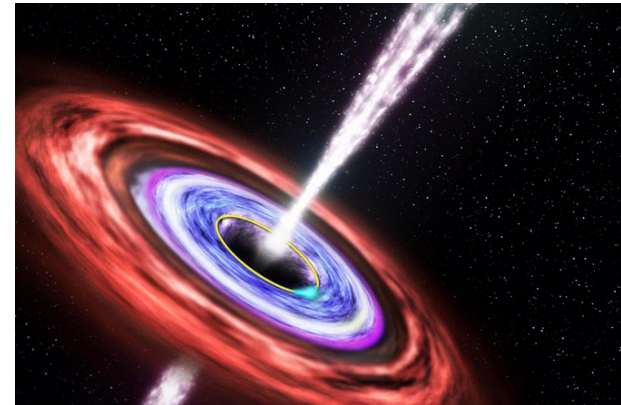
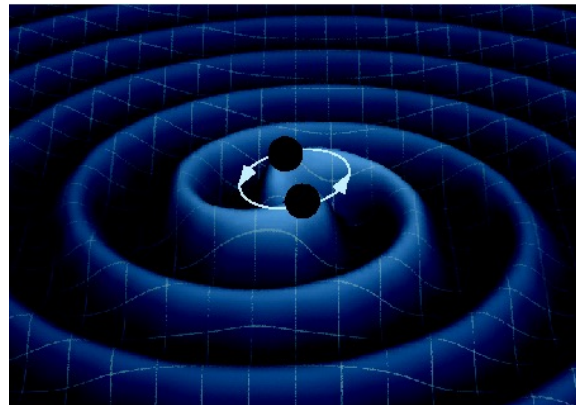
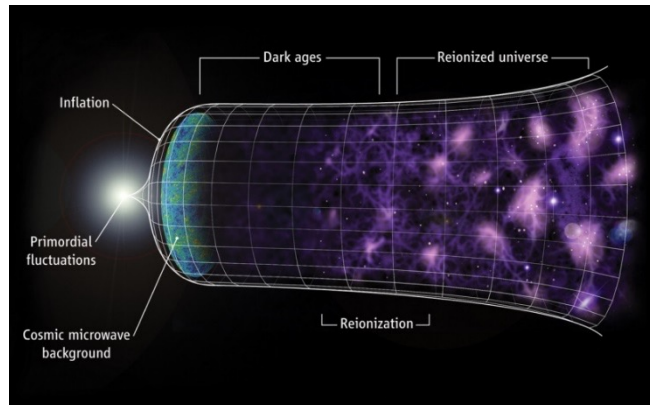
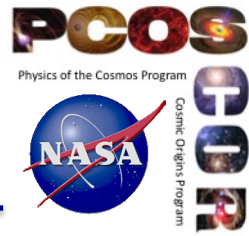


# Physics of the Cosmos Program Analysis Group Report



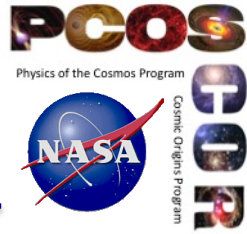
**Ryan Hickox**

Dartmouth College  
*Chair, Physics of the Cosmos Program Analysis Group, PhysPAG*  
*ryan.c.hickox@dartmouth.edu*

*Astrophysics Advisory Committee Meeting, 15 October 2021*

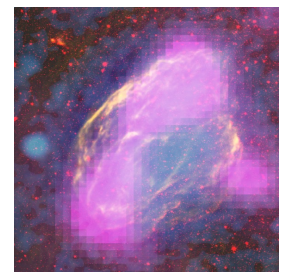
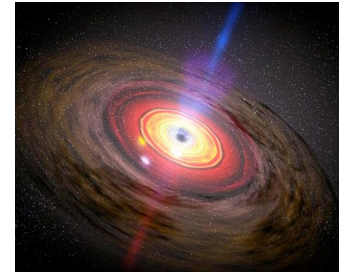
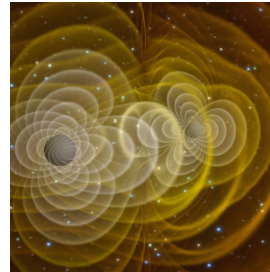
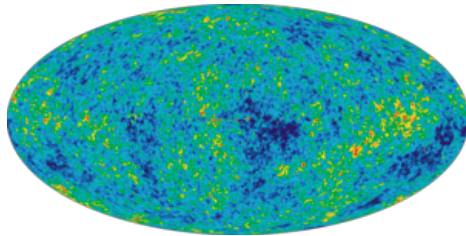
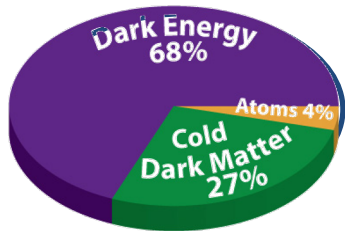
# Outline

