

51st IAA SYMPOSIUM ON THE SEARCH FOR EXTRATERRESTRIAL INTELLIGENCE (SETI) –
The Next Steps (A4)
SETI 1: SETI Science and Technology (1)

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EXTRAGALACTIC SETI

Abstract

The Breakthrough Listen Initiative has embarked on a comprehensive SETI survey of nearby stars in the Milky Way that is vastly superior to previous efforts as measured by a wide range of different metrics. However, it is not always fully appreciated that even the largest radio telescopes observing at 1-2 GHz have a field-of-view that spans several arcminutes, and the Breakthrough Listen (BL) surveys therefore often encompass many distant background sources. This point is traditionally ignored in SETI searches, especially the fact that many of these sources are extragalactic systems. In order to better appreciate and exploit the presence of extragalactic objects in the field of view, the Aladin sky atlas and NED were employed to make a rudimentary census of extragalactic objects that were serendipitously observed by Enriquez2017, as part of one of the initial Breakthrough Listen observing campaigns. Using the 100-m Greenbank telescope observing at 1.1-1.9 GHz, 692 fields were originally targeted, each of which was selected to contain a nearby star of known distance. This work examines 469 of these fields, having excluded fields that were overlapping, fields that included very bright target stars $m_V < 5$, and fields that lay close ($-10 < b < +10$) to the galactic plane. For these 469 fields (assuming a FWHM radial field-of-view of 4.2 arcminutes), NED identified a grand total of 143024 extragalactic objects, including 17810 point sources, 28405 galaxies, 87841 Infrared sources, 44 QSOs, 8016 Ultraviolet sources, 401 X-ray sources, 398 radio sources, 11 Absorption line systems, 5 Gamma ray sources, 53 Galaxy cluster members, 33 galaxy groups, 6 galaxy pairs and 1 galaxy triple. Additional analysis also reveals various AGN types (including Seyfert galaxies, Radio Galaxies etc), interacting galaxies, star formation regions and one confirmed gravitational lens system. Several nearby galaxies, galaxy groups and galaxy clusters are identified, permitting the parameter space probed by SETI surveys to be significantly extended. New constraints are placed on the luminosity function of potential extraterrestrial transmitters and limits on the prevalence of very powerful extraterrestrial transmitters associated with these vast stellar systems are also determined. It is demonstrated that the recent Breakthrough Listen Initiative, and indeed many previous SETI radio surveys, place stronger limits on the prevalence of extraterrestrial intelligence in the distant Universe than is often fully appreciated.