

## Cosmic Origins Program Analysis Group Call for White Papers : Probe-Class Astrophysics Mission Concepts

To: The Astronomical Community  
From: The Cosmic Origins (COR) Program Analysis Group Executive Committee  
Due Date: February 15, 2016  
Submission: Submit PDF white papers to [COPAG\\_Contact@bigbang.gsfc.nasa.gov](mailto:COPAG_Contact@bigbang.gsfc.nasa.gov)

Dear Colleague,

In 2015, Paul Hertz (Director, NASA Astrophysics Division) issued a memo to the astronomical community to stimulate planning for the 2020 Decadal Survey. As part of the subsequent considerations by the COPAG and other groups, the issue of smaller Probe-class missions came up time and time again. Now that the question of Flagship mission studies is advancing to the STDT phase, it is an appropriate time for the COPAG to consider the question of Probe-class missions in a more formal fashion.

In this regard, we consider a Probe-class mission to fit within the **cost envelope between** a Mid-sized Explorer (MIDEX) mission and a Flagship. While previous considerations have used \$1B as a rigid cap, we would like to see where the balance between cost and return naturally falls and consider the size of a potential mission class cost cap in that light. Experience does indicate that this kind of mission class is likely to be **meter-class in size**, but some mission designs may be unique in their formulation. Also be advised that a Probe-class mission is regarded as having a **primary mission goal of addressing a focused science investigation with a PI**, and is not intended to be a general-user type observatory, but some provision for an extended mission guest-observer program could be made if appropriate. This activity is intended to explore the COR community's interest in a line of competed PI missions, in this approximate cost range.

The Cosmic Origins Program Analysis Group (COPAG) invites you to **provide feedback** on what compelling Probe-class missions you would intend to propose to NASA using **one-to-two page white papers**. However, the papers submitted will be **made public**, so do not include proprietary information in your submissions. 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. It should be noted that the mission cost can float above \$1B but not by a lot – we are **not** soliciting mission ideas that are likely to lie in the \$2-3B range and higher – **a small amount over \$1B is allowable if justified**. Please also include an idea of **how long** your mission would likely take to answer its primary science goal, and what the ultimate **mission lifetime** would be. 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. While a **deadline of February 15, 2016** is assigned, if you would like to give a **5-minute summary** presentation of your idea at the upcoming COPAG session at the **AAS meeting in Florida**, the afternoon of Monday

January 4, 2016, please let us know. If interested please send a note to the above-listed email address by **December 21, 2015**, and the presentation itself to the same address by **December 30, 2015**.

## 1. SCIENCE DRIVERS

Describe an important Cosmic Origins 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, “Do molecular clouds subjected to extreme environments (turbulence, strong tidal fields, shocks) favor high-mass star formation?” would be more useful than “observing star forming regions at unprecedented angular and spectral resolution” or “investigating high-mass star formation processes”. If the particular science topic is not specifically related to Cosmic Origins, we will make sure that one of the other PAGs (PhysPAG, ExoPAG) receives your input for consideration as well. Please also be advised that the science case should be one that cannot be done with existing or currently planned facilities, such as HST.

## 2. TECHNICAL CAPABILITIES

Describe the performance capabilities that this mission would require to address key science questions. Include the following information (as appropriate):

- Spectral coverage, e.g. far-UV, UV/visual, near-IR to mid-IR, far-IR?
- 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.).
- Other important capabilities, e.g. multi-object slit spectroscopy, high-contrast coronagraphy, time-resolved photon-counting, etc.

## 3. NEW TECHNOLOGIES

Would new technologies be required by the Probe-class mission you describe above? If so, what new technologies would be required, and what is their current level of maturity (for example, “still in concept formulation”, “separate components in test-bed research phase”, “an integrated breadboard model has been lab-tested”, “a prototype is ready for testing in an operational environment”). Specifying in terms of Technological Readiness Level (TRL) is okay too.

## 4. PROBE-CLASS MISSION 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 flagship mission, or are the science objectives clearly in the realm of a Probe-class mission? Please make this clear.