

A Hybrid Random Forests Method for the Inversion of Exoplanet Spectra

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Direct imaging, interferometry, and transit spectroscopy can provide high-quality spectra of exoplanets made of hundreds to thousands of data-points. Random forest (RF) approaches can compare efficiently the data to forward models, infer constraints on key atmospheric parameters (Teff, log g, abundances, structure, etc) and inform on how the individual data points connect to each of these parameters.

We present a novel RF framework to invert the spectroscopic data of exoplanets. Traditional RF tools tested for the spectral inversion perform a classification to derive pseudo-posterior distributions on the free parameters of the models. In the present approach, we build a model providing continuous posteriors through a robust regression of the data. It is shown to provide higher ranking scores with respect to reference studies using the RF to invert exoplanet spectra. We will show applications on mock datasets and medium-resolution VLT/SINFONI observations of the YSES 1b exoplanet. We will discuss the pros and cons of the method and its potential for the analysis of medium- to high-resolution spectra.