Abstract

In recent years, the transit of HD189733b is the most observed among all known transiting exoplanets. The transmission spectrum of this planet has been measured with several instruments from Spitzer and Hubble (HST) Space Telescopes, and from several ground-based telescopes. In this paper an analytical theory is used to complete this spectrum from near-ultraviolet to infrared (0.33 - 7.85 μm). The model suggests a new approach which takes into account the quantity of light transmitted through the planetary atmosphere and the thermal emissions from the night side of the planet, to describe the transmission spectrum of HD189733b in photometric study. The availability of measures in different wavelengths has allowed us to validate our model with more efficiency. We found an agreement between our transmission spectrum model of HD189733b and data from the infrared to the UV. The model
predicts a value of $R_p=R? = 0.1516$ at 7:3 m, which is a low value compared to all observations at different wavelengths. We interpreted this value by a fluorescence emission from sulphur dioxide (SO$_2$). Therefore, the likely presence of these molecules in the atmosphere of HD 189733b. The second objective of this paper is to study the effect of starspots on the transmission spectrum of this hot-Jupiter. To reach this goal, we developed an analytical theory considered as an extension of the approach proposed by Berta et al. 2011 [5]. The model shows clearly that the unocculted spots would significantly increase the transit radius ratio at visible and near-ultraviolet wavelengths, while having a minimal impact at infrared wavelengths. Therefore, the wavelength dependence of the spots effect has been clearly shown by this new model. At the end of this paper, we reported the way in which this model can provide an estimation of the percentage of the unocculted spots area relative to stellar disk area for an observation of HD189733 performed in a given epoch and at a given wavelength.

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