Charge to Technical Review Panel for Storage Ring EDM Experiments
(May 19, 2009)

A collaboration of particle, nuclear and accelerator physicists led by groups from BNL, Indiana University, and the University of Groningen, has proposed a program of novel measurements of charged-particle electric dipole moments (EDMs), to be carried out with storage rings injected from Brookhaven's AGS. The basic idea is to store longitudinally polarized proton or deuteron beams in dedicated rings with fields tuned to cancel the horizontal spin precession normally associated with the anomalous magnetic moment. In the presence of strong static or motional radial electric fields, a non-zero EDM would then be detected via a buildup in time of a small vertical polarization of the stored beam. The aim is to achieve sensitivity as good as, or better than, the next generation of neutron EDM measurements, i.e., to EDMs as small as 10^{-28}—10^{-29} e·cm.

A proposal for the deuteron EDM measurement – requiring combined electric and magnetic fields to cancel the anomalous magnetic moment precession – was presented to the RHIC/AGS Program Advisory Committee in May 2008. The PAC found the science goal compelling, but judged that the collaboration needed to increase its strength considerably, to produce a realization plan for the experiment with clear R&D milestones, and to have the project undergo a technical review before approving the experiment or seeking funding for it. In considering a realization plan, the collaboration has also developed the concept for a proton EDM measurement of interesting sensitivity, which could in principle be carried out in a storage ring with bending produced only by static electric fields. They thus now have a staged approach to propose, with suitable R&D targets along the path to each stage.

I seek your help in evaluating the technical robustness of the collaboration's present plan. Specifically, I would like your advice on the following questions:

1) Are there technical showstoppers evident at this stage that would seriously imperil attainment of interesting sensitivity levels in the eventual experiments? If there is no single showstopper, are there nonetheless too many high-risk performance goals to maintain a significant probability of payoff?

2) Is the proposed R&D plan sensible and achievable on a timeline suited to mount a competitive experiment? Has the collaboration properly identified the highest risk assumptions and proposed an appropriate set of R&D milestones to manage the risk?

3) Are the collaboration's considerations of systematic errors and approaches to mitigate them unduly optimistic?

4) Are you aware of competitive plans or proposals for charged-particle (other than electron) EDM measurements? Is the need for proton and/or deuteron EDM measurements to complement neutron EDM experiments sufficiently strong to merit proceeding?

5) Do the cost estimates and timelines presented for the R&D stages and for the EDM measurements themselves seem reasonable? (A detailed cost review would be premature at this point.) Is the proposed sequence for the proton and deuteron EDM measurement optimal? Are both measurements worth doing?

6) How much time do you estimate the collaboration needs to develop the proposal to a stage suitable for a DOE Critical Decision 0 ("mission need") review?

It is understood that the collaboration needs to be considerably strengthened to proceed to DOE review of the project. But strengthening the collaboration requires first some stronger commitment from BNL to pursue funding, scheduling and integration with the ongoing RHIC program. Your advice will be essential in considering that commitment.