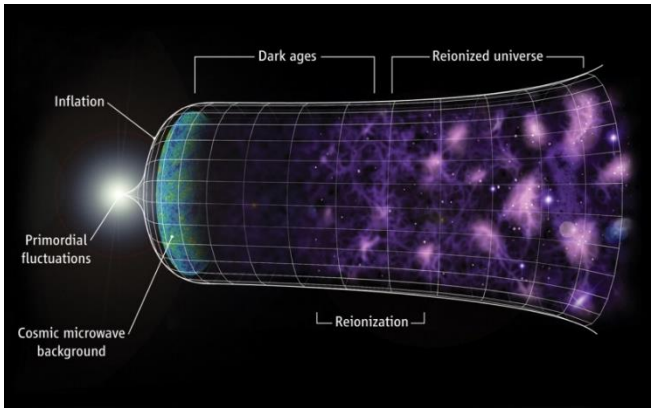
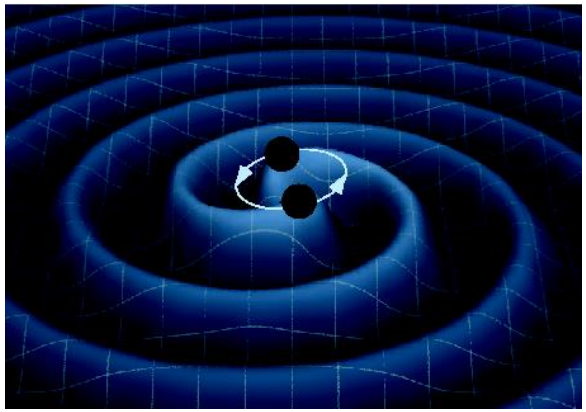
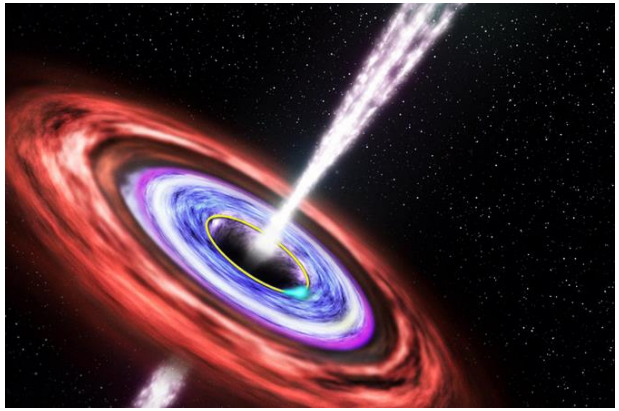
Physics of the Cosmos Program Analysis Group Report







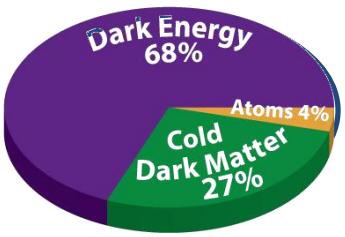
John W. Conklin
University of Florida (jwconklin@ufl.edu)
Chair, Physics of the Cosmos Program Analysis Group

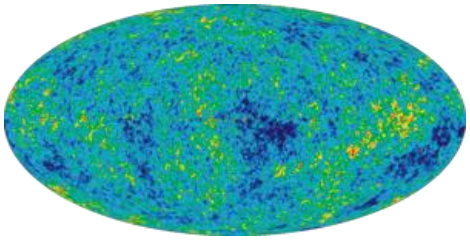
11 April 2018

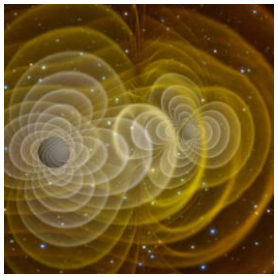
Overview

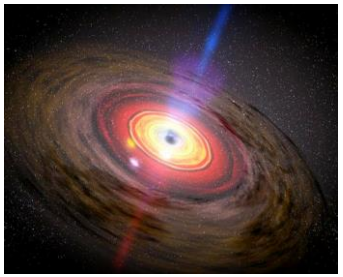
- **Introduction to PhysPAG (reminder)**
- **High-impact research assessment**
- **Multimessenger Astrophysics SAG**
  - A proposal to APAC
- **Highlights and near-term activities**

