

HYPERION: A Novel Approach to Observing the Reionization Global Signal

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The Hydrogen Probe for the Epoch of Reionization (HYPERION) is an exploratory effort towards a specialized low-frequency interferometer designed to study the EoR through the spatial monopole of the 21cm brightness temperature of neutral hydrogen as a function of redshift/time (i.e. the global signal). A successful observation of this signal would provide a first look at the overall neutral hydrogen content in the universe as a function of time, giving insights on the formation of the first stars and galaxies and the physics of the early universe. As of now, such an observation has not been made. This is predominately due to the difficulty of these observations our target signal has a brightness temperature 100,000 times smaller than the galactic synchrotron emission that dominates the sky in our science band.

The innovation of HYPERION from earlier global signal projects comes in its closely-spaced interferometric design. Previous and current global signal experiments have used a single dish design, which enables direct sampling of the spatial monopole 21cm signal. Previous work by members of this group has shown it to be theoretically possible to detect the global signal using an interferometer despite the inability to directly sample the spatial monopole (M.E. Presley et al, ApJ, vol. 809, no. 18, 2015; Singh et al, ApJ, vol. 815, no. 88, 2015). The detection abilities can be improved by closely spacing the antenna elements and by placing absorbers between the elements (T. Venumadhav et al, ApJ, vol. 826, no. 2, 2016). By taking these measures, we hope to control and mitigate the systematic problems that have so far prevented a successful measurement.

We present a review of the science case for HYPERION (including our observational technique), an overview of the current status of the instrument, and our plans for the immediate future of the experiment.