US Funding Strategies
(notes from NAOC Workshop July '13)

- US

NSF Advanced Technology and Instrumentation (ATI) (November 1) ~ $1M, 3 yr

NSF Major Research Infrastructure (MRI) (January) ~ $1M, 3 yr

Mid-Scale Innovations Program in Astronomical Science (pre-proposal Sept 13 '13) $4-40M, < 5 yr

.- every two years?

NSF Catalyzing New International Collaborations (CNIC) (any time) ~ $100K, 1 yr

NSF Theoretical and Computational Astrophysics Networks (TCAN) (Feb '13, again Feb '14?)

CMU, UW, Chicago, JHU (Xin,A. Szalay?), UCI (Cooray), international?. UIUC (Wandelt)

DOE? SciDAC, Fermilab internal? DoE University Program? Snowmass process: 'Cosmology Frontier',

From our last ATI submission (Nov. ‘12)…

“We propose to build and observe with a small array of dish antennas at the radio quiet site at Green Bank. The array is a prototype for a cosmic-structure telescope called Tianlai. The demonstrator will allow the simultaneous use of 16 antennas with dual polarization and instantaneous RF bandwidths of 300 MHz. It will include a broadband feed antenna with an active balun. This places the LNAs within the feed, minimizing system noise. We will construct a software correlator using an array of GPUs. We will apply our existing calibration and foreground removal codes, which have successfully removed foregrounds from HI maps at GBT.”

Review Panel Summary…

(4 readers reports: good, fair, very good, good)

Major Strengths:
Proposal is to measure the 21 cm HI line at z = 0.2 with a 4x4 element interferometer of closely spaced 5 m dishes as a probe of baryon acoustic oscillations in the matter power spectrum.
The concept of using a dense packed array of commercial 5m class paraboloids with an innovative feed design is different from that of most other groups and would provide important information to the construction of Tianlai and the instrumentation field in general. A prototype array will allow tests of possible problems such as coupling between array elements or difficulty in removing foregrounds. There is a fairly complete description of the instrumentation that will be built to do this, and the instrument is fairly simple, being at ~1GHz. Green Bank is a very good environment for this work. The receiver is likely to work as planned, although there are questions about its ultimate performance. This team was involved in the first successful intensity mapping experiments with the GBT.

Minor strengths:
Keeping the dishes and electronics simple helps to minimize costs and maximize reliability. Feeds and amplifiers already have been demonstrated.

Major Weaknesses:
The PI's seem to misunderstand some important properties of interferometry, one of which is that even a dense array of dishes does not fully sample the UV plane. There are always holes in the sampling even when the dishes touch.
Satellite dishes may be a poor choice given that low cost construction leads to feed blockage by legs, and high side lobes.
Dense packing leads to cross coupling between dishes, and difficulty with calibration.
The method of removing point sources and other smooth emission from the maps will not be nearly as simple as at the GBT, which has a beam with very low sidelobes. Fringes from sources in the sidelobes of HSA-D can not be treated in the same way.

It is extremely difficult to estimate systematic errors from this type of measurement, so any detection is not reliable by itself, although detections can be tested by cross-correlation against optical data from the SDSS.

Minor weaknesses:
A test at Green Bank with its RFI environment would not be as reliable as a test at the planned site in China.
Many of the technical developments are being worked on by other groups and have reached mature design in other technology development proposals.