THE MURCHISON WIDEFIELD ARRAY

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For the MWA collaboration

The Murchison Widefield Array (MWA) is a dipole-based aperture array synthesis telescope designed to operate in the 80-300 MHz frequency range. It is capable of a wide range of science investigations, but is initially focused on three key science projects. These are detection and characterization of 3-dimensional brightness temperature fluctuations in the 21cm line of neutral hydrogen during the Epoch of Reionization (EoR) at redshifts from 6 to 10, remote sensing of the inner heliosphere via propagation effects on signals from distant background sources (including diagnostics of the magnetic field), and high-sensitivity exploration of the variable radio sky.

The array design features 8192 dual-polarization broad-band active dipoles, arranged into 512 “tiles” comprising 16 dipoles each. The tiles are quasi-randomly distributed over an aperture 1.5km in diameter, with a small number of outliers extending to 3km. All tile-tile baselines are correlated in custom FPGA-based hardware, yielding unprecedented instantaneous monochromatic uv coverage and PSF quality. The correlated data are calibrated in real time using novel position-dependent self-calibration algorithms.

The resulting array capabilities are revolutionary, with high fidelity imaging at high spectral resolution over a wide fractional bandwidth and over a very wide field of view of many hundreds of square degrees. The survey speed of the array, per unit hardware cost, is extraordinary and provides rich scientific opportunities. The array is located in the Murchison region of outback western Australia. This region is characterized by extremely low population density and a superbly radio-quiet environment, allowing full exploitation of the instrumental capabilities.

In this contribution, the array design are be outlined, and early results from MWA hardware deployed in the field are presented. Commissioning and initial observing plans are also described.