Leibniz-Institut für
Astrophysik Potsdam

Transmission spectroscopy of HAT-P-19 b

Matthias Mallonn[1], Jörg Weingrill[1], Klaus G. Strassmeier[1], Ignasi Ribas[2]

[1]Leibniz-Institut für Astrophysik Potsdam (AIP)
[2]Institut de Ciències de l'Espai (CSIC-IEEC)

Transmission spectroscopy as the search fo chromatic radius variations

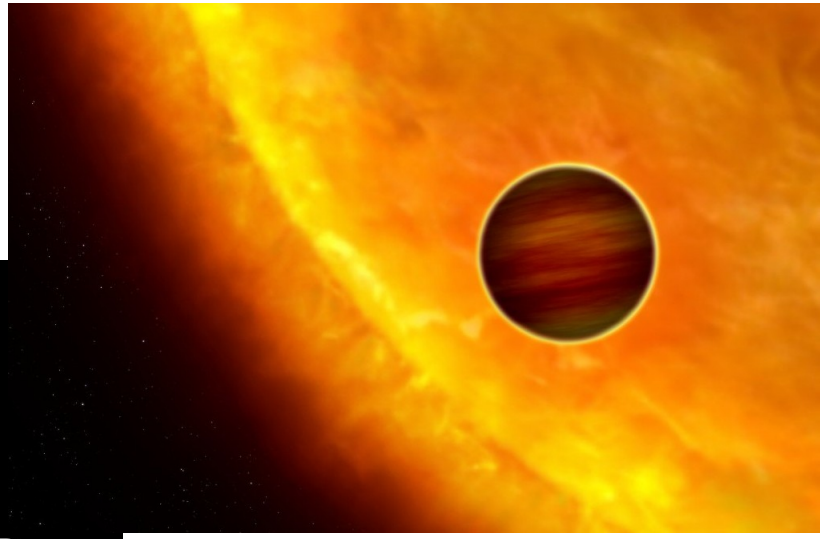


Image credit: ESA

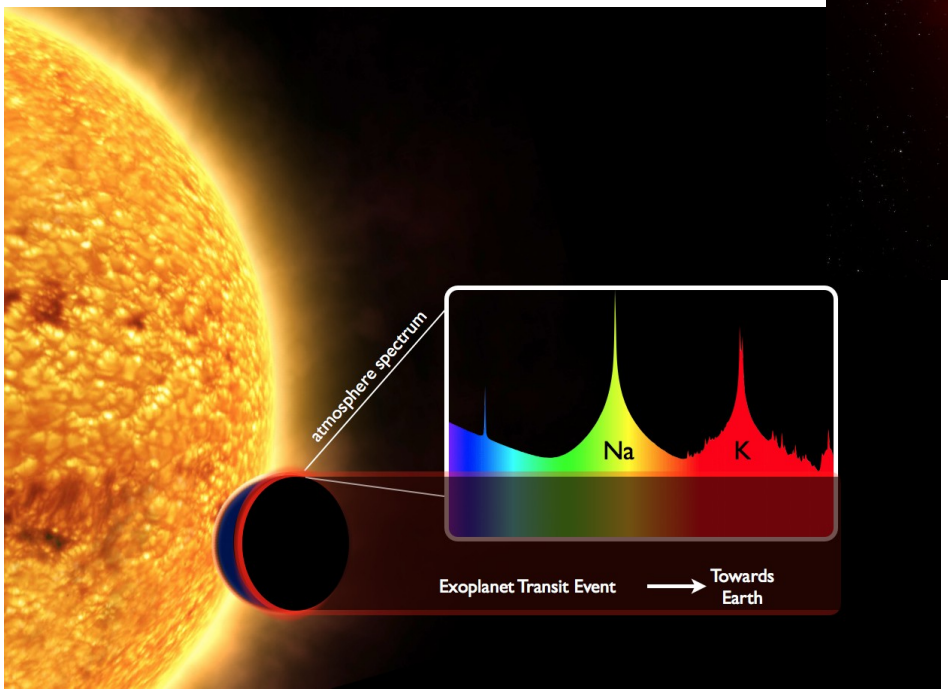


Image credit: ESA

Opacity over wavelength of the atmospheric ring can be revealed by the transit depth over wavelength

