EPSC Abstracts
Vol. 15, EPSC2021-185, 2021
https://doi.org/10.5194/epsc2021-185
Europlanet Science Congress 2021


# Alfnoor: a population study on Ariel's low resolution transmission spectra.

**Lorenzo V. Mugnai**[1], Ahmed Al-Refaie[2], Andrea Bocchieri[1], Quentin Changeat[2], Enzo Pascale[1], and Giovanna Tinetti[2]

[1]Sapienza Università di Roma, Dipartimento di Fisica, Roma, Italy (lorenzo.mugnai@uniroma1.it)

[2]Department of Physics and Astronomy, University College London, Gower Street, London, WC1E 6BT, UK

In the next decade, the Ariel Space Telescope will provide the first statistical data set of exoplanet spectra, performing spectroscopic observations of about 1000 exoplanets in the wavelength range 0.5 - 7.8 micron during its Reconnaissance Survey. The Ariel Reconnaissance Survey has been designed specifically to identify planets without molecular features in their atmosphere, and select targets (about 500) for accurate chemical characterisation with higher SNR spectroscopic observations.

In this work, we investigate the information content of Ariel's Reconnaissance Survey low resolution transmission spectra. We produce different planetary populations using the Ariel candidate target list, randomizing the planetary atmospheres, and simulating the Ariel observations using the Alfnoor software. Then we analyse the dataset, getting three different results:

(1) We present a solid strategy that will allow selecting candidate planets to be reobserved in an Ariel's higher resolution, using a chi-squared based metric to identify the flat spectra.

(2) Because the reconnaissance survey is not optimised for spectral retrieval, we propose a novel model-independent metric to preliminary classify exoplanets by their atmospheric composition. Without any other planetary information than the spectrum, our metric proves capable of indicating the presence of a molecule when its abundance in the atmosphere is in excess of $10^{-4}$ in mixing ratio.

(3) We introduce the possibility of finding other methods to better exploit the data scientific content. We report as an example of possible strategies, a preliminary study involving Deep and Machine Learning algorithms. We show that their performance in identifying the presence of a certain molecule in the spectra is marginally better than our metric for some of these algorithms, while others outperform the metric.

We conclude that the the Ariel reconnaissance survey is effective in detecting exoplanets manifesting featureless spectra, and we further show that the data collected in this observing mode have a rich scientific content, allowing for a first chemical classification of the observed targets.