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HOW TO BUILD A COMMENSAL SETI SEARCH ENGINE FOR RADIO TELESCOPE ARRAYS

Abstract

The Breakthrough Listen program has broadened the search for extraterrestrial intelligence to unprecedented levels in multiple dimensions and in multiple regions of the electromagnetic (EM) spectrum. In the radio portion of the EM spectrum, Breakthrough Listen initially utilized primary observing time on two of the world's most sensitive radio telescopes: the Green Bank Telescope in West Virginia, USA and the Parkes Radio Telescope in New South Wales, Australia.

Breakthrough Listen continues to broaden the search further by engaging with other radio telescope facilities and adding commensal observing capabilities. Commensal observing trades off control of the telescope for greatly increased amounts of telescope time, but for radio telescope arrays with relatively large fields of view (e.g. MeerKAT, ALMA, ngVLA) this is of less consequence. Digital techniques such as coherent beam-forming afford a commensal backend control over where to point narrow synthetic beams within the telescope's primary beam. Breakthrough Listen has deployed a commensal digital backend on the MeerKAT radio telescope array in the Karoo region of South Africa to do just this. In this paper we discuss the design and implementation of this commensal SETI search engine and present some data to showcase its capabilities.