Can Exoplanet Studies Inform Astrobiology and SETI?

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The explosion in detection of planets around other stars and early attempts at characterizing these bodies has prompted some to suggest that this is opening a new era in both astrobiology at large and is increasing our ability to conduct SETI. "Astrobiology" in this context can be defined as the natural biological system that arises on a planet. I examine in detail these claims and attempt to map out where these studies overlap to produce new arenas of consideration (Figure 1). The intersection of exoplanet characterization with astrobiology can produce a broader understanding and appreciation of the habitability potential of various types of planets. A consideration of exoplanet properties in the context of whether there are likely to be planetary types that somehow are more conducive to intelligence than others could be termed the planetary foundation of intelligence. Lastly, any intelligent species is ultimately a product of its planetary ecology at the time of its inception, thus the interplay of astrobiology with SETI could be called an intelligence ecology. At this point, our understanding of much of this intellectual terrain is primitive at best or entirely absent. However, even unquantified notional hypotheses that are poorly constrained can be instructive when we still face a dire paucity of data. In this case, the immediate utility of such thinking is to point us towards the types of data from exoplanets that might be useful in understanding their habitability potential, and potential for intelligence ecologies.

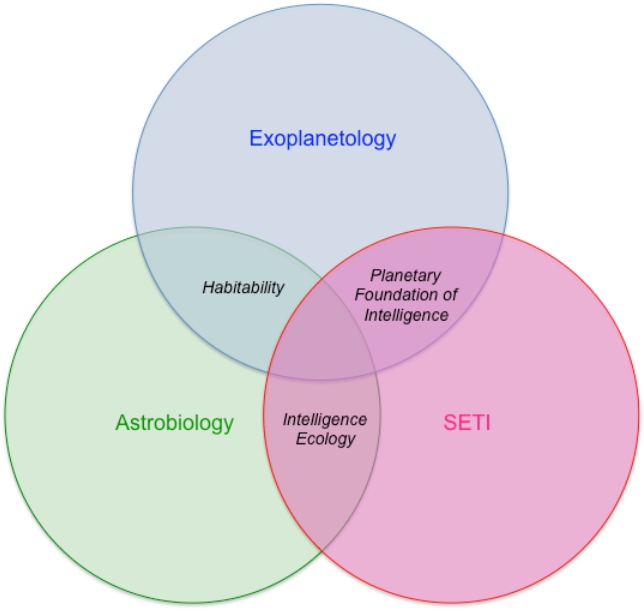

Figure 1: Conceptual diagram of interactions between exoplanetology with astrobiology & SETI.

The types of data that we can glean from exoplanet observations at present is severely limited to a few parameters possibly including mass, diameter, orbital period, distance from the primary star, density (allowing some inference of composition), possibly temperature information, and some information about the chemistry of the atmosphere. Data that is critical to understanding exoplanets includes direct multispectral imaging, more highly spatially resolved spectroscopy, and other techniques to enhance understanding of atmospheric and possibly surficial chemistry. Can this type of data collection actually be done? This is unclear but a conceptual framework can help guide our efforts to improve the technology used to characterize exoplanet environments.