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OPPORTUNITIES FOR RADIO TECHNOSIGNATURE SEARCHES WITH THE ALLEN TELESCOPE ARRAY AND VERY LARGE ARRAY

Abstract

The Allen Telescope Array (ATA), located at the Hat Creek Radio Observatory in Northern California, is an interferometric radio telescope that comprises 42 6.5-m offset-gregorian dish antennas equipped with novel broadband log periodic dipole receivers covering 1-12 GHz. A development program is currently underway to upgrade the receivers with a new version providing greater frequency coverage and higher sensitivity, particularly at high frequencies. The ATA is currently operated in a partnership between SI and SRI International in which operations costs are borne by SRI and observing time is split between both institutions. A flexible signal processing system allows up to four 600 MHz bands to be processed simultaneously. Currently available digital backends are FPGA-based and include two 64 input correlators (104 MHz), three phased-array beamformers (70 MHz) and several commodity compute clusters for real-time processing and analysis. In collaboration with the University of California, Berkeley and the California Institute of Technology, our team is currently evaluating the performance of the revised feeds and commissioning a modern heterogeneous digital backend that will permit flexible technosignature searches over broader bandwidths than the existing systems and permit parallel searches for interesting astrophysical transients such as fast radio bursts (FRBs).

We see three key opportunities to leverage the ATA to further technosignature science. First, to undertake a wide-field high spectral resolution multi-epoch synoptic sky survey using the upgraded digital backend currently being developed. This survey would cover an order of magnitude more of the radio spectrum than any previous wide-field technosignature search. Second, to develop and undertake a rapid follow-up observing program for radio technosignatures toward targets identified by other search technosignature programs or exotic objects means (e.g. stars with anomalous spectral energy distributions or unidentified photometric features). Third, to employ the ATA as a testbed for developing a prototype technosignature search capability for the Jansky Very Large Array (JVLA) in New Mexico. Such a system could be operated commensally and continuously alongside other JVLA science and would be deeply complementary to planned commensal technosignature searches with Southern Hemisphere SKA precursors.

Here we will describe these opportunities, their potential scientific impact and our efforts to actualize them.