A MILKY WAY SEARCH STRATEGY FOR EXTRATERRESTRIAL INTELLIGENCE

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ABSTRACT. We assume that the density of sites of technical civilizations emitting suitable signals (whether purposeful or unintentional) is proportional to the stellar density at any location in our Galaxy, as modelled by Bahcall and Soneira (1980). A wide variety of possible radio luminosity functions Ø(L) for these civilizations is then assumed and for each the number of detectable signals per square degree over the sky is calculated. We find that most detectable signals occur at galactic latitudes of 10° or less and longitudes within 90° of the galactic center, a region which covers only 9 per cent of the entire sky. This result holds for a wide range of Ø(L) types, including Gaussian distributions and power law functions with slopes less than 2.5, or any combination of these. The Milky Way is much less preferred, but still advantageous, for cases of steep power law functions (slopes greater than 2.5) or Gaussian functions with mean luminosities so low that any existing civilizations can only be detected at distances less than 0.5 kpc. The only cases where low galactic latitudes are not advantageous are (1) for frequencies of operation less than 600 MHz where the deleterious effects on signal-to-noise ratios of the natural galactic background emission become dominant, and (2) in searches for narrowband ($\lesssim$ 1 Hz) signals at frequencies less than 2 GHz where significant interstellar broadening of signals occurs over distances of $\gtrsim$10 kpc. Furthermore, all of the above results have broader applicability: they are equally valid for searches for any type of <u>natural</u> radio phenomenon if its probability of occurrence is proportional to stellar density.

For a non-targeted search, we therefore argue for a Milky Way strategy which concentrates on the inner galactic plane. The factor of 10 in time saved over an all-sky survey can then be used for, say, increased sensitivity or a survey of nearby galaxies. For a targeted search, rather than search the nearest n solar-like stars, time is more profitably spent, for example, on the very nearest 0.1n stars plus the next nearest 0.9n stars which are also within 10° of the galactic plane. This picks up the Milky Way background while only sacrificing a factor of two in the average distance to the target stars.

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