Physics of the Cosmos
Report for the Astrophysics Subcommittee
17 March 2015

Jamie Bock

Mark Bautz

PhysPAG EC membership

Name	Institution	Topical Area	Term end
J. Bock, Chair	Caltech/JPL	CMB	December 2016
M. Bautz, Vice Chair	MIT	X-rays	December 2016
R. Bean	Cornell Univ.	Dark Energy	December 2016
J. Bookbinder	SAO	X-rays	December 2015
J. Conklin*	Univ. of Florida	Gravitational Waves	December 2017
N. Cornish	Montana State	Gravitational Waves	December 2016
O. Doré*	JPL	Dark Energy	December 2017
H. Krawczynski*	Washington Univ. in St. Louis	Gamma-rays	December 2017
M. McConnell	U. of New Hampshire	Gamma-rays	December 2016
A. Miller*	Columbia Univ.	CMB	December 2017
J. Nousek	PSU	X-rays	December 2015
A. Olinto	Univ. of Chicago	Astroparticles	December 2015
Eun-Suk Seo	U. of Maryland	Astroparticles	December 2016
E. Wollack*	NASA/GSFC	CMB	December 2017

*new member

PhysPAG and SIGs

- **PhysPAG has five SIGs in operation:**
  - Inflation Probe SIG (Chair: Amber Miller and Ed Wollack)
  - Gravitational Wave SIG (Chair: Neil Cornish)
  - X-ray SIG (Chair: Jay Bookbinder)
  - Gamma ray SIG (Chair: Mark McConnell)
  - Cosmic Ray SIG (Chair: Angela Olinto)

  - *Pending:* Cosmic Structure SIG (Chair: Olivier Doré, Rachel Bean)

Proposal to Start the Cosmic Structure SIG

This SIG is intended to collect the input of measures of cosmic structure based on 3-dimensional surveys using galaxies, supernovae, weak lensing, etc to measure the physical parameters of the universe, including the study of the parameters of dark energy, tests of inflation, etc.

There is some overlap with the Inflation Probe SIG, though more in the theoretical community. The experimental community has little overlap.

CoSSIG science has obviously been very influential in the development of Euclid and WFIRST. It was never formalized into a SIG for reasons of prior history.

However clearly the scientific input from this group is relevant in the current discussion of large missions. This input will continue to be valuable on many issues as we move to new issues up to the 2020 Decadal and requires a mechanism for continued interaction with the PhysPAG.

Status and Schedule on Large Missions

- **March**
  - SIGs have started collecting community input
  - Develop list of questions and issues the PhysPAG wants to address in its report
- **April - June**
  - Community input phase
  - Parallel work on PhysPAG report outline
  - Parallel joint PAG meetings
- **July – September**
  - Write PhysPAG report
  - Coordinate PhysPAG report with other PAGs

Large Mission PhysPAG Themes*

- **Far-Infrared Surveyor**
  - How and when did the first supermassive blackholes form?
  - Evolution of galaxies and their supermassive black holes
  - Multi-messenger studies with GW events
  - Technology synergies with Inflation Probe and X-ray detectors and optics
  - Intensity mapping measurements of large-scale structure
- **Habitable Exoplanet Imaging Mission**
- **UV/Optical/IR Surveyor**
  - Evolution of galaxies and their supermassive black holes
  - Understand the physics of supernovae and feedback on evolution of galaxies
  - Understand the physical state, composition and kinematics of baryons in the cosmic web
  - Multi-messenger studies with GW events
  - Follow-on studies of large-scale structure measurements
- **X-Ray Surveyor**
  - How and when did the first supermassive blackholes form?
  - Evolution of galaxies and their supermassive black holes
  - Test strong GR by probing behavior of matter in the vicinity of supermassive black holes
  - Measure the spin distribution of supermassive black holes in the local Universe
  - Determine the properties of matter at the highest densities and pressures in neutron stars
  - Understand the physics of supernovae and feedback on evolution of galaxies
  - Understand the physical state, composition and kinematics of baryons in the cosmic web
  - Multi-messenger studies with GW events

*An incomplete list

Questions and Reactions from PhysPAG SIGs

- **X-ray Surveyor**
  - How are X-ray Surveyor's science goals related to those of Athena?
- **Gravitational-Wave L3 Mission**
  - Given that LISA is the highest priority unfinished business from the last decadal and does not appear on the list, how should strong and timely support for a GW mission be achieved?
  - The GW community requests that an implementation study for L3 be conducted concurrently with the other decadal studies
- **Inflation Probe**
  - Community generally agrees this is a probe-class mission, however
  - Mission development needs to be supported for 2020 Decadal survey preparation
  - Technology program needs to be supported and re-evaluated by mid-decadal panel
- **Probe Mission Line**
  - Strong interest in probe line for PhysPAG science
  - Strong interest in developing studies to support a competed probe-class mission line
  - PhysPAG example probe missions: Inflation Probe, Gamma-Ray Probe, Cosmic-Ray Probe, X-Ray Probe

Upcoming community events

- **April 2015, American Physical Society meeting, Baltimore, MD**
  - PCOS table within display hall
  - PCOS mini-symposium on Tuesday, April 14, 2015
  - GammaSIG mini-symposium “Future MeV Gamma-Ray Science and Missions”
  - Space-based GW oral session on Monday
  - GWSIG meeting on Saturday evening at 6PM
  - CosmicSIG meeting …
- **June 29-July 1, 2015 “Special HEAD meeting”**
  - X-Ray and Gamma-Ray SIG discussions planned
  - Last venue for community input
- **August 2015, IAU-AAS meeting in Honolulu**