Towards identifying biological processes with transit spectroscopy

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Abstract

Over the past decades transit spectroscopy has become one of the pioneering methods to characterise exoplanetary atmospheres. With the increasing number of observations, and the advent of new ground and spaced based instruments, it is now crucial to find the most optimal and objective methodologies to interpret these data, and understand the information content they convey. This is particularly true for smaller and fainter Earth like type planets, where atmospheric spectroscopy represents a unique way to detect biomarkers such as Ozone or the vegetation's red edge. In this conference we will present a new take on the spectral retrieval of transiting planets, with particular focus on super-Earth and Earth atmospheres, and the potential to detect biological processes. Using TauREx (Waldmann et al. 2015a,b.), a new line-by-line radiative transfer atmospheric retrieval framework for transmission and emission spectroscopy of exoplanetary atmospheres, we investigate the impact of signal to noise, spectral resolution and wavelength coverage on the retrievability of individual model parameters from transit spectra of exoplanets, and put our models to test (Rocchetto et al. 2015). For the first time, we analyse in a systematic way large grids of spectra generated for different observing scenarios. We perform thousands of retrievals aimed to fully map the degeneracies and understand the statistics of current exoplanetary retrieval models, in the limiting signal-to-noise regime of super-Earth and Earth observations. This work allows us to understand the fundamental observational thresholds required to constrain the properties of these foreign worlds, and to identify possible biological signatures.

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