Abstracts for APS PCOS mini-symposium
PhysPAG

1. Invited —Ann Hornschemeier
Lognumber: APR16-2016-000717
Title: High Energy Astrophysics and Cosmology from Space: NASA's Physics of the Cosmos Program

We summarize currently-funded NASA activities in high energy astrophysics and cosmology, embodied in the NASA Physics of the Cosmos program, including updates on technology development and mission studies. The portfolio includes development of a space mission for measuring gravitational waves from merging supermassive black holes, currently envisioned as a collaboration with the European Space Agency (ESA) on its L3 mission and development of the X-ray observatory that will measure X-ray emission from the final stages of accretion onto black holes, currently envisioned as a NASA collaboration on ESA's Athena observatory. The portfolio also includes the study of cosmic rays and gamma ray photons resulting from a range of processes, of the physical process of inflation associated with the birth of the universe and of the nature of the dark energy that dominates the mass-energy of the modern universe. The program is supported by an analysis group called the PhysPAG that serves as a forum for community input and analysis and the talk will include a description of activities of this group.
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2. CosmicSIG — Eun-Suk Seo
Lognumber: APR16-2016-000118
Title: Spaced-based Cosmic Ray Astrophysics

The bulk of cosmic ray data has been obtained with great success by balloon-borne instruments, particularly with NASA's long duration flights over Antarctica. More recently, PAMELA on a Russian Satellite and AMS-02 on the International Space Station (ISS) started providing exciting measurements of particles and anti-particles with unprecedented precision upto TeV energies. In order to address open questions in cosmic ray astrophysics, future missions require spaceflight exposures for rare species, such as isotopes, ultra-heavy elements, and high (the "knee" and above) energies. Isotopic composition measurements of $1 \leq Z \leq 28$ up to ~10 GeV/nucleon that are critical for understanding interstellar propagation and origin of the elements are still to be accomplished. The cosmic ray composition in the knee (PeV) region holds a key to understanding the origin of cosmic rays. Just last year, the JAXA-led CALET ISS mission, and the DAMPE Chinese Satellite were launched. NASA's ISS-CREAM completed its final verification at GSFC, and was delivered to KSC to await launch on SpaceX. In addition, a EUSO-like mission for ultrahigh energy cosmic rays and an HNX-like mission for ultra heavy nuclei could accomplish a vision for a cosmic ray observatory in space. Strong support of NASA's Explorer Program category of payloads would be needed for completion of these missions over the next decade.

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3. CosSIG — Olivier Doré
Lognumber: APR16-2016-000809
Title: Space Based Dark Energy Surveys

Dark energy, the name given to the cause of the accelerating expansion of the Universe, is one of the most tantalizing mystery in modern physics. Current cosmological models hold that dark energy is currently the dominant component of the Universe, but the exact nature of DE remains poorly understood. There are ambitious ground-based surveys underway that seek to understand DE and NASA is participating in the development of significantly more ambitious space-based surveys planned for the next decade. NASA has provided mission enabling technology to the European Space Agency's (ESA) Euclid mission in exchange for US scientists to participate in the Euclid mission. NASA is also developing the Wide Field Infrared Survey Telescope-Astrophysics Focused Telescope Asset (WFIRST) mission for possible launch in ~2024. WFIRST was the highest ranked space mission in the Astro2010 Decadal Survey and the current design uses a 2.4m space telescope to go beyond what was then envisioned. Und erstanding DE is one of the primary science goals of WFIRST-AFTA. This talk will review the state of DE, the relevant activities of the Cosmic Structure Interest Group (CoSSIG) of the PhyPAG, and detail the status and complementarity between Euclid, WFIRST and ot ambitious ground-based efforts.
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4. GammaSIG — Mark McConnell
Lognumber: APR16-2016-000219
Title: Future Prospects for Space-Based Gamma Ray Astronomy

