



Revisiting the atmosphere of HD 209458b with HARPS-N, CARMENES and ESPRESSO

Núria Casasayas-Barris^{1,2}, Enric Pallé^{1,2}, Monika Stangret^{1,2}, Guo Chen³, Fei Yan⁴, and the ESPRESSO consortium*

¹Instituto de Astrofísica de Canarias, Vía Láctea s/n, 38205 La Laguna, Tenerife, Spain (nuriacb@iac.es)

²Departamento de Astrofísica, Universidad de La Laguna, Spain

³Key Laboratory of Planetary Sciences, Purple Mountain Observatory, Chinese Academy of Sciences, Nanjing 210023, China

⁴Institut für Astrophysik, Georg-August-Universität, Friedrich-Hund-Platz 1, D-37077 Göttingen, Germany

*A full list of authors appears at the end of the abstract

HD 209458b was the first transiting planet discovered, and the first for which its atmosphere, in particular Na I, was detected. With time, it has become one of the most studied planets, with a large diversity of atmospheric studies using low- and high-resolution spectroscopy. Here, we present the analysis of high-resolution transmission spectroscopy of HD 209458b using a total of five transit observations with HARPS-N and CARMENES spectrographs. In contrast to previous studies where atmospheric Na I absorption is detected, we find that, for all of the nights, either individually or combined, the transmission spectra can be explained by the combination of the centre-to-limb variation and the Rossiter-McLaughlin effect. Thus, the transmission spectrum reveals no detectable Na I absorption in HD 209458b. This is also observed in the time-evolution maps and transmission light curves, but at lower signal-to-noise ratio. Other strong lines such as H α , Ca II IRT, the Mg I triplet region, and K I D1 are analysed, and are also consistent with the modelled effects, without considering any contribution from the exoplanet atmosphere. New ESPRESSO observations, with state-of-the-art stability and considerably larger signal-to-noise, confirm the results of our study and will also be shown.

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