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Studies of the atmosphere of ultra-hot Jupiter TOI-1431b/MASCARA-5b

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Ultra-hot Jupiters are defined as giant planets with equilibrium temperatures larger than 2000 K. Most of them are found orbiting bright A-F stars, making them extremely suitable object to study their atmospheres using high-resolution spectroscopy.

TOI-1431b, also known as MASCARA-5b, a newly discovered planet with the temperature of 2375 K is a perfect example of ultra-hot Jupiter. We studied this object using three transit observations obtained with high-resolution spectrographs HARPS-N and EXPRES. Analysis of Rossiter-McLaughlin effect shows that the planet is in the polar orbit, which speaks about an interesting dynamical history, and perhaps indicating the presence of more than one planet in the early history of this system. Applying the cross-correlation and transmission spectroscopy method, we find no evidence of atoms and molecules in this planet. These results are at odds with the other studies of similar UHJs orbiting bright stars, where various species have been found.