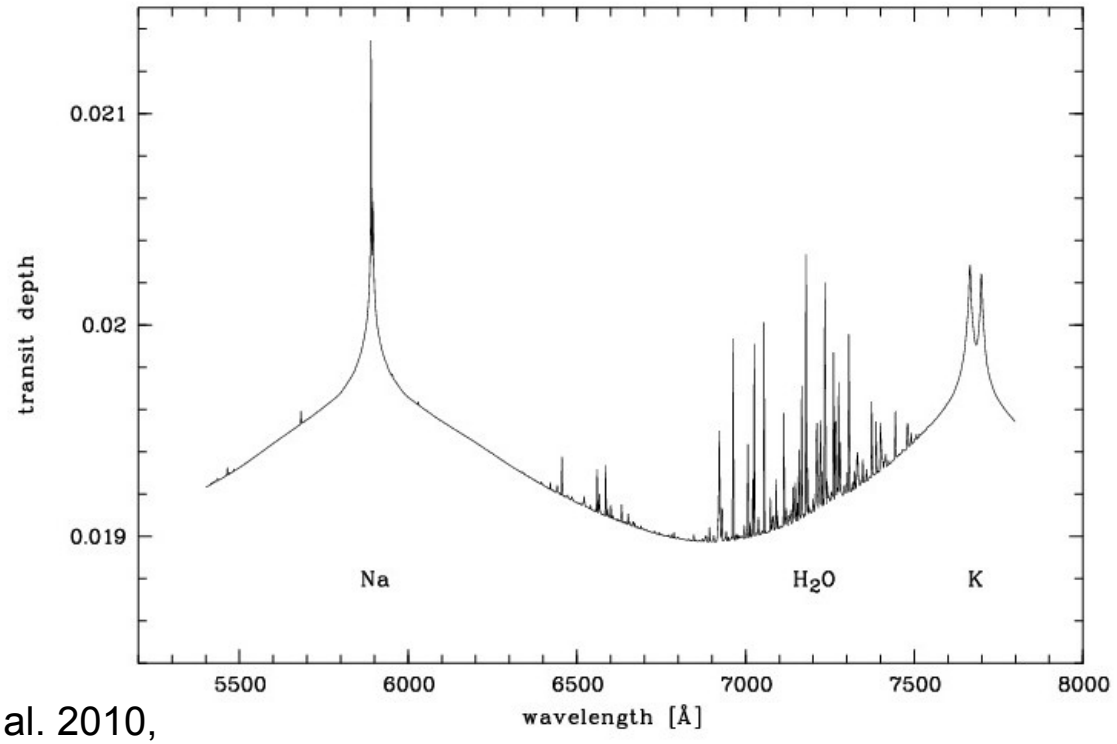
Our target: the Hot Jupiter HAT-P-19 b

A Jupiter-sized planet lighter than Saturn (Hartman et al. 2011)