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- **Introduction to PhysPAG**
- **Anticipation of Astro2020 Decadal Survey**
- **Physics of the Cosmos Discovery Series**
- **Expanding Participation in the NASA Astrophysics Community**
- **Upcoming PhysPAG/SIG Meetings and Activities**

# Physics of the Cosmos Science Objectives



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

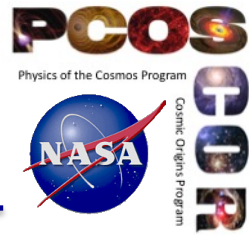
## Science Analysis Groups (SAGs)

- **Multimessenger Astrophysics** (MMA SAG) (Chairs: Kevin Huffenberger): Analyze the potential scientific benefits of multimessenger observations made possible by NASA observatories in the 2020 decade and beyond, working in conjunction with each other or with other ground and space-based instruments.

## Science Interest Groups (SIGs)

- **Inflation Probe** (IP SIG) (Chairs: Kevin Huffenberger and Graça Rocha): Coordinate community activities and preparations for a future cosmic microwave background polarization mission.
- **Gravitational Wave** (GW SIG) (Chairs: Jillian Bellovary and Sean McWilliams): Coordinate community activities and preparations for a future gravitational wave mission.
- **X-ray** (XR SIG) (Chairs: Ryan Hickox, Jillian Bellovary, and Grant Tremblay): Coordinate community activities and preparations for a future X-ray astronomy mission.
- **Gamma Ray** (GR SIG or GammaSIG) (Chairs: Marcos Santander, Bindu Rani, and Justin Finke): Coordinate community activities and preparations for a future gamma ray astronomy mission.
- **Cosmic Ray** (CR SIG) (Chairs: Marcos Santander and Andrew Romero-Wolf): Coordinate community activities and preparations for a future cosmic ray astronomy mission.
- **Cosmic Structure** (CoS SIG) (Chairs: Kevin Huffenberger, Graça Rocha, and Vera Gluscevic): Coordinate community activities for future space activities concerning the nature of dark energy, dark matter, neutrinos, and tests of inflation, as well as astrophysical galaxy evolution.

# PhysPAG EC Membership

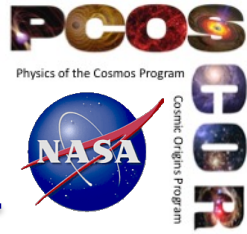


Name	Affiliation	Area of Expertise	Term Ends
Graça Rocha (Chair Emeritus)	JPL/Caltech	GW SIG	Dec 2021
Ryan Hickox (Chair)	Dartmouth College	XR SIG	Dec 2021
Marcos Santander	Univ. of Alabama	CR SIG / GR SIG	Dec 2021
Jillian Bellovary	Queensborough Comm Coll.	GW SIG / XR SIG	Dec 2022
Sean McWilliams	WVU	GW SIG	Dec 2022
Bindu Rani	SURA, GSFC	GR SIG	Dec 2022
Grant Tremblay (Vice-Chair)	SAO	XR SIG	Dec 2022
Justin Finke	NRL	GR SIG	Dec 2023
Vera Glusevic	Univ. of Southern California	CoS SIG	Dec 2023
Andres Romero-Wolf	JPL	CR SIG	Dec 2023

- **PhysPAG EC nominations are now open!** Please nominate promising candidates, and feel free to contact us with any questions (Ryan.C.Hickox@dartmouth.edu)

# Anticipation of Astro2020 Decadal Survey

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PhysPAG eagerly anticipates the release of the Astro2020 Decadal Survey report

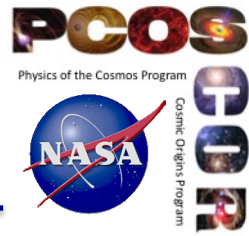
Continued discussion of efforts on **cross-cutting technologies** and **data analysis frameworks** will proceed once survey is released

In coordination with other PAGs, aim is to host a discussion with the community after the release of the report to determine how the **PhysPAG can best support the survey recommendations**



# Physics of the Cosmos Discovery Series

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We are formulating a plan for **monthly virtual meetings of the PCOS** community including research seminars given by PCOS members. Inspired on successful virtual seminar series organized by PAGs and other groups (e.g., AAS HEAD).

