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Progress Towards Measuring the Cosmic 21cm Background from the Epoch of Reionization

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Measuring 21cm hyperfine emission from neutral hydrogen at cosmological distances is one of the most promising techniques for probing our early universe. During cosmic reionization, this signal is sensitive to myriad cosmological and astrophysical processes as the first stars and galaxies heat and ionize the intergalactic medium. Recently, the Precision Array to Probe the Epoch of Reionization (PAPER) has overcome the key technical hurdles facing 21cm reionization experiments to place physically constraining upper limits on the cosmological signal. These limits imply a level of heating of the intergalactic medium inconsistent with a rapid decrease in star formation rate density at high redshifts and inconsistent with lower prescriptions relating X-ray luminosity to star formation rate. Building on these successes, the US community has coalesced around a next-generation experiment for exploring cosmic reionization via 21cm emission. The Hydrogen Epoch of Reionization Array (HERA) will be a large array of zenith-pointing parabolic dishes optimized for power spectral measurements. HERA's considerable collecting area enables it to precisely measure ionization fraction versus redshift, to directly image larger ionization bubbles, and to probe heating in pre-reionization epochs. Phase I of HERA was recently funded and construction has already begun.