Transit depth ~ 2 %

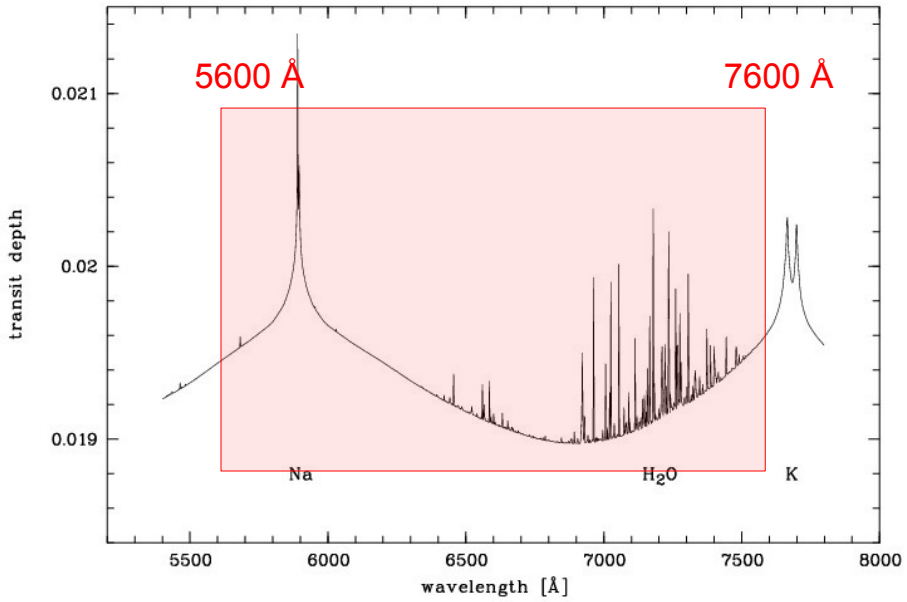
g ~ 6 m/s²

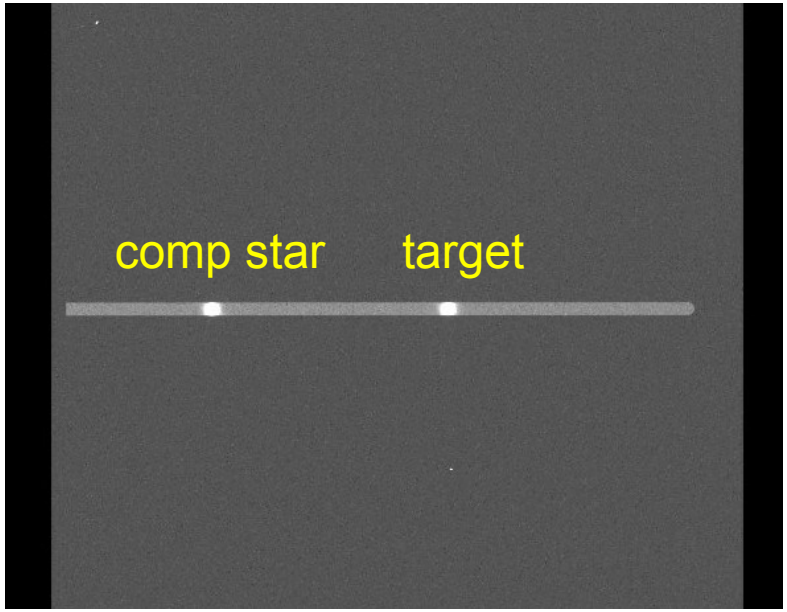
T equilibrium ~ 1000 K



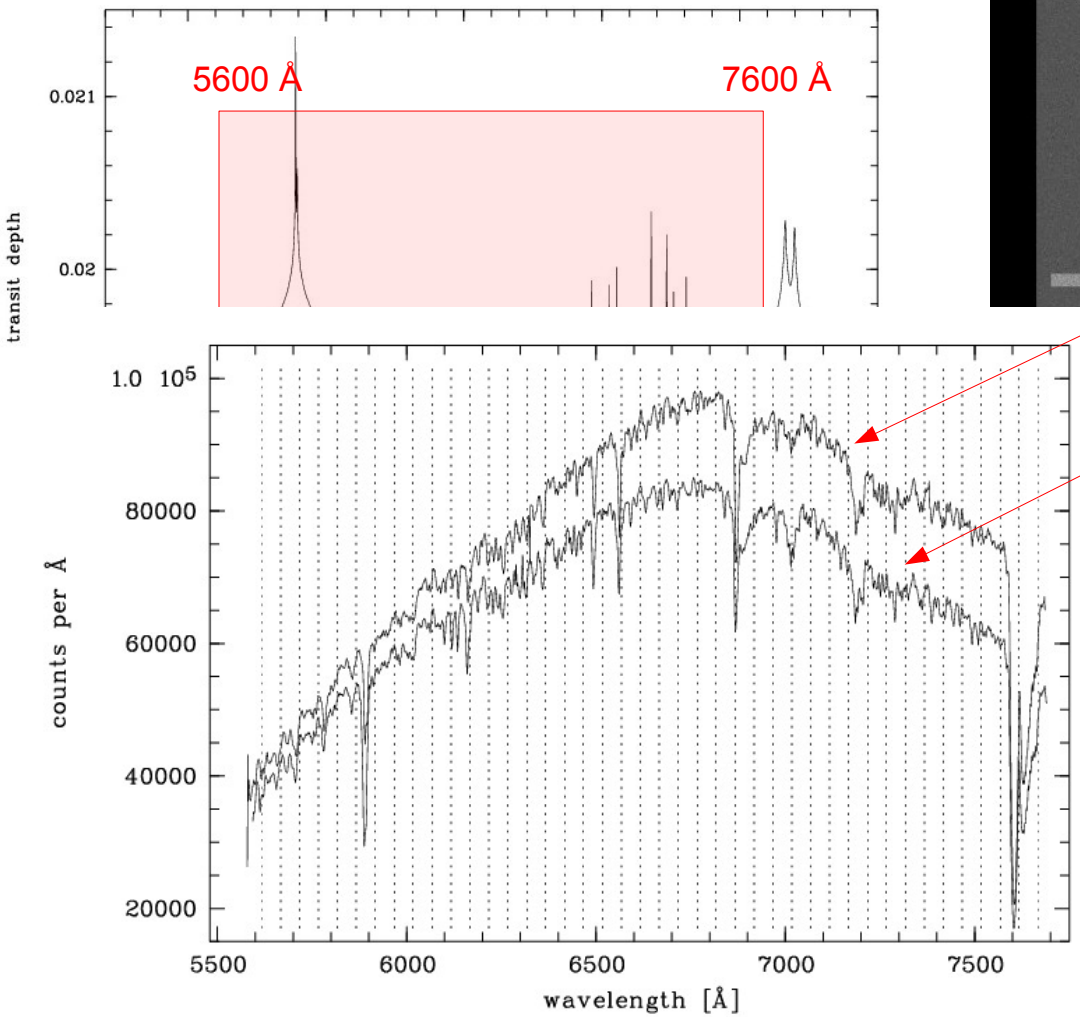
model by Fortney et al. 2010,
calculated for HAT-P-19 b

