MITEoR: A Prototype Highly Scalable Interferometer for 21 cm Cosmology

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Abstract: Studying astrophysics and cosmology with the 21 cm line of neutral hydrogen requires extreme sensitivity and, therefore, radio telescopes with enormous collecting areas. Achieving that size with an interferometer is limited by the computational cost of the correlator, which scales as N^2, where N is the number of antennas in the array. However, a large class of highly redundant interferometers can cut that scaling down to $N \log N$. Redundant configurations also enable new algorithms for precise and automated calibration. For this reason we designed MITEoR, a 64-element, dual-polarization prototype radio interferometer designed to demonstrate these scalable technologies, which we constructed at MIT and deployed this summer in The Forks, Maine. We report on the results of MITEoR and the lessons learned for next generation radio interferometers.

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