LRG-BEASTS: An Optical Transmission Spectrum for the hot Jupiter WASP-94Ab using EFOSC

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Introduction

The aim of the LRG-BEASTS (Low Resolution Ground-Based Exoplanet Survey using Transmission Spectroscopy) is to gather a large sample of optical transmission spectra of hot Jupiter atmospheres.

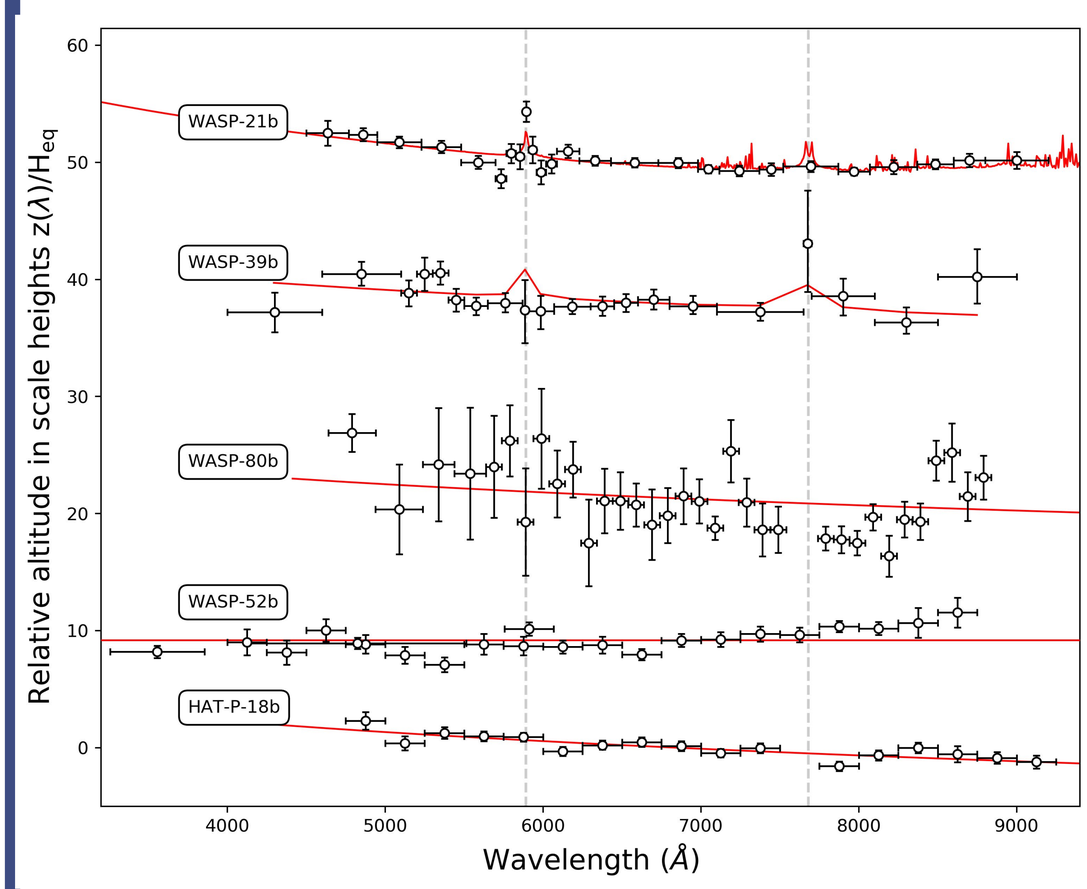

Fig. 1 LRG-BEASTS published results to date (see LRG-BEASTS website), demonstrating our ability to obtain a precision of around 1 atmospheric scale height.

For all planets, the best fitting atmospheric forward model is plotted in red, while the dashed grey lines indicate the Na doublet at ~5900 Å and the K doublet at ~7700 Å.

Observations

Observations of WASP-94A took place on the night of the 14th of August 2017, using the EFOSC2 instrument[1] mounted at the Nasmyth B focus of the NTT.

The total number of spectra observed during the night is 477 with airmass ranging from 1.70 to 1.00 to 2.41, covering the wavelength range of 3800 - 7100 Å.

WASP-94A and its companion star WASP-94B are of almost identical spectral type with F8 and F9 and of similar V magnitude with 10.1 and 10.5, respectively; with this and in combination with their angular distance being ~15 arcseconds[2], WASP-94B provides optimal requirements to be used as a comparison star to perform differential spectroscopy in order to minimize the noise caused by the perturbations of the Earth's atmosphere.

