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Unveiling an exoplanetary Neptunian atmosphere through multiband transit photometry

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Abstract

The "effective" radius of a planet is a function of wavelength due to scattering and/or absorption processes, and we can exploit simultaneous multiband transit photometry to probe the atmospheric scale height and composition. We present new photometric data of the recently discovered "hot Uranus" GJ3470b [1, 2], gathered with the LBC camera at LBT. Light curves of unprecedented accuracy (0.0012 mag in U and 0.00028 mag in a narrow band centered at 972 nm; Fig. 1 and 2) allowed us to measure an increasingly larger planetary radius at shorter wavelengths, which we interpret as a signature of Rayleigh scattering by a large scale height atmosphere. Further follow-up observations to confirm this result and probe the presence of specific atomic and molecular species is ongoing.

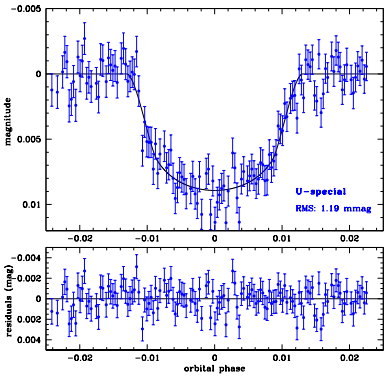

Figure 1: Light curve of GJ3470b gathered with the blue channel of LBC in the $U_{\rm spec}$ band ($\lambda_{\rm c} = 357.5$ nm), plotted with the original sampling cadence (upper panel) and residuals from the best-fit model (lower panel).

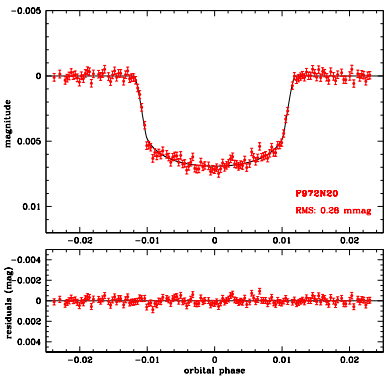

Figure 2: Same as the previous plot, but in the $F972N20$ band of the red channel of LBC ($\lambda_{\rm c} = 963.5$ nm).

References

[1] Bonfils, X.; Gillon, M.; Udry, S. et al.: A hot Uranus transiting the nearby M dwarf GJ 3470. Detected with HARPS velocimetry. Captured in transit with TRAPPIST photometry, A&A, Vol. 546, A27, 2012

[2] Demory, Brice-Olivier; Torres, Guillermo; Neves, Vasco et al.: Spitzer Observations of GJ 3470 b: A Very Low-density Neptune-size Planet Orbiting a Metal-rich M Dwarf, ApJ, Vol. 768, 154