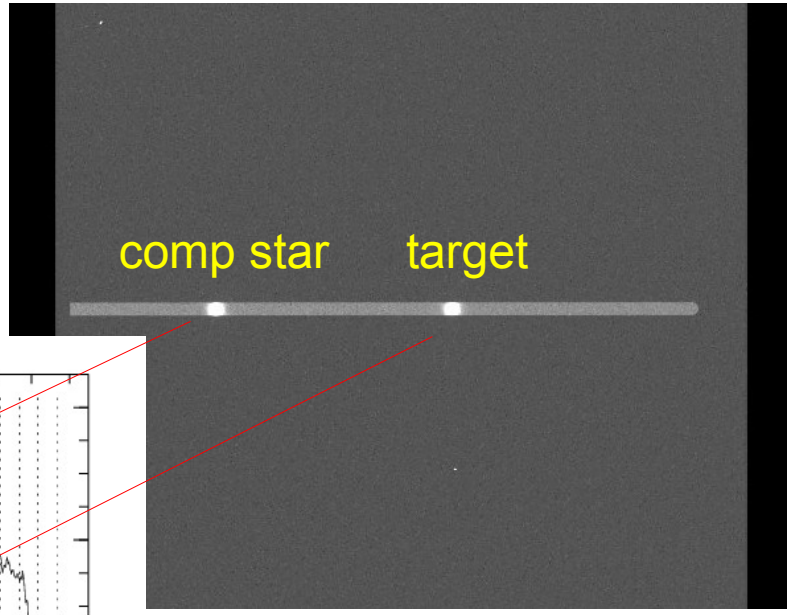
The observation of one transit event with OSIRIS@GTC