Aims are:

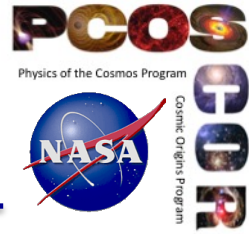
1. Bring together the diverse PCOS community more frequently than at conferences
2. Highlight outstanding research from PCOS members, with a particular focus on early-career scientists and researchers from historically marginalized groups and/or institutions

**”Discovery Series”** would include:

1. Update from the PhysPAG EC
2. 1-2 talks solicited from members of the PhysPAG community
3. Opportunities for discussion on relevant news and topics

# Expanding Participation in the NASA Astrophysics Community

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## Proposed Cross-PAG SAG on Expanding Participation in NASA Astrophysics

*Proposed SAG Name: Astrophysics With Equity: Surmounting Obstacles to Membership (AWESOM)*

- **Draft Terms of Reference were presented to the Meeting of Experts in June 2021.**

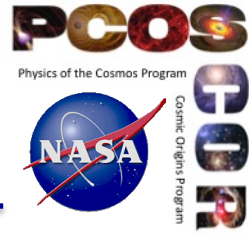
### Feedback from MOE:

- The **aims of the effort be more proactive** rather than gathering information
  - The group will focus more on collaboration with ongoing efforts within NASA (e.g., R&A DEI Task Force) on how to maximize participation in NASA Astrophysics research
- The effort should **align with recommendations from Astro2020** regarding State of the Profession
  - The group will meet and discuss soon after the release of the Astro2020 report



# Expanding Participation in the NASA Astrophysics Community

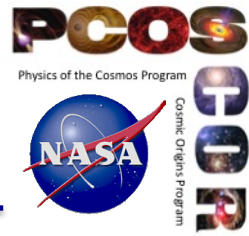
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Conference sessions on engagement with NASA Astrophysics:

- **SACNAS Diversity in STEM meeting, 25-29 October 2021**
  - PhysPAG proposal for session on “Exploring the Universe with the NASA Astrophysics Community”, including talks from all three NASA science programs
  - Talks recorded September 2021, live Q&A will happen during the virtual session
- **National Society of Black Physicists Conference, 4-7 November 2021**
  - Similar session being planned by PhysPAG, COPAG, and ExoPAG

# Expanding Participation in the NASA Astrophysics Community



## Exploring the Universe with the NASA Astrophysics Community

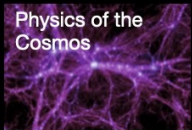
SACNAS National Diversity in STEM Conference, 25 October 2021



Chair: **Prof. Ryan Hickox** (Dartmouth College; Chair of NASA's Physics of the Cosmos Program Analysis Group)



**Dr. Ronald Gamble** (NASA Goddard Space Flight Center)  
Exploring the Universe with the NASA Astrophysics Community



**Prof. Jorge Moreno** (Pomona College)  
*How does the Universe work?* Formation of cosmic structure



**Dr. Janice Lee** (Gemini Observatory Chief Scientist, NSF's OIRLab)  
*How did we get here?* Formation of stars in galaxies



**Dr. Natasha Batalha** (NASA Ames Research Center)  
*Are we alone?* Characterization of extrasolar planets

Image Credits: NASA/M. Vogelsberger/J. Lee

# Upcoming Meetings and Activities

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- **Winter AAS, January 2022, Salt Lake City**
  - Will have **five SIG sessions** plus **one Town Hall**
- **Spring APS**

Will have multiple SIG sessions plus one Town Hall on “Astro2020 and a new era of discovery” (Invited speaker Erin Kara, MIT, APS Astro Chair)
- **Regular meetings of PhysPAG EC, SIGs, organization of potential SAGs, and planned Discovery Series**