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0.94 - 2.42 μm ground-based transmission spectra of the hot Jupiter HD-189733b

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Abstract

We present here new transmission spectra of the hot Jupiter HD-189733b using the SpeX instrument on the NASA Infrared Telescope Facility. We obtained two nights of observations where we recorded the primary transit of the planet in the J-, H- and K-bands simultaneously, covering a total spectral range from 0.94 to 2.4μm. We used Fourier analysis and other de-trending techniques validated previously on other datasets ([3], [5]) to clean the data . We tested the statistical significance of our results by calculating the auto-correlation function, and we found that, after the detrending, white noise dominates at most frequencies. Additionally, we repeated our analysis on the out-of-transit data only, showing that the residual telluric contamination is well within the error bars. While these techniques are very efficient when multiple nights of observations are combined together, our results prove that even one good night of observations is enough to provide statistically meaningful data, which might appear counterintuitive given the daunting accuracy to be achieved. Our observed spectra are consistent with space-based data recorded in the same wavelength interval by multiple instruments ([1], [2], [4], [6]) indicating that low-resolution exoplanet spectroscopy is indeed feasible with medium-sized telescopes from the ground and hence that ground-based facilities are becoming a viable and complementary option to spaceborne observatories. The best fit to the features in our data was obtained with water vapour with a mixing ratio computed between 10^{-4} and $5{\cdot}10^{-4}$. Our error bars are not small enough to address the presence of additional molecules.

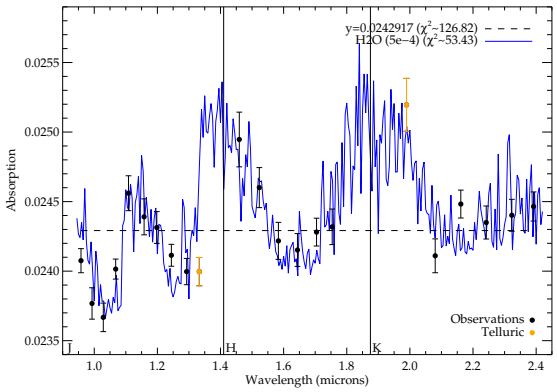

Figure 1: 0.94-1.4 μm IRTF transmission spectrum compared to a simulated spectrum for water with a mixing ratio of $5 \cdot 10^{-4}$, assuming an isothermal atmosphere at $T \sim 1500$K. The χ^2 value for this fit is also given, where the data values known to suffer from telluric contamination (marked 'Telluric' in the figure legend) were excluded for this calculation. For reference, a straight line with a value equal to the mean of all of the data points ($y = 0.0243$) is also shown, with the associated χ^2 value.

References

[1] Pont, F., Knutson, H., Gilliland, R. L., Moutou, C., & Charbonneau, D. 2008, MNRAS, 385, 109

[2] Swain, M. R., Vasisht, G., & Tinetti, G. 2008, Nature, 452, 329

[3] Swain, M. R., Deroo, P., Griffith, C. A., et al. 2010, Nature, 463, 637

[4] Gibson, N. P., Aigrain, S., Roberts, S., et al. 2012, MNRAS, 419, 2683

[5] Waldmann, I. P., Tinetti, G., Drossart, P., et al. 2012, ApJ, 744, 35

[6] Waldmann, I. P., Tinetti, G., Deroo, P., et al. 2013, ApJ, 766, 7