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【95】Observation of Exoplanetary Atmospheres with High-Resolution Transmission Spectroscopy

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Under specific conditions, exoplanets and their atmospheres gradually unveiling themselves to our knowledge. Among the best characterized exoplanets, hot Jupiters still show a number of peculiarities that remained unexplained. Among them are the radius anomaly, the presence of clouds that darken atmospheres and the atmospheric evaporation due to different mechanisms. The transmission spectroscopy technique studies the light filtered through the atmosphere of an exoplanet, as it passes in front of its star. These observations have experienced a rapid development in the last few years, allowing us to precisely probe the low part of atmospheres. Despite this progress, we still are unable to understand the link between the low and the upper part of atmospheres, with the latter undergoing evaporation. This last point calls for new types of complementary observations.
My work explored the possibility to use HARPS, a high-resolution spectrograph in the optical domain, in order to measure exoplanetary transmission spectra. It allowed us to measure, for the first time with a medium-size telescope, some high-resolution transmission spectra of hot Jupiters. The studies of sodium lines (via the Fraunhofer D doublet) into the atmospheres of the two hot Jupiters HD189733b and WASP-49b revealed new informations about their thermospheres, whose are very specific region of intermediate altitudes. Some innovative temperatures and winds measurements in these regions complement the observation made at others wavelengths and resolutions. Henceforth, observations at high-resolution, particularly in the optical domain, are a valuable and important resource in order to understand exoplanets atmospheres.

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