

Physics of the Cosmos Program Analysis Group Call for White Papers: Probe-Class Astrophysics Mission Concepts

To: The Astronomical Community
From: The Physics of the Cosmos Program Analysis Group Executive Committee
Due Date: **March 1, 2016**
Submission: Submit PDF white papers to PhysPAG_Contact@bigbang.gsfc.nasa.gov

Dear Colleague,

The Physics of the Cosmos Program Analysis Group (PhysPAG) invites you to provide feedback via submission of one-to-two page white papers on compelling Probe-class missions that NASA should consider for the 2020s. It does NOT represent a call for proposals, or pre-proposals. We are using this information to assess community interest in probes, and to understand the range of concepts.

Context: In 2015, Paul Hertz (Director, NASA Astrophysics Division) issued a memo to the astronomical community to stimulate planning for the 2020 Decadal Survey. Now that the question of large mission studies is advancing to the STDT mission-study phase, it is an appropriate time for the PhysPAG to consider the question of Probe-class missions in a more formal fashion.

Definition of Probe: We consider a Probe-class mission to fit within the cost envelope between a Mid-sized Explorer (MIDEX) mission and a large mission. While previous considerations have used \$1B as a rigid cap, we would like to see where the balance between cost and return falls. A Probe-class mission would have a primary mission goal of addressing a focused science investigation with a PI, and is not intended to be a general-user type observatory. This activity is intended to explore the PCOS community's interest in a line of competed PI missions, in this approximate cost range.

Details of submissions: The papers submitted will be made public, so do not include proprietary information. Please include in your submission an initial estimate at the cost of your mission and the basis upon which this cost estimate has been made. The cost cap of probe missions is a matter of discussion, but will not exceed \$1B (life cycle cost, LCC). The PhysPAG particularly wants to understand the potential for missions in the \$0.5M-1B range. Please also include an idea of the mission lifetime needed for meeting its science goal(s). This initial call for white papers is only a start - the white papers will form a core set of community input for discussion regarding whether the establishment of a formal Probe-class mission line is warranted.

All white papers must include a title, author names, and email address of the lead author. Length is limited to 2 pages, including figures. Font size must be 10 point or greater. PDF submissions are preferred, although Microsoft Word submissions and plain text submissions are also acceptable. We recommend that you consider the following types of information below in your white paper responses.

Deadline for submission of the white papers: March 1, 2016.

Suggested format for the papers:

1. SCIENCE DRIVERS

This is the most important section of your white paper. Describe an important Physics of the Cosmos science question(s) that you think should be addressed by a Probe-class mission. Please be as specific as possible by describing science questions or specific measurements to be addressed rather than general capabilities or science areas. For example, “Are supermassive black holes and strong magnetic fields always required for the formation of relativistic jets?” would be more useful than “observing extragalactic jets at unprecedented angular and spectral resolution” or “investigating the origin of the radio-loud and radio-quiet AGN dichotomy”. Note that the most compelling science cases for future Probes will likely be those that cannot be addressed in the 2020’s by existing or currently planned facilities, such as Chandra, Fermi, and Athena.

2. TECHNICAL CAPABILITIES

To the extent you can specify it, describe the performance capabilities that this mission would require to address key science questions. Include the following information (as appropriate):

- Spectral coverage
- Spectral resolving power (both for imaging and spectroscopy)
- Angular resolution
- Field of view
- Primary operational mode, e.g. survey, point-and-stare, etc.
- Sensitivity. (If you can’t answer in a quantitative way, try to describe in terms of the class of object that you would want to be able to detect out to a particular distance, at a desired signal-to-noise ratio, etc.)
- Basic requirements on the spacecraft. That includes approximate mass, orbit, lifetime, data rate, pointing requirements, etc.

3. NEW TECHNOLOGIES

Identify technology development required to implement the probe concept you describe, and, to the extent possible, estimate the time and effort needed to complete that development. (e.g., none, very little/ a year or two, significant/5 years). Explain the basis of your estimate, for example by comparing the required technical capability to that available now.

4. REASONS WHY A PROBE-CLASS MISSION IS NEEDED

Could the science question(s) described above be addressed (in total or in part) by a smaller mission (Explorer-class, suborbital payloads, etc), or a larger mission, or are the science objectives clearly in the realm of a Probe-class mission? Please make this clear.

5. COST ESTIMATE

To the extent possible, explain why you think the mission you describe could be executed for a cost between \$0.5B and \$1.0B.