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Studying Big Planets with Small Telescopes: The z'-Band Occultation of WASP-19b Observed with EulerCam and TRAPPIST

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Transiting planets have opened up a window to the detailed study of extrasolar planets as their orbital orientation allows the measurement of the planet/star radius and flux ratios. From the observation of planetary transits and occultations at different wavelengths we can gain insights into the planets temperature, atmospheric composition, energy redistribution and albedo. In order to contribute to the characterization of planetary atmospheres, it is necessary to obtain high precision measurements of planetary transits and occultations as the signals of interest have amplitudes of typically 100 ppm.

We use two dedicated instruments, EulerCam at the 1.2m Euler-Swiss telescope and the 0.6m TRAPPIST telescope for the in-depth study of transiting planets through time resolution photometry. While single lightcurves from 1m class telescopes typically reach photometric precisions of around 1mmag, we obtain very high accuracy on the transit and occultation shape by not relying on single observations but collecting larger samples of lightcurves.

In this framework, we have performed an extensive observing campaign on the Hot Jupiter WASP-19b collecting over 60 hours of observations with EulerCam and TRAPPIST. The data cover 14 transits and 10 occultations of WASP-19b. We demonstrate how the attainable photometric precision and accuracy of the derived parameters can be greatly improved by combining an increasing number of lightcurves as instrumental and stellar effects can be identified and accounted for.

We report the detection of the occultation of WASP-19b in the z'-band. This measurement is one of only a handful of exoplanet occultations detected from the ground at wavelengths shorter than 1μm , and so far the only one obtained from the ground using 1m class telescopes. Our value adds to an ensemble of occultation measurements for this planet, and is indicative of an Oxygen-dominated chemistry. From our sample of transits, we measure the transit depth to a precision of better than 1% in the r', I+z' and z' bands.