Physics of the Cosmos Science Objectives



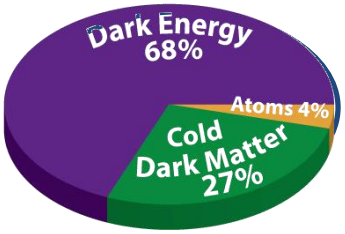


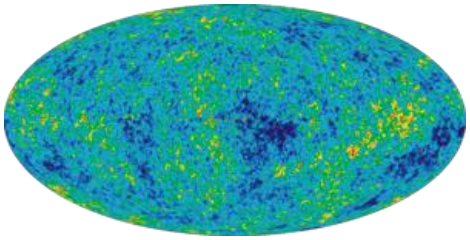


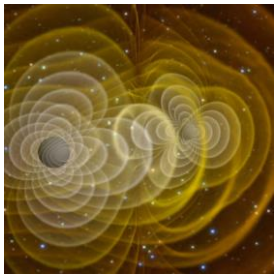


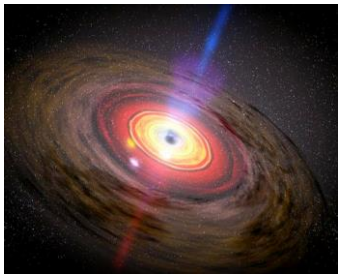
- **Increase our knowledge of dark energy**
- **Precisely measure cosmological parameters governing evolution of the universe and test inflation hypothesis of Big Bang**
- **Test validity of Einstein's General Theory of Relativity and investigate nature of spacetime**
- **Understand formation and growth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

Physics of the Cosmos Program Analysis Group









- **Six Science Interest Groups (SIGs):**
  - Cosmic Rays (CRSIG)
  - Cosmic Structure (CoSSIG)
  - Gamma-ray Astrophysics (GammaSIG)
  - Gravitational Waves (GWSIG)
  - Inflation Probe (IPSIG)
  - X-ray Astrophysics (X-RaySIG)

PhysPAG EC membership

*New members as of January 2017

Name	Affiliation	Area of Expertise	Term Ends
Mark Bautz (former chair)	MIT	X-RaySIG	March 2018
John Conklin (Chair)	Univ. of Florida	GWSIG	December 2019
Jim Beatty	Ohio State Univ.	CRSIG	December 2019
Sylvain Guiriec	George Washington Univ.	GammaSIG	December 2019
Kelly Holley-Bockelmann	Vanderbilt Univ.	GWSIG	December 2019
Kevin Huffenberger	Florida State Univ.	CoSSIG/IPSIG	December 2020
Ralph Kraft	SAO	X-RaySIG	December 2018
Henric Krawczynski	Washington Univ. in St. Louis	GammaSIG	December 2018
Igor Moskalenko	Stanford Univ.	CRSIG	December 2018
James Rhoads	GSFC	CoSSIG	December 2020
Graça Rocha (Vice Chair)	JPL	IPSIG/CoSSIG	December 2020
John Tomsick	UC Berkeley	GammaSIG/X-RaySIG	December 2019
Abigail Vieregg	Univ. of Chicago	IPSIG/CRSIG	December 2020
Nicolas Yunes	Montana State Univ.	GWSIG	December 2020

High-impact Research: Prior PhysPAG EC Discussion

- **Summary of Fall 2017 activities**
  - July 2017: APAC receives charge to 'Review NASA SMD R&A Methods to Foster High-Impact Research (HIR)'
  - PhysPAG EC telecon September 2017 to discuss charge
    - Q: Does SMD have effective processes in place to solicit, review, select HIR projects?
    - A: (a) Dedicated solicitations
      (b) Given R&A budgets, 10%-20% for HIR projects reasonable
      (c) STMD NIAC program might be an example

High-impact Research: PhysPAG Web Survey

- **Discussions at Sept. 2017 PhysPAG EC (T. Brandt) and Oct. 2017 APAC meetings suggested broader community input might be useful**
- **Web survey developed in early 2018 and deployed in March**
- **Key results: (see backup material for questions)**
  - 61 respondents; every PhysPAG SIG represented
  - Broad agreement on definition of 'high-impact'; much less agreement on meaning of 'high-risk'
  - 57% claimed to have submitted proposals for high-impact research; 38% to have submitted proposals for high-risk research
  - 20% said NASA now provides adequate opportunities for HR research; 43% are not sure; 35% said there are not sufficient opportunities for HR research; 25 narrative comments in response to this question
  - About 30% of respondents would like greater opportunities for HI/HR research even if funding came at the expense of other R&A opportunities
  - Just over half thought 10-20% of R&A budget could be devoted to new HI/HR opportunities

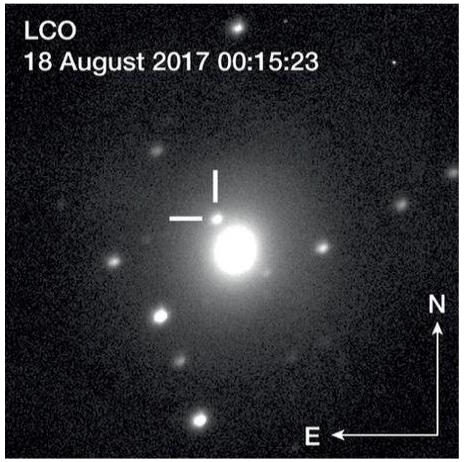
High-impact Research: PhysPAG Web Survey

Selected Comments:

- "More and more, HI/HR research proposals simply don't get funded. Previous funding for a HI/HR proposal to NIAC led to my development (with my then postdoc) of the stellar occulter architecture for TPF. These days, … if your theoretical proposal doesn't directly promise to do calculations … needed for the science goals of a specific mission then you won't get funded."
- "The short duration of most grants is a serious impediment to real HR work."
- "I submitted only 2 LISA-related proposals in the last 5 years because success rates seemed low."
- "I am considering writing such a proposal. I would like to know that it might actually have a chance of success."
- "A fun exercise, but I doubt anything will come of this. Hope to hell you prove me wrong!!!"
- "Thank you NASA. YOU ARE MY BELOVED AGENCY!"

