhysPAG**
- **High-impact research assessment**
- **Highlights and near-term activities**

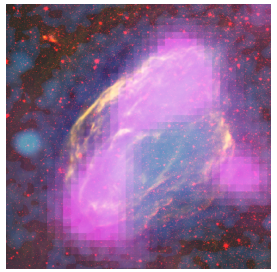
Physics of the Cosmos Science Objectives





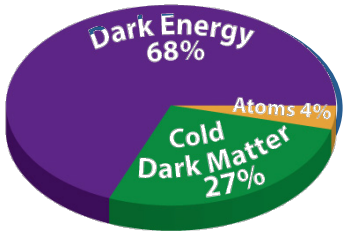


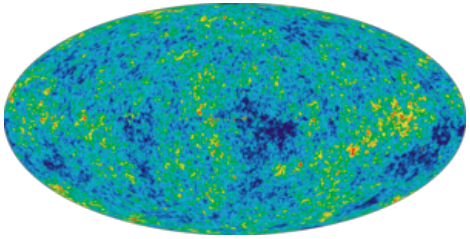


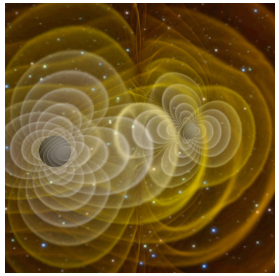


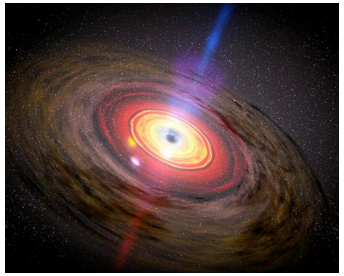
- Increase our knowledge of dark energy
- Precisely measure the cosmological parameters governing the evolution of the universe and test the inflation hypothesis of the Big Bang
- Test the validity of Einstein's General Theory of Relativity and investigate the nature of spacetime
- Understand the formation 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

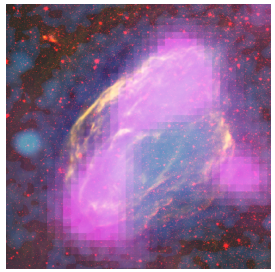
Physics of the Cosmos Program Analysis Group











Six Science Interest Groups (SIGs):

- Cosmic Rays (CR SIG)
- Cosmic Structure (CosSIG)
- Gamma-ray Astrophysics (Gamma SIG)
- Gravitational Waves (GWSIG)
- Inflation Probe (IPSIG)
- X-ray Astrophysics (X-Ray SIG)

High-impact research: PhysPAG EC Discussion

In July, 2017, APAC received charge to

'Review NASA SMD R&A Methods to Foster High-Impact Research'

- **PhysPAG EC convened in September to discuss this charge**
- **Discussion featured participation by**
  - Dan Evans, Lead for Astrophysics Research, NASA HQ
  - Rita Sambruna & Thomas Hams, PCOS Program Scientists, NASA HQ
  - Ann Hornschemeier & Terri Brandt, PCOS Chief Scientists, GSFC

High-impact research charge

From Dan Evans Briefing, adapted from Michael New's briefing to SMD Advisory Committees :

Two questions to be asked of the ACs

Does the SMD R&A program have effective processes in place to solicit, review and select high-impact/high-risk projects?

PhysPAG EC Discussion

Does the SMD R&A program have effective processes in place to solicit, review and select focused, interdisciplinary, and interdivisional projects?

High-impact research charge

From Dan Evans Briefing, adapted from Michael New's briefing to SMD Advisory Committees :

Naturally, there are sub-questions

For high-impact/high-risk research:

a) What is your committee's working definition of a high-impact project? A high-risk project?

b) Are there aspects of the solicitation, review and selection process that could be added, removed or modified that would allow SMD to more effectively elicit and support high-risk/high-impact projects or, is the current practice of soliciting by topic and evaluation for merit followed by flagging high-impact/high-risk projects for the selection official adequate?

c) If it were to be recommended that solicitations or evaluation methods be modified for high-impact/high-risk projects, how should these be designed?

d) Acknowledging the value of incremental progress on achieving strategic objectives, and thus recognizing that much of the research that SMD supports will be of moderate impact, how should SMD determine the correct balance between moderate impact research and high-impact/high-risk research?

