EPSC Abstracts
Vol. 14, EPSC2020-1085, 2020, updated on 01 Jul 2022
https://doi.org/10.5194/epsc2020-1085
Europlanet Science Congress 2020

CaRM: Retrieving exoplanets transmission spectra with high resolution spectroscopy

Eduardo Cristo[1,2]
[1]Instituto de Astrofísica e Ciências do Espaço, Portugal (ecristo@astro.up.pt)
[2]Faculdade de Ciências da Universidade do Porto

High resolution spectra is the standard source to derive precise radial velocities. With the development of state-of-art instrumentation, like ESPRESSO, we are able to have higher resolutions and long term stability.

During a transit the star light from a observer point of view is filtered in the day-night terminator of the exoplanet. As the light transverses it, diverse chemical species, dust, hazes and clouds let an imprint in the host star light. This allows to detect exoplanet atmospheres using transmission spectroscopy. However, a chromatic approach of the Rossiter-McLaughlin (RM) effect also permits to measure the planet radius wavelength dependence as a composition proxy.

The Rossiter-McLaughlin effect is an phenomenon in radial velocities. When a star rotates, there is a velocity distribution created by the half of the surface that is moving towards the observer, presenting a intrinsic blueshift, compensated by the redshifted portion rotating away. A transiting planet produces an asymmetric distortion of the stellar line profiles of an observer giving origin to a RM profile.

We present CaRM (Chromatic Rossiter-McLaughlin), a code developed to retrieve the transmission spectrum of an exoplanet using HARPS and ESPRESSO data. It employs a Markov chain Monte Carlo algorithm to fit two distinct RM models, with a linear or quadratic limb-darkening law, to Cross Correlated spectra. The orbital parameters retrieved as result, e.g. spin-orbit misalignment, are of foremost importance when constraining the models of planetary formation and evolution.

A chromatic approach to the RM has been used in HD 189733b HARPS transit data, which is reproduced by this code with a good degree of agreement to previous results. We expect now to apply CaRM to ESPRESSO data (ESO-VLT), taking this method to a new level.