The observation of one transit event with OSIRIS@GTC

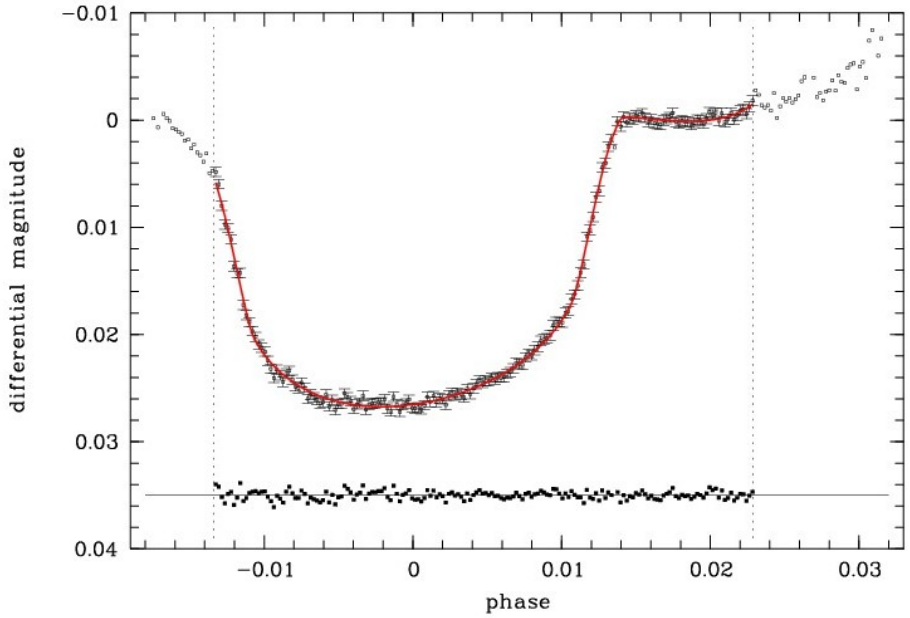


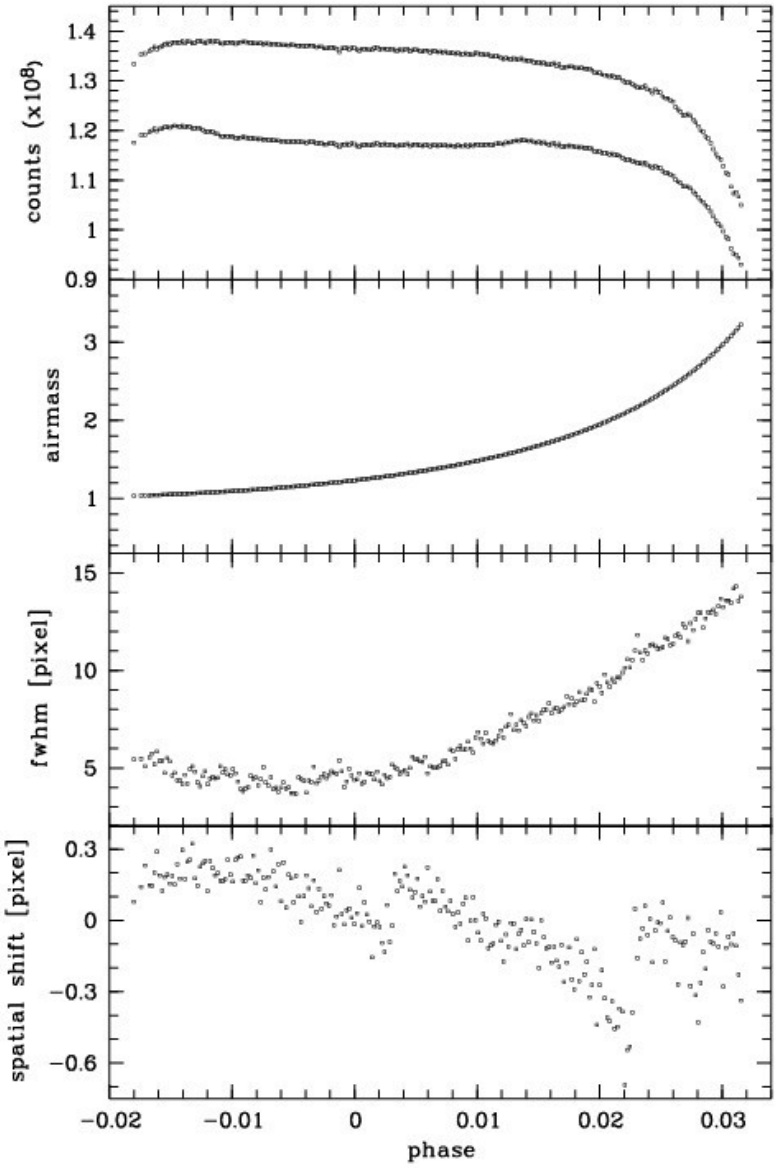


The observing conditions

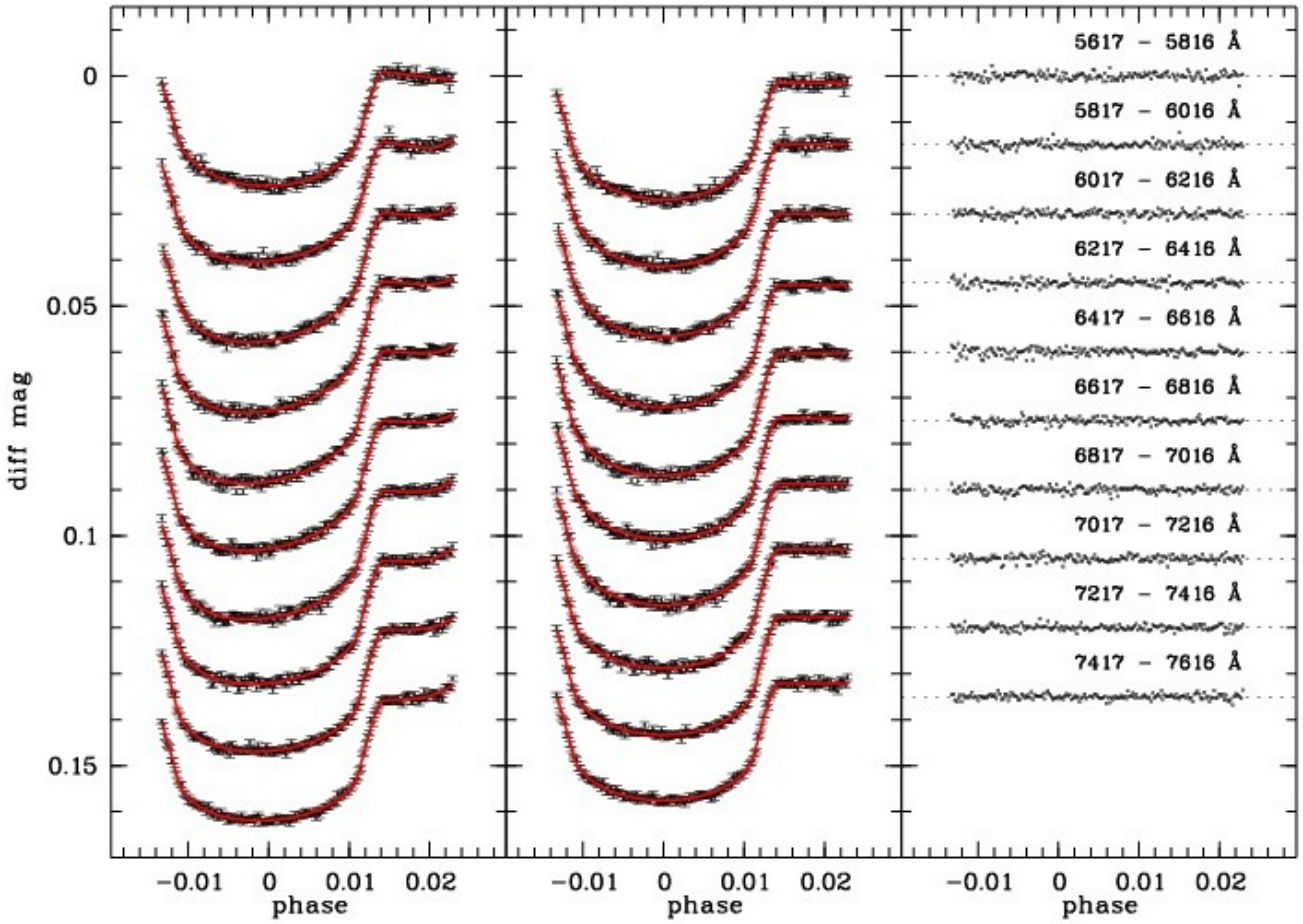
Non-perfect conditions:

