Green Bank 100 m Telescope Observations of Boyajian's Star from 1-27.5 GHz with the Breakthrough Listen Backend.

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Background: Boyajian et al. [1] announced the discovery of an extraordinary object in the *Kepler* prime catalog, KIC 8462852 ("Boyajian's Star"), which exhibited a bizarre set of short dimming events ("dips"). These dips are somewhat reminiscent of "dipper" stars, but the star shows no evidence of youth or a close-in disk, including no spectral emission reversals and no IR or mm excess. Schaefer [2] and later Montet & Simon [3] showed that the star also exhibits an extraordinary long-term dimming, over 10% in the last century and 4% during the *Kepler* mission itself.

Both sorts of dimming are unprecedented and remain unexplained, despite significant creative efforts by many teams. Wright & Sigurdsson [4] analyzed several families of solutions, including obscuring material from a breakup event on cometary orbits [1,5,6], the effects of a merger with a planet or brown dwarf [5], and obscuration by interstellar material.

Dyson [7] predicted that advanced alien civilizations might intercept large amounts of starlight to provide a large energy supply. Arnold [8] predicted that *Kepler* would be sensitive to such structures and sufficiently sensitive to distinguish them from planets. Wright et al. [9] connected the dimming events of Boyajian's Star to Arnold's predictions, attracting significant popular and professional attention to the star.

SETI observations in the radio [10] and optical [11,12] have so far found no interesting signals.

Observations: We obtained 25 h of Green Bank 100 m Telescope time through the NRAO Open Skies call to search Boyajian's Star for radio transmissions from a potential alien civilization there. Our observations were spread over 4 days between 26 October 2016 and 31 January 2017.

We used the L,S,C,X, and KFPA receivers to cover much of the spectrum between 1–27.5 GHz. We used the Breakthrough Listen backend to achieve an instantaneous bandwidth of up to 3.938 GHz. We covered the entire bandwidth afforded by the KPFA receiver with three intermediate frequency tunings of the downconversion system. We nodded the telescope to produce on/off pairs of observations to enable robust RFI rejection. We observed flux and polarization standards in each configuration, and made observations of Mars in X band (to observe known narrowband signals from its orbiters) and maser sources (including DR 21(OH)) as checks on our procedures.

We all recorded data in "raw voltage" mode, and transferred these data over the Internet to the Penn State Institute for CyberScience Advanced CyberInfrastructure high performance computing cluster for analysis, storage, and distribution. The total data volume for the first three observations was ~250 TB.

Analysis and Distribution: Analysis at Penn State of these data is ongoing. Because the data were stored as raw voltages, we anticipate applying novel analysis methods, and invite suggestions for them. As with all Breakthrough Listen data, we intend to make the data public or publicly analyzable. These observations demonstrate the capabilities of the Breakthrough Listen backend and we hope will be emblematic of "gold standard," high bandwidth SETI observations for future observing campaigns of particularly promising SETI targets identified via artifact SETI.

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