Abstracts for APS Savannah meeting

Ann Hornschemeier <Ann.Hornschemeier@nasa.gov>, Invited Speaker
Lognumber: APR14-2014-000714
Title: High Energy Astrophysics and Cosmology from Space

While much can be learned from physics experiments on and astronomical observations from the ground, certain questions require space-based investigations. Sometimes the scale of the measurement, such as the baseline of approximately 10^6 km necessary for the observation of gravitational waves in the frequency range expected for high-redshift supermassive black hole mergers, causes us to leave behind the limitations of the earth. From space we measure the X-ray emission from the final stages of accretion onto black holes and critical energy ranges of cosmic rays and gamma ray photons resulting from particle acceleration in e.g., star forming environments, that otherwise we could not measure due to the atmosphere. Space-borne experiments may also measure all of the cosmological information available in the polarization of the cosmic microwave background to probe the physical conditions that caused the process of inflation in the early universe, moments after the big bang. This presentation will cover the NASA high energy astrophysics and cosmology science portfolio, embodied in its Physics of the Cosmos program, including updates on technology development and programmatic matters.

Shaul Hanany <hanany@physics.umn.edu>, CMB
Lognumber: APR14-2014-000337
Title: CMB Measurements: Looking forward from Planck2013

The Planck satellite had its first data release in 2013. Since then two experiments reported new CMB polarization results, probing for the first time the B-mode signal, which can ultimately shed light on the epoch of Inflation at the beginning of the Universe. More results from a host of experiments, including Planck, are forthcoming. I will review the status of the field and discuss the progress anticipated over the next few years.

Guido Mueller <mueller@phys.ufl.edu>, Gravitational Waves
Lognumber: APR14-2014-000206
Title: Space-based gravitational wave observatories: Learning from the past, moving towards the future.

This century began with a planned launch of the joint NASA/ESA Laser Interferometer Space Antenna in 2011.

In a remarkable reversal of fate, 2011 instead saw the end of the NASA/ESA partnership and the termination ofthe LISA project. This was despite the very high scientific ranking of a mHz gravitational wave observatory in both the US and Europe, and significant progress in technology development, mostly spearhead by industrial studies in Europe. The first half of the current decade continues to be dominated by struggles of the international community to get a LISA-like mission back on track for a launch in the next decade. Following a second place in ESA's L1 selection, the science theme 'The Gravitational Universe' has now been selected as the L3 mission in Europe which is scheduled to launch in 2034 assuming no further delays or re-plans for the L1-L2-L3 mission sequence. On a more optimistic note, the upcoming launch of the LISA Pathfinder in 2015 and the first direct detections of gravitational waves by Advanced LIGO and by pulsar timing later in this decade may provide the necessary impetus to accelerate the development of a space-based gravitational wave detector.

Angela Olinto <olinto@kicp.uchicago.edu>, Cosmic Rays
Lognumber: APR14-2014-000235
Title: CosmicSIG science and plans

Recent activities of the Cosmic Ray Science Interest Group (CosmicSIG) of the Physics of the Cosmos PAG will be reviewed. CosmicSIG was formed to provide an assessment to NASA HQ and the PCOS program office of the status of current and future missions in the area of cosmic-ray astrophysics. CosmicSIG also strives to act as a focal point and forum for the cosmic ray community.

Hays, Elizabeth A. <elizabeth.a.hays@nasa.gov>, Gamma Rays
Lognumber: APR14-2014-000414
Title: Exploring the future science of space-based gamma-ray observations

Gamma rays probe an unique, dynamic and extremely broad range of astrophysical phenomena. Their observation probes the sites and mechanisms of nature's most powerful accelerators, sheds light on possible characteristics of dark matter and tests the limits of our understanding of matter and energy in the Universe. Past and current observatories have made significant advances in part of this waveband, but key areas remain largely unexplored. The Gamma-ray Science Interest Group (GammaSIG) exists to provide metrics and assessments to NASA in regard to current and future needs of the gamma-ray astrophysics community. The GammaSIG, as a part of the Physics of the Cosmos Program Analysis Group, provides a forum open to all members of the gamma-ray community. Currently, this group is exploring science goals for future space-based gamma-ray observations through the development of open workshops on both science and instrumentation leading to a summary of available paths for continued high impact gamma-ray astrophysics in the coming years.

Jay Bookbinder <jbookbinder@cfa.harvard.edu>, X-rays
Lognumber: APR14-2014-000858
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 clusters. At the most basic level, a significant fraction of the energy output in the Universe is in X-rays, with half or more of the baryons today in a hot (>1 MK) X-ray-emitting phase. The recent European Space Agency selection of the Hot & Energetic Universe theme for their next large space astrophysics mission will address questions such as how ordinary matter assembles into the large-scale structures that we see today, and how black holes evolve and influence the Universe. We know, for example, that building a SMBH releases 30× the binding energy of a galaxy, but do not understand the feedback mechanism that creates a tight relationship between galaxy bulge properties and the central SMBH. These questions will be addressed by an ESA mission, likely with US contributions, that is scheduled for launch in 2028. New technology for future X-ray imaging, spectroscopy, and polarimetry missions under development in the US will also be briefly discussed.

Rhodes, Jason D <jason.d.rhodes@jpl.nasa.gov>, Dark Energy
Lognumber: APR14-2014-000173
Title: NASA and Dark Energy

Dark energy, the name given to the cause of the accelerating expansion of the Universe, is one of the most profound mysteries in modern science. Current cosmological models hold that dark energy is currently the dominant component of the Universe, but the exact nature of dark energy remains poorly understood. There are ambitious ground-based surveys underway that seek to understand dark energy 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-AFTA) mission for possible launch in \textasciitilde 2023. WFIRST was the highest ranked space mission in the Astro2010 Decadal Survey and the AFTA incarnation of the WFIRST design uses a 2.4m space telescope to go beyond what the Decadal Survey envisioned for WFIRST. Understanding dark energy is one of the primary science goals of WFIRST-AFTA. I'll discuss the status of Euclid and WFIRST and comment on the complementarity of the two missions.