Dome vignetting and
strong increase in FWHM

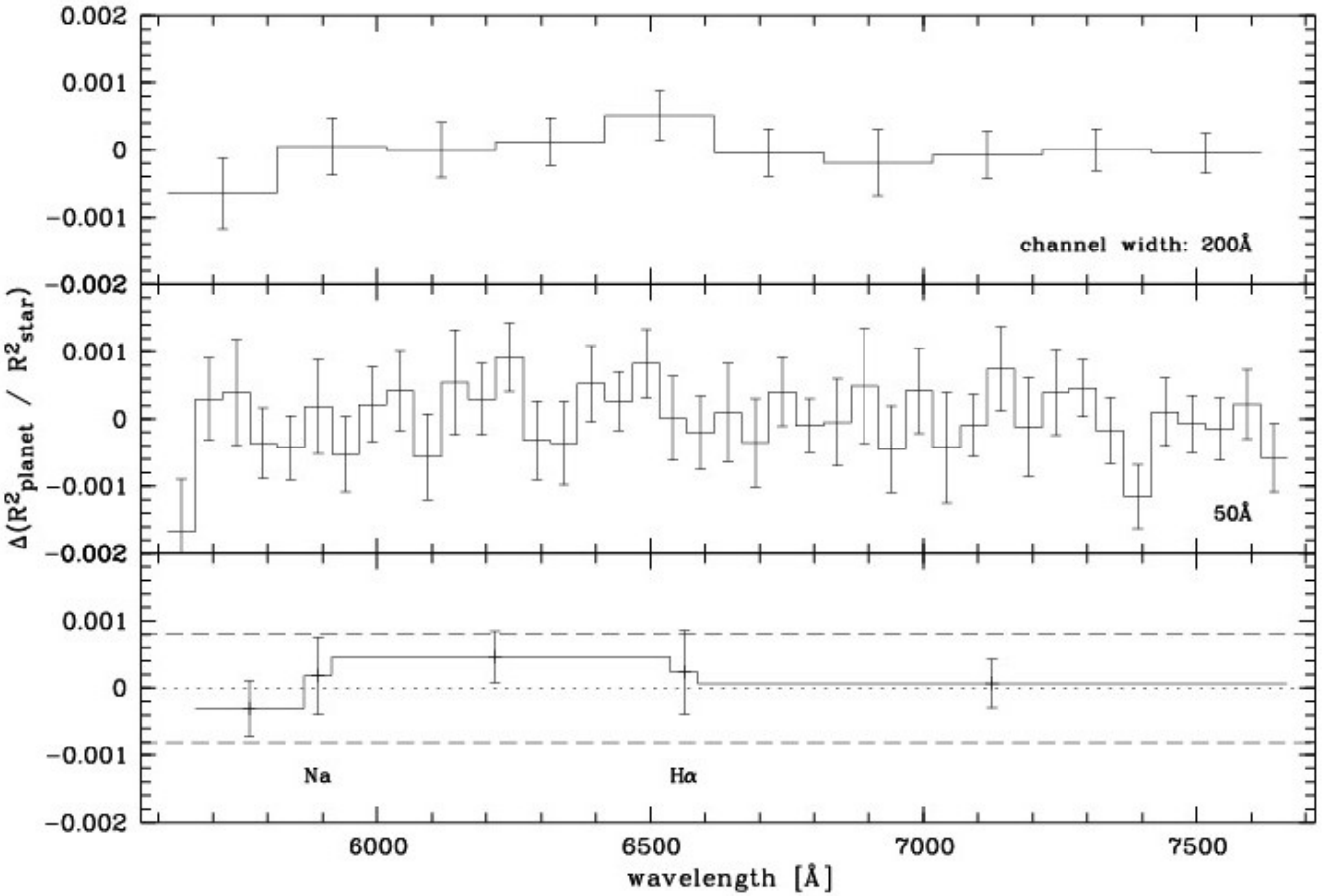




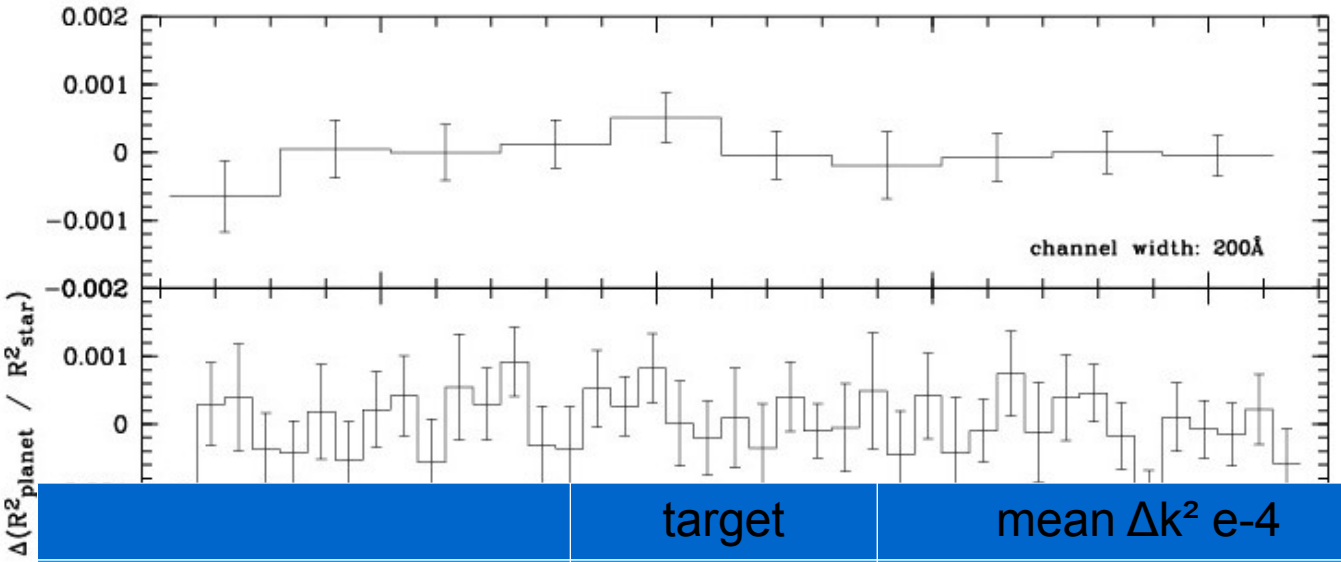
Flux binning in wavelength channels



Transit depth over wavelength

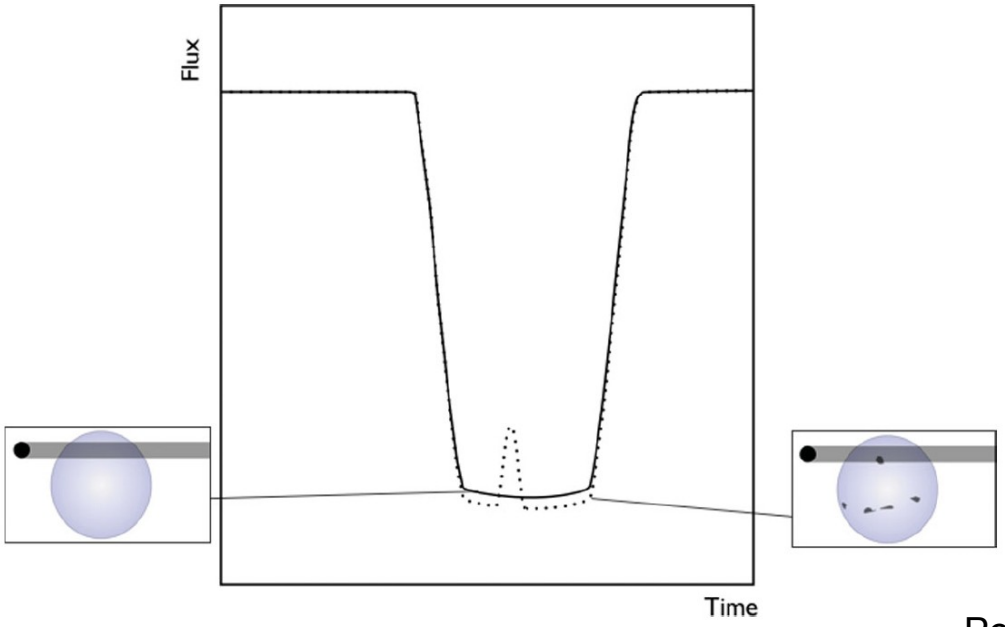


Transit depth over wavelength



	target	mean Δk² e-4
Sing et al. 2012	XO-2b	0.8
Gibson et al. 2013a	WASP-29b	3.4
Gibson et al. 2013b	HAT-P-32b	2.0
Jordan et al. 2013	WASP-6b	2.5
Murgas et al. 2014	WASP-43b	1.8
this work	HAT-P-19b	3.8

