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THE ALLEN TELESCOPE ARRAY: THE FIRST WIDEFIELD, PANCHROMATIC, SNAPSHOT RADIO CAMERA FOR RADIO ASTRONOMY AND SETI

Abstract

The first 42 elements of the Allen Telescope Array (ATA-42) are beginning to deliver data at the Hat Creek Radio Observatory in Northern California. Scientists and engineers are scrambling to capitalize on all of the flexibility designed into this innovative instrument for conducting surveys of the astrophysical sky simultaneously with surveys for distant technological civilizations. According to Jerry Ostriker (Plumian Professor, Cambridge; Professor of Astrophysics, Princeton; Provost, Princeton), "Surveys aren't just something that astronomers do, they are the only thing astronomers do." These words are understandable, given Prof. Ostriker's intimate association with the Sloan Digital Sky Survey that is presently transforming our view of the optical universe. The ability to systematically survey one quarter of the sky, with the dynamic range and spatial resolution to zoom in to study individual objects, is providing us with the first truly 3-dimensional map of thenearby cosmos. The optical portion of the spectrum unveils the moderately energetic and hot components of the universe, but the physics of the cool constituents is probed at radio wavelengths, and that is where the ATA will make pioneering contributions.

Eventually, the ATA will consist of 350 radio telescopes, each 6.1 m in diameter. The ATA will do for the radio sky what the Sloan Digital Sky Survey has done for the optical sky. Moreover, it will survey so rapidly that it will also provide the first systematic look at the transient radio universe. The ATA delivers simultaneous access to any frequency between 500 MHz and 11.2 GHz, with four separate frequency channels feeding a suite of signal processing backends that can produce wide-angle radio images of the sky in 1024 frequency channels, and at the same time, study up to 32 point sources of interest within its large field of view. This new approach to commensally sharing the sky allows SETI (the Search for ExtraTerrestrial Intelligence) and traditional radio astronomical science to be on the air nearly all the time: our tools are beginning to be commensurate with the size of the vast explorations of the radio sky that we wish to undertake.

This talk summarizes the innovative design elements of the ATA, the cost savings made possible by the use of COTS components, and the cost/performance trades that eventually enabled this first snapshot radio camera. The fundamental scientific program of this new telescope is varied and exciting; some of the first astronomical results will be discussed.