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SETI 1: SETI Science and Technology (1)

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# BREAKTHROUGH LISTEN ON THE MURCHISON WIDEFIELD ARRAY

**Abstract**

Breakthrough Listen (BL) is humanity's largest search for technosignatures. Our targets range from Solar System objects, through Galactic stars, to nearby galaxies, scanned using facilities operating in the optical as well as at radio frequencies from 1 - 100 GHz. The radio component of the program has deployed high-speed digital backends to some of the world's most capable radio telescopes, generating petascale datasets that are searched for candidate SETI signals as well as astrophysical phenomena such as fast radio bursts.

BL's searches are pushing into unexplored regions of parameter space (sensitivity, resolution, frequency coverage, duty cycle, sky coverage / number of targets, etc.). Low-frequency aperture arrays offer an excellent opportunity to cover large areas of the sky and to survey a region of the radio spectrum (frequencies of hundreds of MHz) that has been underexplored from a SETI perspective.

BL has recently deployed digital backend hardware to the Murchison Widefield Array (MWA), the Square Kilometre Array low-frequency precursor telescope in Western Australia. With a field of view of hundreds of square degrees, there are always targets of interest for technosignature searches within the field of view. The BL instrumentation, commissioned in collaboration with the MWA team at Curtin University, has been developed to allow commensal SETI searches that do not require dedicated time on the telescope, but rather can beamform in the direction of stars, galaxies, or other SETI targets, as well as incoherently summing the signals from all of the antennas (essentially treating the array as a single dish). Our deployment at MWA provides an important step towards SETI with the SKA itself as well as the development of all-sky SETI capabilities.

We will describe the MWA, previous SETI searches done with the telescope, the new BL hardware and how it integrates with other upgrades to the MWA backend, the initial observations that have been

made, and our plans moving forward. We will also discuss the development of new algorithms such as cyclostationary imaging that could help to sift through the large volume of interfering human-generated signals and help isolate truly interesting technosignature candidates.