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CHALLENGES ASSOCIATED WITH THE REMOTE DETECTION OF METHANE AS A PRIMITIVE BIOSIGNATURE

Abstract

Since 1992 over 700 exoplanets have been discovered, and this number has been increasing with thanks to new technologies such as the Kepler mission. The announcement of Earth-sized planets are just beginning to emerge out of the data. This trend is likely to continue as more data is analyzed and advanced technology is developed and implemented. Since the notion of Earth-like planets is no longer fiction but fact, humans are faced with the very real possibility of life on other planets. Using both ground based as well as spaced based telescopes, like the Hubble Telescope, we are begging to analyze the atmospheres of exoplanets using the eclipsing method. However, this method requires the planet to be transiting with its star and requires large integration times to allow for the signal to be subtracted out of the noise for the absorption features to be distinguished.

Future missions such as proposed TPF class missions (such as the New Worlds Observer mission) will be able to block out the light of the parent star making it possible for the comparatively weaker light of starlight reflected from the exoplanets to be captured. Since no such mission is currently being funded yet, we can prepare by creating a library of atmospheric constituents likely to be classified as biosignatures. It is also fruitful to examine Earth's atmospheric history for clues of past atmospheric biosignatures. Before the rise of molecular oxygen in the atmosphere, due to photosynthetic metabolism, it is widely thought that methane was a major biosignature and greenhouse gas on early Earth. Methane is a byproduct of methanogenic metabolism prevalent in the Archean atmosphere (based on geologic evidence), however, methane is also produced abiotically. This raises several concerns when looking for primitive life in the Universe. In 2010 controversial claims of methane plumes on Mars in 2010 (Mumma et al) were met with doubts among atmospheric scientists such (Zanhle 2011). In this paper I will discuss the challenges associated with the detection of Methane as a biosignatures and lend suggestions to discern abiototically produced methane versus biologically produced methane.