**ABSTRACT submitted for: ICEAA**

**Special Session titled:** Array Systems for Radio Astronomy and Space Applications: Design, Measurement and Calibration

**Organized by:** Eloy de Lera Acedo and Giuseppe Virone

The Hydrogen Epoch of Reionization Array (HERA)

David R. DeBoer(1) on behalf of the HERA Collaboration

(1) University of California Berkeley, CA USA, e-mail: ddeboer@berkeley.edu

The Hydrogen Epoch of Reionization Array (HERA – http://reionization.org) is a staged experiment that uses the unique properties of the 21-cm line from neutral hydrogen to probe the Epoch of Reionization (EOR). During this epoch, roughly 0.3 - 1 billion years after the Big Bang, the first stars and black holes heated and reionized the early Universe. Direct observation of the large scale structure of reionization and its evolution with time will have a profound impact on our understanding of the birth of the first galaxies and black holes, their influence on the intergalactic medium (IGM), and cosmology.

Detecting, characterizing and ultimately imaging this epoch is a key goal for the astronomy and astrophysics community. Current projects (PAPER (http://eor.berkeley.edu), MWA (http://mwatelescope.org), LOFAR (http://www.lofar.org)) are striving to make the first detection of the statistical power spectrum of the signal, however current best limits still fall above even optimistic predictions of its intrinsic strength. While these projects are still taking data, it is recognized that an optimized array based on our new understanding of the signal characteristics is needed to make a strong detection and begin to characterize this signal over multiple scales and redshifts. These results would also inform design elements for the Square Kilometer Array.

HERA has been funded under the US National Science Foundation’s Mid-Scale Innovations Program to begin building elements optimized for robust power spectrum detection. The key is to produce inexpensive collecting area optimized for the spatial scales needed to detect the EOR. This has resulted in a close-packed array of transit 14-meter dishes, with the first elements currently under construction at the South African Karoo Astronomy Reserve, the current location of the Donald C. Backer Precision Array to Probe the Epoch of Reionization (PAPER) array.

Beginning with the current NSF funding, HERA will rollout in a staged deployment. The first phase extending to August 2016 will deploy 37 elements that will test the HERA element design for performance and manufacturability at location. These 37 elements will more than double the sensitivity of the 128-element PAPER array. The next phase extending into 2018 will build out to 127 elements, which should provide a very robust detection of the EOR signal. Finally, extending into 2020, HERA will build out to 352 elements to further EOR science as a function of redshift and spatial scale, potentially producing the first images of the EOR.