Site Selection, Data Communications and Array Design for the Long Wavelength Array

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The Long Wavelength Array (LWA) will be a next generation radio telescope with imaging power 2-3 orders of magnitude better than current or past capabilities at frequencies below the FM band. When completed the LWA will consist of 52 stations, each comprised of 256 dipoles spread over a 100 m diameter area. These stations will be distributed across New Mexico with baselines ranging up to 400 km in length. The LWA frequency range will be 10-88 MHz, so at the upper end of the range the expected angular resolution is 2 arcseconds. Primary science drivers are (1) an improved characterization of the ionosphere at fine spatial and temporal scales; (2) measurements of supernova remnants, gamma-ray bursts, active galaxies, and clusters of galaxies to constrain models for these diverse cosmic accelerators; (3) measuring the relaxation state of clusters to constrain the cosmological evolution of both Dark Matter and Dark Energy in the universe; and (4) using high temporal (millisecond or better) and high spatial resolution (few arcseconds) to probe the transient universe at long wavelengths. Further details about the instrument can be found at the LWA web page (http://lwa.unm.edu).

The design effort is currently underway is for construction of the first LWA station. However, the design of the complete array is a high priority since obtaining leases and establishing data communications between sites is a long lead-time item. Given an expected data rate from each site of between 0.5 and 5 Gbps, the most practical long-haul solution for data communications is over optical fiber. Initial site selection is constrained by availability of land, power, access to fiber, and the radio frequency environment. Sites are chosen with regard to how they impact the imaging capability of the final array, and intermediate stages. At the same time, the initial sites are being selected on the basis that they could potentially be combined with the VLA to dramatically enhance the imaging and sensitivity of the 74 MHz system. We will describe the iterative site selection process and report on our current status.

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