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SETI 1: SETI Science and Technology (1)

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AUTOMATION AND TARGET SELECTION FOR COMMENSAL SETI OBSERVING

Abstract

Radio telescope arrays offer exciting opportunities for commensal SETI surveys. Ethernet-based architectural approaches adopted by MeerKAT, the VLA [1] and the Allen Telescope Array allow multiple observers to receive data simultaneously. Breakthrough Listen is conducting an automated commensal SETI survey at MeerKAT, subscribing to raw voltage data streams from the F-engines. The Breakthrough Listen system at MeerKAT will perform both coherent and incoherent beamforming on the buffered raw voltages. In the coherent mode, synthesized beams will be formed on objects of interest within the primary field of view of the telescope. The bulk of the objects for observation will be selected from a set of 26 million stars drawn from Gaia DR2. A reconfigurable processing pipeline will perform SETI searches on the data from each beam. As there is ultimately a limit on in-situ computation, a finite number of beams may be formed and processed simultaneously. All or a subset of the available stars will be observed,

depending on the number of stars in the primary field of view and the duration of the primary pointing. Stars will be prioritised according to metrics such as distance, among others.

In this talk, we describe the automation of Breakthrough Listen's commensal observing at MeerKAT. Commensal observers encounter many different types of primary observation. We examine the optimal automated response of the observing system to these different scenarios, along with the associated processing, target selection and survey figures of merit. Practical implementation details are discussed, including the software (in development [2]) written to automate observations in accordance with the strategies outlined above. Finally, we evaluate automated observing performance under these different scenarios according to appropriate metrics.

[1] Hickish, J., Beasley, T., Bower, G., Burke-Spolaor, S., Croft, S., DeBoer, et al., 2019. Commensal, Multi-user Observations with an Ethernet-based Jansky Very Large Array. arXiv preprint: arXiv:1907.05263

[2] https://github.com/UCBerkeleySETI/commensal-automator