Review of PhysPAG Statement on Probes and Summary of New Frontiers Program

Summary Presentation to XRSIG Splinter Meeting at the 227th AAS Meeting

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PhysPAG Executive Committee

Physics of the Cosmos Program Analysis Group (PhysPAG) Report on Flagship Mission Concepts to Study for the 2020 Decadal Survey

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Executive Summary

- Enthusiasm for developing probe missions as a vital component for planning the next decade was widespread and strongly expressed.
  - The community finds both the cost and schedule of probe missions attractive.
  - Compared to the price and development time for flagship missions, several probe missions could be flown in a decade, leading to rapid science return across a broad scientific spectrum.
  - This higher rate of missions may offer scientific synergies, such as multi-wavelength observational capability.

Full text at: http://pcos.gsfc.nasa.gov/docs/PCOS_facility_missions_report_final.pdf

Executive Summary

- Many in the community are interested in developing specific probe missions, and a number of new probe-class concepts were brought before the PhysPAG. These generally cover new scientific territory outside of the reach of foreseeable flagship missions.

Full text at: http://pcos.gsfc.nasa.gov/docs/PCOS_facility_missions_report_final.pdf

The PhysPAG received several Unsolicited New Probe Mission Concepts

- X-ray Grating Spectrometer Probe Mission to study WHIM, outflows from SMBHs, bursting neutron stars
- Large X-ray Timing Observatory Probe Mission to measure neutron star matter, structure of black hole and neutron star accretion flows.
- Transient X-ray Astrophysics Probe Mission wide FOV X-ray and near infrared telescopes: gamma-ray bursts, tidal disruption events, supernova shock breakouts, counterparts of gravitational wave detections.
- High Energy X-ray Probe Mission spins of stellar and supermassive black holes, SMBH survey, Type Ia supernovae.
- Soft X-ray Wide-Field Survey Telescope Probe Mission evolution of SMBHs, clusters, and groups of galaxies over cosmic time.
- Advanced Gamma-ray Telescope Probe Mission keV to MeV energy range to study 511 keV emission from the galactic center, a supernova census, and polarimetric studies of the jets
- Advanced Cosmic Ray Probe Mission for ultrahigh energy cosmic rays by observing air showers from space, increasing number of events at the highest energies
- + others (and not including Inflation Probe)

Executive Summary

- Many in the community stressed the importance of the cost and schedule discipline of the NASA Explorer program, *which has returned excellent science while carefully managing costs*. These proponents reason that Explorer missions are less susceptible to the large and unfortunate cost, scope and schedule growth encountered in recent flagship missions. This group advocates for an expansion of the Explorer program to larger mission categories, and that developing the parameters of a category (or categories) of larger competed Explorers is as important as defining particular scientific concepts.

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Executive Summary

- Some pointed out that Explorer missions are not currently integrated into the strategic scientific planning process, in that they follow an open proposal process outside of the scientific investigations directed by the Decadal Review.
- Others noted that the planetary community has incorporated a degree of strategic planning for their larger competed Discovery and New Frontiers missions in their most recent decadal review.

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NASA Planetary Division's *New Frontiers* program

- Designed for medium-sized missions that cannot be achieved within the cost and time constraints of Discovery ($0.5 billion), but not as large as Flagship-class missions
- Current missions include New Horizons (Pluto/Kuiper Belt) and Juno (approaching Jupiter this year). Osiris/REX to be launched this year.
- Original charge – launch every 52 months, cost capped at $1B (FY15) excluding launch vehicle
- PI led – responsible for forming the scientific and technical team (e.g. similar to SMEX/MIDEX)
- Science selected by NASA based on input from Planetary Decadel (e.g. similar to Flagship missions)
- In last planetary decadal, 26 mission studies were initiated by NASA to support the survey. Based on scientific merit, cost, and technology readiness, five were advanced as possible candidates for New Frontiers 4 (start later in this decade).

Discussion: How to Present Probes to Decadal Committee?

- Should (can?) the X-ray community do something more organized in support of probes than just submitting White Papers on individual mission concepts?
- Do we want to formalize probes in Astrophysics the same way that New Frontiers has been on the planetary side? If so, should the community make formal recommendations about how this program could be structured (e.g. cost cap, science selection, management)?
- Opposing view – are there any compelling reasons not to promote probes to the Decadal Survey?