

Proposal Planning

- US
 - Revised NSF Extragalactic Astronomy Proposal? Due Nov 15 '22
 - Keck Foundation Proposal? Preproposal due Nov 1 '22
- Programs in France?
- Programs in China?

2021 NSF AAG Proposal:

Measuring Large Scale Structure with HI Intensity Mapping

We proposed:

Low-z cross-correlation with galaxy redshift surveys

Tianlai is the only dedicated HI interferometer that can operate near $z = 0$, allowing comparison and cross-correlation with several optical and HI surveys, and because the Tianlai dish array is steerable, unlike other existing dedicated HI interferometers, long integrations on small parts of the sky (NCP or narrow strips) are possible.

Cross-correlate low-redshift ($z < 0.07$) HI maps from the Tianlai arrays with the SDSS, ALFALFA, and WIYN/Hydra galaxy surveys.

Successful detections would be the first by a HIM dish array. We also expect to make the first auto-detections of HI by any HI instrument.

Because Tianlai has been operating for 5 years, we are in a unique position to inform the design of, and analysis of data from, CHORD and HIRAX and proposed arrays such as PUMA.

We expect to determine the 3D power spectrum of HI at low redshift and the low-mass tail of the HI mass function, which are not well-constrained by direct detection methods (i.e., ALFALFA).

Review of NSF AAG Proposal

** Strengths:

HIM is a promising new field that would benefit from further development in preparation for next generation experiments. While current experiments have only modest sensitivity, **the long term prospects for this science are exciting.**

This proposal would make use of data from the existing Tianlai facility, in which there has already been significant investment.

** Weaknesses:

While this proposal is aimed at pathfinding methods for future experiments, it does not make a strong enough case that the key work will directly translate to these experiments. In particular, the low redshift foregrounds may have significantly different characteristics than at higher redshifts, and the noise levels and scales being probed are also very different.

The proposed timeline is highly compressed given the ambitious nature of the work, particularly with regard to the power spectrum measurement in the final year.

Many key aspects of this work are being performed by unfunded collaborators.

The EM sims, while crucial to understanding systematics, are instrument specific. It is therefore unclear how much of this considerable effort will be relevant for future experiments.

Keck Proposal:

- Internal proposal to UW Madison was selected. 3 page preproposal to Keck due Nov 1. Full proposal in April '23.
- Proposal was to build a small test array at Green Bank with different antenna designs to study cross-coupling and other systematic effects.
- Keck is interested in supporting projects that US agencies will not – needs to be high-risk, high-payoff.
- \$1M – \$2M. Can have collaborators
- Needs science payoff too – not just engineering

Programs in France?

-FACTS French/Chicago program?

Programs in China?

- SKA proposal, Yougang PI, repair & update Tianlai correlator (SKA Pathfinder?), more dishes for calibration, other ideas?