PhysPAG EC Discussion

High-impact research (HIR) discussion 1/2

PhysPAG EC Consensus

- **Effective solicitation of HIR would require dedicated solicitations**
  - HIR proposals must be evaluated separately from those for 'moderate impact' (more conventional) research
- **Given fixed R&A budgets, allocation of a fixed fraction (~10%) or fixed $ total of R&A resources to HIR would be appropriate**
- **STMD's NASA Innovative Advanced Concepts (NIAC) program is a model that should be evaluated for relevance to Astrophysics HIR solicitation**

High-impact research discussion: NIAC model

From NASA STMD web page:

"NIAC Phase I studies are focused on early studies of visionary concepts. Proposals must be:

- Aerospace architecture, mission, or system concepts
- Revolutionary, yet technically substantiated
- Very early development (TRL 1-2 or early 3; aiming 10+ years out)
- To be analyzed in a mission context"

NIAC Phase I solicitations are a two-step process

- Step A: 3-page white paper plus summary chart.
- Step B: Full proposal only if invited after Step A review

High-impact research discussion 2/2

Other results from PhysPAG EC discussion:

- **Very few PhysPAG EC members admitted to having submitted 'high-risk/ high-impact' proposals**
- **It was suggested that broader community input could readily be obtained via web survey. Example questions (after T.J. Brandt):**
  - Have you considered proposing a high-impact/high-risk project to NASA?
  - Does NASA provide you sufficient opportunities to propose high-impact / high-risk research?
  - Would you like to see more funding opportunities for high-impact/ high-risk given a fixed total budget?
- **LIGO was noted as an example of high-risk/high-impact research**
  - Fraction of NSF PHYS resources devoted to LIGO may, alas, be unknowable
- **Concern was expressed by some that NASA's risk aversion may have had large and unrecognized opportunity costs.**
  - Possible example: LISA

Other PhysPAG Highlights

- **ISS-Cream launched August 14!**
- **AAS/HEAD meeting August 20-24 in Sun Valley featured:**
  - PCOS Town Hall, X-ray & Gamma-SIG meetings
  - Special sessions on LISA/GW, NICER first results, X- and Gamma-ray polarimetry, and cosmic-ray feedback
- **Call for XARM Participating Scientists released September 12**
- **LISA Study Team has been appointed**
  - 1st meeting November 16-17
- **2017 PCOS Annual Technology Report released October 2**
- **Call for PhysPAG EC members released (closed Oct 16)**
- **Breakthrough results announced October 16**

PCOS Transitions

- **Legendary PCOS Chief Scientist Ann Hornschemeier stepped down on October 1**

- **Ann has been a force of nature, a sardonic wit, and an engine of PCOS progress for many years. PhysPAG owes her more than we'll ever know, and we thank her for her service.**

- **Terri Brandt, Acting PCOS Chief Scientist, has hit the ground running. We look forward to working with her.**

PhysPAG EC membership

New members as of January 2017

Name	Affiliation	Area of Expertise	Term Ends
M. Bautz (Chair)	MIT	X-ray astrophysics	Dec 2017
R. Bean	Cornell University	Dark energy	Dec 2017
J. Beatty	Ohio State University	Particle astrophysics	Dec 2019
J. Conklin (Vice Chair)	Univ. of Florida	Gravitational waves	Dec 2017
O. Doré	JPL	Dark energy	Dec 2017
S. Guiriec	George Washington University	Gamma-ray astrophysics	Dec 2019
K. Holley-Bockelmann	Vanderbilt University	Gravitational waves	Dec 2019
R. Kraft	SAO	X-ray astrophysics	Dec 2018
H. Krawczynski	Washington University	Gamma-ray astrophysics	Dec 2017
A. Miller	Columbia University	CMB	Dec 2017
I. Moskalenko	Stanford University	Particle astrophysics	Dec 2018
J. Tomsick	UC Berkeley	X-ray and Gamma-ray astrophysics	Dec 2019
E. Wollack	NASA/GSFC	CMB	Dec 2017