Pilot SETI Survey with the Upgraded Allen Telescope Array

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About the ATA

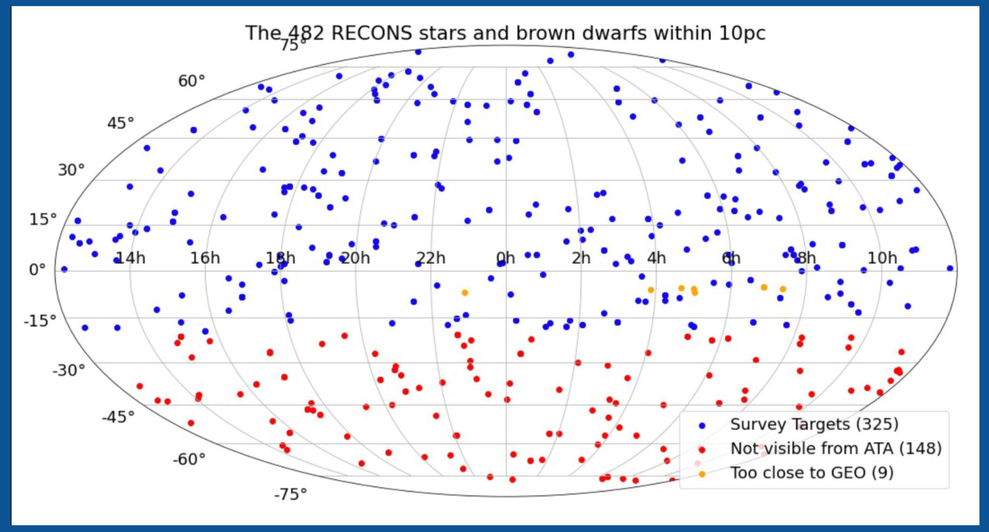
The Allen Telescope Array (ATA) is a flexible 42-element radio interferometer located in Northern California, and the first instrument to be solely built to conduct SETI research [1].
The ATA has undergone a refurbishment program over the past few years and recently completed its commissioning stage. It has commenced science observations with 20 elements equipped with upgraded feeds, receptive to a frequency range of 1-10 GHz, featuring an instantaneous bandwidth of 1.4 GHz.
Additionally, the ATA has seen improvements to its backend, with a newly deployed beamformer and an online correlator

Technosignatures

Technosignatures are any measurable signals that are potential telltale signs of artificial technology. Assumed to be narrow band signals of a few Hz, they are thought to be frequency drifting, as transmitters will likely have a relative motion with respect to us. This creates a net Doppler shift of the signal in frequency space.
Our pilot survey focused on looking for these signals, using a high-resolution spectrometer and a de-Doppler search-trial algorithm known as *turboSETI*. The ATA has the ability to perform real-time analysis through its backend.

The Pilot Survey

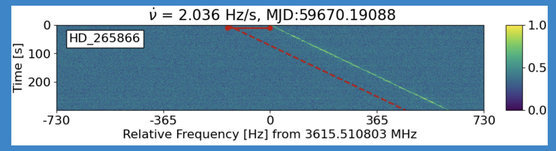
The targets were a sub-sample of approximately 300 stars from the REsearch Consortium Of Nearby Stars (RECONS) catalog, which consists of stars within 10 pc from Earth. The subset were those visible from the ATA (<-20° dec), while also removing the Geostationary arc (-6° dec).



SETI surveys have been typically conducted at lower frequencies, i.e., less than 1.5 GHz. However, the **ATA feeds enables us to conduct high-frequency observations between 3-10 GHz**, with an instantaneous bandwidth of 1.4 GHz. The data collected were analyzed using turboSETI, looking for narrow band signals over a wide range of drift-rates across all covered sub-bands.

Survey Results

Many drifting signals were found using turboSETI, as the one illustrated below. However, similar candidates seem to appear in observations of different sky positions, with common frequencies and drift rates. **This highlights the need for multi-beam analysis, which would help mitigate many false positives due to Radio Frequency Interference (RFI).**



Future Prospects at ATA

There is scope to continue this and other SETI surveys with the ATA using multi-beam analysis. Beyond this survey, the ATA has been used to conduct follow-up observations of the WOW signal [2] and K-2 exoplanets [3]. Work at the ATA extends beyond SETI, encompassing studies on Gamma-ray bursts [4]. There is also the potential to explore long-term pulsar scintillation monitoring, observations of repeating Fast Radio Bursts (FRBs), RFI environment characterization, and follow-up radio counterpart observations of slow transients.

Publications

[1]DeBoer, D. et al. 2004, [2] Perez, K. I., et al. 2022, [3] Saide, R.C. et al. 2023, [4] Bright, J. S., et al. 2023