

A list of potential plans for the Decadal Committee  
The CMBpol Mission Concept Study

November 4, 2008

Please comment by Wednesday, November 12

The Primordial Polarization Program Definition Team (PPPDT) has mobilized researchers in the CMB polarization community to generate a report for the next Decadal Survey Committee. The goal of that report is to outline a plan of research and to heighten the priority of CMB research in the Decadal Survey. The CMB community must converge on the shape of the plan soon.

A number of options for the next ten years are presented here. All aim to increase the priority of CMB research in the Decadal Survey. However, the plans differ their proposed timing and programmatic importance of the space-based part of the plan. During the CMBPol Workshops this past summer, support for plans ranging from an immediate space mission proposal to ‘why do we need a space mission at all’ were voiced. Now the final plan and the arguments will need to be put into place. To facilitate discussion, three plans and an outline of their justification spanning the range of opinion are presented here. These are not intended to be seen as the only three possibilities, rather, they illustrate a range of possibilities and the hope is that they will foster a reaction from the community. They are a set of strawman plans designed to be critically reviewed and to inspire other ideas.

As a member of the community who has indicated an interest in playing a part in the development of the CMBPol report, we ask that you take a look at these plans. We are interested in your ideas about whether these three span the important possibilities and your thoughts on which is the correct one to put forward. Also we are interested in additional arguments supporting the plan that are not touched on here. Responses may be e-mailed to S. Meyer or S. Hanany. Responses and comments may also be sent to any member of the PPPDT or member of the CMBPol Mission Concept Study.

Here is a brief outline of three plans:

1. **The CMBpol community is ready to propose a space mission now.** Inflation models are key to current ideas of the early universe including flatness and the seeds for structure formation. They predict observables that are measurable today. These measurements can differentiate between inflation models and shed light on physics that is otherwise outside of experimental reach. The needed technology is in hand for a definitive space mission: detectors, optics, cooling and the tools to analyse the results of such a mission are demonstrated by current experiments. The sooner we start, the faster we will make important discoveries.

One aspect of this plan is that the recommendation of the BEPAC placed both JDEM and LISA ahead of an Inflation Probe mission in the NASA Beyond Einstein

Program. Whether this is an issue is not clear but we must be aware that we may be working against a precedent. It will only be a problem if the Decadal Committee is not inclined to plan the decade in direct conflict with the BEPAC report.

2. **The CMBpol community will propose a space mission within five years.**

We have carried out a review of the current state of the theoretical, experimental and analysis aspects of the measurement of CMB polarization from inflationary gravitational waves. The ESA Planck Mission and current sub-orbital experiments and their analysis will lead to great advances in our understanding of all aspects of future CMB polarization experiments. Theoretical advances and an improved understanding of foreground contamination including galactic emission and gravitational lensing will be the result of these experiments. They may also provide the first detections of the B-Mode signal. The rapid current progress will enable us to propose an optimized space mission in mid-decade. The main message to the Decadal Committee is that the progress towards ground-breaking new discoveries requires a concerted, well funded program of CMB research, theory, experiment and technology development, leading to the initiation of a space mission.

In this plan there remains the question of what will trigger the new space proposal. A well thought-through plan must include the reasoning and timing for this next step. Some options (and there may be others) are:

- (a) A new NASA announcement of opportunity for a mission concept within the Beyond Einstein program.
- (b) An event in the field such as the initial detection of B-Modes or a new theoretical development.

The statement of a decisive trigger in the plan has the potential to intervene in the timing of the proposal if the trigger is delayed. This possibility should be considered.

3. **The CMBpol community believes that a space mission will be important after the next decade.**

Here the statement to the Decadal Committee is that the progress in CMB research is strong and rapid and will lead to important discoveries within this decade without a space mission. The main message would be that support for CMB research, theory, experiment and technology development, are needed and should have priority in the decade because of the science potential but that a space mission is not, at this point, foreseen to be necessary. The key to this argument will be to make the case for the scientific importance of the field as a justification for funding priority. Here the case that the community is large, has important ties to a large range of physics and astrophysics and is well coordinated may be central to success of this plan. It would be counterproductive if the message was that CMB research can be slowed down because we will get to the important science without a strong endorsement from the Decadal Committee.