Collaborative Research: Measuring Large Scale Structure Using HI Intensity Mapping and Optical Redshifts

INTELLECTUAL MERIT

Strengths: This proposal has the unique aim of measuring HI in a controlled regime, at low redshift. The goals are to cross-correlate TDA with galaxy surveys and to make a first auto-detection of HI with dish array interferometer.
The steps to achieve these goals are well thought out, building from cross-correlation measurements to get to a potential auto-detection. This will make the latter more convincing, as it is expected to be hard, posing unknown challenges.
The proposed work takes advantage of 2 regimes of observation: the North cap which has high sensitivity but low number of galaxies, and the mid latitude survey that is wider but less sensitive. In addition, the North cap (NCP) observations can give valuable foreground information.
Valuable preparatory work has been made to support this work, such as spectroscopic observations in the NCP.
This proposed work is supported by the PI who is a driver of the field.

Weaknesses: The proposal lacked details on the technical aspects of the work, such as mapmaking, cross-correlation measurements and foreground cleaning using machine learning. It was therefore hard for the panel to assess if they could achieve their goals.
It is also not clear how the coordination with international collaborators will be done to ensure the needed change of filters on the TDA in a timely manner. The NCP observations, while compelling, only provide a limited number of galaxies.
Overall, the proposed work is ambitious including a spectroscopic program, observations and pipeline development, which might require more resources.

BROADER IMPACTS

Strengths: The proposed work will provide paid high school internship, explicitly reaching out to high-school students as their demographics is more diverse than in college.

The new public lecture proposed for the Universe in the park at U of Wisconsin is compelling.

Weaknesses: none noted

DATA MANAGEMENT PLAN

The data management plan would have been stronger by committing to release the software used to reduce observations, as it is the standard in the field.

Also, time ordered data will be archived at Fermilab's Active Archive Facility only for the duration of the grant. The most important products are the maps, there are no central place to host them yet but there are plans to store them on a public website.

SYNTHESIS AND SUMMARY COMMENTS

The proposed work is compelling and convincing thanks to appropriate preparatory work and the team's expertise.

However the proposal would benefit from giving more details on the technical aspects of the analysis and the coordination on the telescope, to ensure the success of the proposed work.