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Author: Ms. Julia DeMarines
University of California, Berkeley, United States, julia.demarines@gmail.com

Dr. Jacob Haqq-Misra
Blue Marble Space Institute of Science, United States, jacob@bmsis.org
Dr. Edward Schwieterman
University of California, Riverside (UCR), United States, eschwiet@ucr.edu
Dr. Woodruff Sullivan
University of Washington, United States, woody@astro.washington.edu
Dr. Andrew Siemion
Univerisity of California, United States, siemion@berkeley.edu
Mr. Howard Isaacson
UC Berkeley, United States, hisaacson@berkeley.edu
Dr. Steve Croft
University California Berkeley, United States, scroft@berkeley.edu
Mr. Sanjoy Som
University of Washington, United States, sanjoy@u.washington.edu

THE MOONBOUNCE PROJECT: OBSERVING THE EARTH AS A COMMUNICATING EXOPLANET

Abstract

The Moonbounce Project attempts to measure the Earth's unintended radio leakage, known as our 'technosignature', to better understand how our planet is viewed by a distant observer. The Moonbounce Project is an observational effort to measure radio waves emanating from the Earth reflected by the moon using radio telescopes, similar to earthshine measurements in the visible wavelengths. This project is a collaboration between the Breakthrough Listen team (a SETI initiative run through the UC Berkeley SETI Research Center) and scientists from the Blue Marble Space Institute of Science (a not-for-profit virtual research group). It attempts to expand upon earlier 'radioshine' observations conducted in the late 70's and again in 2012 to help answer questions such as 'what is Earth's technosignature?' and 'how is it changing over time?'. These observations will also have implications for refining SETI algorithms and future searches.

The Moonbounce Project will corroborate radio observations with optical observations of earthshine in the NIR/VIS/UV wavelengths to search for technosignatures such as anthropogenic emissions (e.g., NOx, CO2, CFC's, CH4) using high spectral resolution telescopes. Attempts at detecting these technosignatures through ground-based telescopes are in their nascent stages and could have significant implications for measuring Earth's anthropogenic emissions over the next several decades.

We plan to observe through the Green Bank Telescope (GBT) and reduce these data using the Breakthrough Listen backend and use three prime focus receivers to cover broad frequency ranges (290-395 MHz, 680-920 MHz, and 910-1230 MHz). These ranges include several television channels as well as an assortment of mobile, radionavigation, and other telecommunication channels. For measuring earthshine we propose to use the 2.4m Automated Planet Finder (APF) at Lick Observatory (also allocated

for Breakthrough Listen observations) to measure in visible wavelengths from 375nm-980nm with high spectral resolution in attempts to resolve anthropogenic trace greenhouse gases.

As humanity advances in technology and countries continue to develop, our radio and atmospheric signatures will change. This changing relationship with our planet is an interesting biosignature in itself. Corroboration of technosignature data across the electromagnetic spectrum can help inform future SETI and exoplanet observations and yield insight to how our own technosignature is changing over time (i.e. will CFC's be non-existent in our atmosphere in 50 years, or will we be radio quiet as we move toward fiber optic communications?). Here we present a novel and holistic study of Earth as an evolving, intelligent, communicating exoplanet.