

# Venus as a Laboratory for Exoplanetary Science

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## **Abstract**

The goals of the astrobiology community are focused on developing a framework for the detection of biosignatures, or evidence thereof, on objects inside and outside of our solar system. A fundamental aspect of understanding the limits of habitable environments and detectable signatures is the study of where the boundaries of such environments can occur. Thus, the need to study the creation, evolution, and frequency of decidedly uninhabitable environments is an integral part of a complete understanding of habitability in the overall astrobiology story. These provide the opportunity to understand the bifurcation, between habitable and uninhabitable. The archetype of such a planet is the Earth's sibling planet, Venus. Given the need to define the conditions that can rule out bio-related signatures of exoplanets, Venus provides a unique opportunity to explore the processes that created a completely uninhabitable environment. Here we describe the current state of knowledge regarding Venus in the context of remote sensing techniques that are being or will be employed in the search for and characterization of exoplanets. We discuss exoVenus candidates from the *Kepler* and *TESS* exoplanet missions and provide an update to exoplanet demographics that can be placed in the potential runaway greenhouse regime where Venus analogs may reside. We discuss specific outstanding questions regarding the Venus environment and the relevance of those issues to understanding the atmospheres and interior structure of exoplanets. Finally, we outline the path towards a deeper analysis of our sibling planet and the synergy to exoplanetary science.