

External review of the 21 cm R&D Initiative at Fermilab

The committee is charged with reviewing the progress of the R&D effort at Fermilab to develop a 21 cm radio telescope experiment. Such an experiment would make a 3-D map of 21 cm radiation from large red shifts in order to measure baryon acoustic oscillations (BAO) and thus study dark energy. We request that the committee assess and summarize the scientific, technical and management status of this project, and its relationship to other projects in the field. Specifically, we would like the panel to recommend whether this project is suitable to be the next dark energy experiment at FNAL beyond DES. To arrive at this recommendation, we suggest you consider the following:

1. Science

a) Evaluate the science requirements for this experiment, and the justifications for them. Compare to proposals for other experiments intended to study BAO, and dark energy in general. Is the dark energy 'reach' comparable to other proposals of similar scale, in a similar timeframe? Will a single-purpose BAO experiment such as this produce compelling dark energy results? Will it be compelling enough to garner the necessary community support to be funded? How risky is this project compared to competing proposals of similar scale?

2. Technical approach

a) The collaboration should present a strawman design, with concise technical specifications. Evaluate whether this design is a reasonable starting point and examine their plan for developing this design into a full conceptual and technical design, paying particular attention to how R&D and prototype work feed into this plan.

b) Is a rigorous site selection process underway? Are there technical, cost/schedule, and collaboration factors that make a Morocco site better than other possibilities?

c) What role will FNAL play in the technical design and prototyping process. In particular, will FNAL have a significant role in antenna design or electronics? Does FNAL have people with sufficient expertise to do this work and, if so, are such people available? If the hardware design is mostly done by other institutions, do they have the technical resources and expertise to carry it out?

d) Evaluate the plans for calibration and monitoring of the radio telescope. Can these be done sufficiently well to extract the signal from the foreground?

e) Assess progress on simulations and algorithms being developed to extract the 21 cm signal. Are these mature enough to proceed with technical design of the instrument, or do they need substantial further development?

3. Collaboration and funding

a) Has a coherent collaboration emerged, capable of moving this concept towards an experiment? Are there well-defined institutional roles during the design and R&D phase? What are the institutional commitments? Does the collaboration have the credibility and expertise to carry this project to completion?

b) Is there a realistic schedule and budget for completing R&D and moving forward with a project? Is there a realistic plan to obtain funding for R&D?

c) What is the total project cost projected to be, including realistic estimates for labor, overhead, contingency? How much do the construction and operations costs depend on the site chosen? Have these issues been folded into the overall project planning?

d) Is there a viable funding model for this project as a whole? Does the radio astronomy community expect to support it, through funding and participation?

We ask that the committee provide a written report, with comments, findings and recommendations, to FCPA within one week after the June 3 review.