MMA SAG Inspiration

- **August 2017 BNS merger discovery demonstrated power of MMA**
  - Gamma-rays detected by *Fermi*
  - Gravitational waves detected by LIGO/Virgo
  - Flurry of follow-up observations by international astronomical community



MMA SAG Motivation

- **NASA observatories in 2020 decade and beyond will have an important role to play in future MMA observations, including:**
  - those that continue to operate in the 2020s (*Hubble*, *Chandra*, *Swift*, *Fermi*)
  - those currently planned (JWST, WFIRST, Athena, LISA, and Explorers)
  - those that will be considered by the 2020 astrophysics decadal committee
- **Many scientific communities within PCOS are now preparing for the 2020 decadal survey**
- **MMA SAG will analyze potential scientific benefits of MMA observations made possible by NASA observatories in 2020's, beyond**
  - NASA observatories working in conjunction with each other or with other ground and/or space-based instruments

Goals of the MMA SAG

1. **Identify science goals achieved by combining different messengers measured by current/future ground/space observatories**
2. **Identify measurements that can be made by existing, currently approved, and future ground- and space-based observatories that could contribute to MMA in 2020's and early 2030's**
3. **Determine how these science goals align with NASA Astrophysics scientific priorities**
4. **Identify key qualitative technical drivers needed to achieve these goals (e.g. wavelength, sensitivity, sky localization, latency, …)**
   - If feasible, determine desirable performance levels for each

What is the MMA SAG?

- **Community-driven; community-owned**
- **MMA SAG will consist of astrophysicists from multiple disciplines within the PhysPAG**
- **COPAG will participate**
- **While inspired by GW BNS observation, MMA SAG is not necessarily GW-specific**
- **Steering committee responsible for collecting and organizing input from the astrophysics community and for ensuring that the SAG achieves the goals above**

MMA SAG Steering Committee

- **MMA SAG Steering Committee:**
  - Sarah Burke Spolaor, West Virginia University
  - Peter Shawhan, University of Maryland
  - Dieter Hartmann, Naval Research Laboratory
  - Erin Kara, University of Maryland
  - Nathan Whitehorn, UCLA
  - Scott Wakely, University of Chicago
  - Suvi Gezari (COPAG rep), University of Maryland
- **Ex officio members:**
  - John Conklin, PhysPAG EC Chair, University of Florida
  - Terri Brandt, PCOS Acting Chef Scientist, NASA GSFC

Outcomes of the MMA SAG

- **Timing of MMA SAG designed to be commensurate with 2020 decadal process**
- **The SAG will document its findings in one or more publically available white papers**
  - Delivered to APAC in mid-2019

Lynx STDT & NASA LISA Study Team

- **Lynx STDT is ongoing; see talk by Feryal Ozel later today**

- **NLST Activities**
  - LISA decadal whitepaper work-a-thon, 12-13 Feb, Nashville, TN
  - Several (many) meetings with LISA Consortium & Working Groups, ESA + ESA Science Study Team
  - 'Advoreach' activities:
    - Sensitivity curves, primer for astros, vignettes for AAS, etc.

SIG Updates

- **Gamma SIG working to organize gamma-ray community for decadal white paper writing**
  - Via sessions at AAS, HEAD, and APS and regular community telecons
  - Setting up website to track white papers

- **GWSIG Activities**
  - Making connections between LISA and other missions: HabEx, LUVOIR, Lynx
    - Gave talk @ AAS on LISA+LUVOIR; invited back to give LUVOIR seminar
  - Lots of advertising of LISA and LISA Prep Science call for proposals
    - Over email and in person during several invited talks and colloquia
  - Supporting NLST 'Advoreach' activities

PhysPAG/SIG Meetings

- **Past Meetings**
  - AAS Meeting January 2018, Washington, DC
    - PhysPAG, Joint-PAG, GWSIG, X-raySIG, GammaSIG
  - Chicago HEAD meeting
    - Lynx Special Session, X-raySIG, GammaSIG

- **Upcoming meetings**
  - April APS 2018, Columbus OH
    - Minisymposia: PCOS, GWSIG, CRSIG, GammaSIG, IPSIG

Backup …

HI/HR: PhysPAG Web Survey Questions (Summary)

The complete survey is available here

- **What is high-impact research? High-risk research?**
- **What SIG, if any do your answers represent?**
- **Have you ever proposed High-impact and/or High-risk research to NASA Astrophysics?**
  - If yes, were your proposals adequately reviewed?
  - If no, why not?
- **Does NASA Astro R&A offer you sufficient opportunities for HI/HR research?**
- **If some R&A funding were re-programmed specifically for HI/HR research, what fraction is appropriate?**
- **Please comment**