The data of WASP-94A b was reduced with the custom-built Python script as described in detail in [3] and also used in all other LRG-BEASTS survey papers[4,5,6].

WASP-94A b

WASP-94A b is reported to have a mass of 0.452 Jupiter masses and a radius of 1.72 Jupiter radii, orbiting its host star in ~4 days at a distance of 0.055 AU. These characteristics make WASP-94Ab an optimal target for transmission spectroscopy, however no atmospheric studies have been done so far.

Conclusions & Future Work

With our observations of WASP-94Ab using the ground-based EFOSC instrument on the NTT, the atmosphere is revealed to have a Sodium absorption feature, which suggests a fairly cloud-free atmosphere. However, we also detect a Rayleigh slope implying that aerosols are likely to be present in the atmosphere of WASP-94Ab, though not masking the Na feature.

Atmospheric retrieval analysis has to be performed to identify accurate opacity contributions and strength of the Rayleigh scattering.

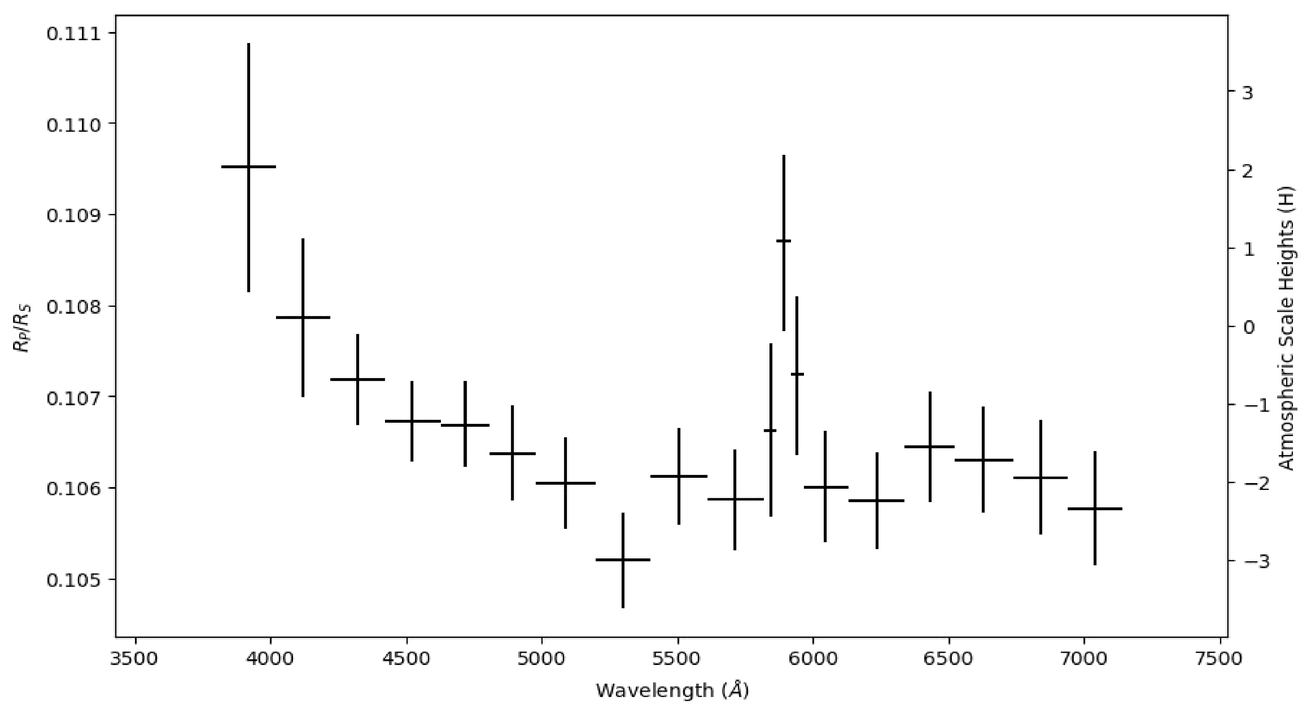

Fig. 2: Transmission spectrum for WASP-94Ab, showing a Na feature as well as a Rayleigh slope.

References

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