The gamma-ray sky offers a unique view into broad range of high energy astrophysical phenomena, from nearby solar flares, to galactic pulsars, to gamma-ray bursts at the furthest reaches of the Universe. In recent years, results from the Fermi mission have further demonstrated the broad range of topics that can be addressed by gamma-ray observations. The full range of gamma-ray energies is quite broad, from about 100 keV up to about 100 TeV. The energy range below several hundred GeV is the domain of space-based gamma-ray observatories, a range that is not completely covered by the Fermi LAT instrument. The gamma ray community has embarked on an effort to define the next steps for space-based gamma ray astronomy. These discussions are being facilitated through the Gamma-ray Science Interest Group (GammaSIG), which exists to provide community input to NASA in regards to current and future needs of the gamma-ray astrophysics community. Through a series of workshops and symposia, the GammaSIG is working to bring the community together with one common vision, a vision that will be expressed in the form of a community roadmap. This talk will summarize some of the latest results from active gamma ray observatories and will summarize the status of the community roadmap effort.

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5. GWSIG — John Conklin
Lognumber: APR16-2016-000503
Title: The gravitational wave decade

With the expected direct detection of gravitational waves by Advanced LIGO and pulsar timing arrays in the near future, and with the recent launch of LISA Pathfinder this can arguably be called the decade of gravitational waves. Low frequency gravitational waves in the mHz range, which can only be observed from space, provide the richest science and complement high frequency observatories on the ground. A space-based observatory will improve our understanding of the formation and growth of massive black holes, create a census of compact binary systems in the Milky Way, test general relativity in extreme conditions, and enable searches for new physics. LISA, by far the most mature concept for detecting gravitational waves from space, has consistently ranked among the nation's top priority large science missions. In 2013, ESA selected the science theme ``The Gravitational Universe'' for its third large mission, L3, under the Cosmic Visions Program, with a planned launch date of 2034. NASA has decided to join with ESA on the L3 mission as a junior partner and has recently assembled a study team to provide advice on how NASA might contribute to the European-led mission. This talk will describe these efforts and the activities of the Gravitational Wave Science Interest Group and the L3 Study Team, which will lead to the first space-based gravitational wave observatory.

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6. IPSIG — Edward Wollack
Lognumber: APR16-2016-000118
Title:The Cosmic Microwave Background Radiation and its Polarization

The cosmic microwave background (CMB) radiation and its faint polarization have provided a unique means to constrain the physical state of the early Universe. Continued advances in instrumentation, observation, and analysis have revealed polarized radiation signatures associated with gravitational lensing and have heightened the prospects for using precision polarimetry to experimentally confront the inflationary paradigm. Characterization of this relic radiation field has the power to constrain or reveal the detailed properties of astroparticle species and long wave gravitational radiation. On going and planned CMB polarization efforts from the ground, balloon, and space borne platforms will be briefly surveyed. Reent community activities by the Inflation Probe Science Interest Group (IPSIG) will also be summarized.

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7. XRSIG — Mark Bautz / Ralph Kraft
Lognumber: APR16-2016-000327
Title: Probing the Hot and Energetic Universe: X-rays and Astrophysics

X-ray observations are a cornerstone of our understanding of the formation and evolution of structure in the Universe, from solar-system-sized supermassive black holes (SMBH) to the largest galaxy clusters. At the most basic level, a significant fraction of the energy output in the Universe is in X-rays, and much of this emission traces the response of baryonic matter to the inexorable, gravity-driven growth of cosmic structure. At present, for example, half or more of the baryons in the Universe reside in a hot (\textgreater 1 MK) X-ray-emitting phase. We discuss some of the remarkable progress that has been made in understanding the broad outlines of these processes with the current generation of X-ray observatories. We summarize the potential of recently launched and forthcoming X-ray observatories to track the development of large-scale cosmic structure and to understand the physics linking the growth of SMBH with that of the (many orders of magnitude larger) galaxies and
clusters which host them. We briefly review nearer-term prospects for smaller, focussed missions, including one that will soon exploit pulsating X-ray emission from neutron stars to probe the equation of state of matter at nuclear densities.
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