Long term variability of the host star – star spot correction



Pont et al. 2013

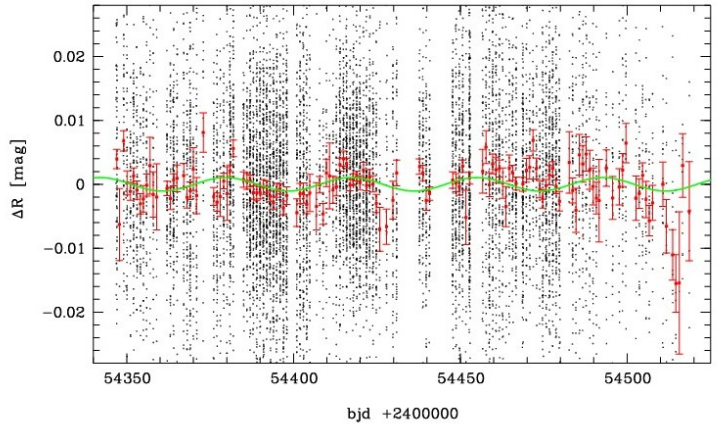
Unocculted star spots influence the measured transit depth k^2 by:

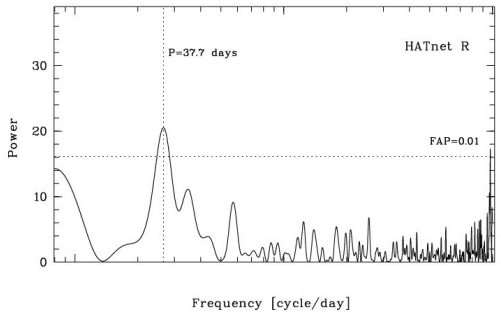
$$\frac{k^2_{meas} - k^2_{true}}{k^2_{true}} = \alpha \Delta f \ , \qquad \Delta f = \frac{f_{meas} - f_{quiet}}{f_{quiet}}$$

Désert et al. 2011

Long term variability of the host star – star spot correction

HATnet photometry from Hartman et al. 2011

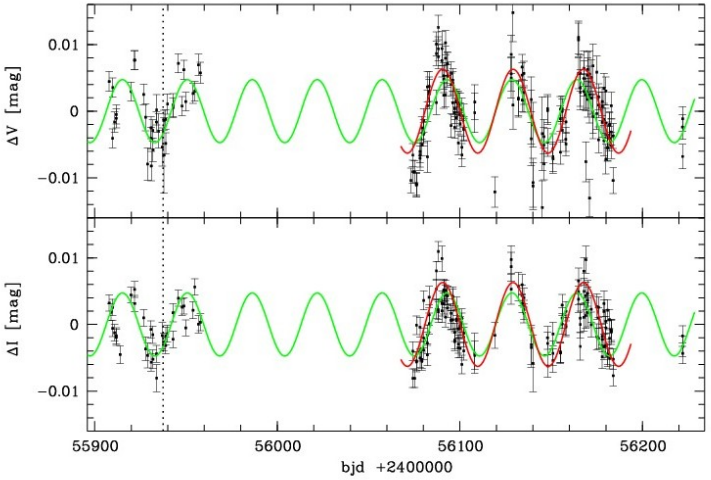


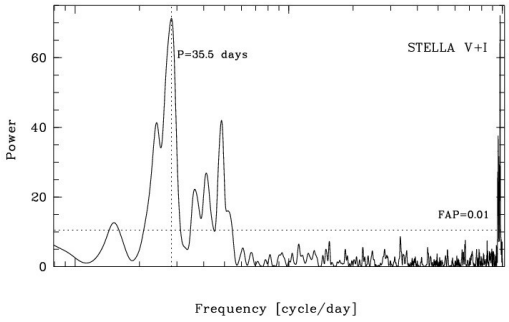


Observed: 2007/2008

P ~ 38 days
Amplitude: 1 mmag

Own monitoring program with the STELLA telescope



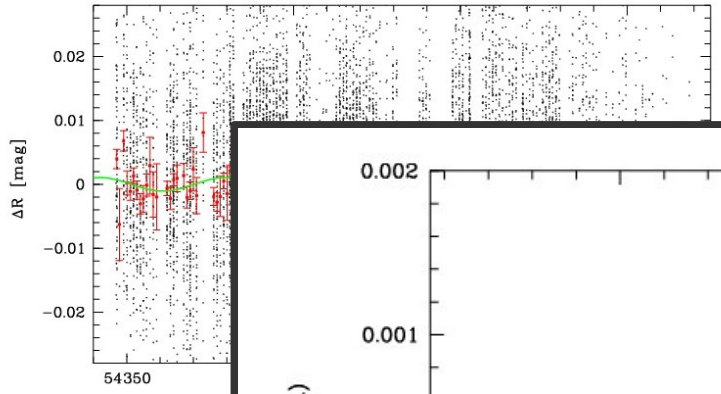


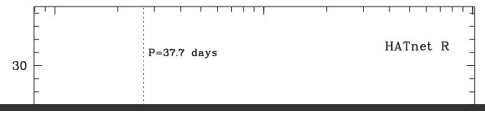
Observed:
2011 + 2012

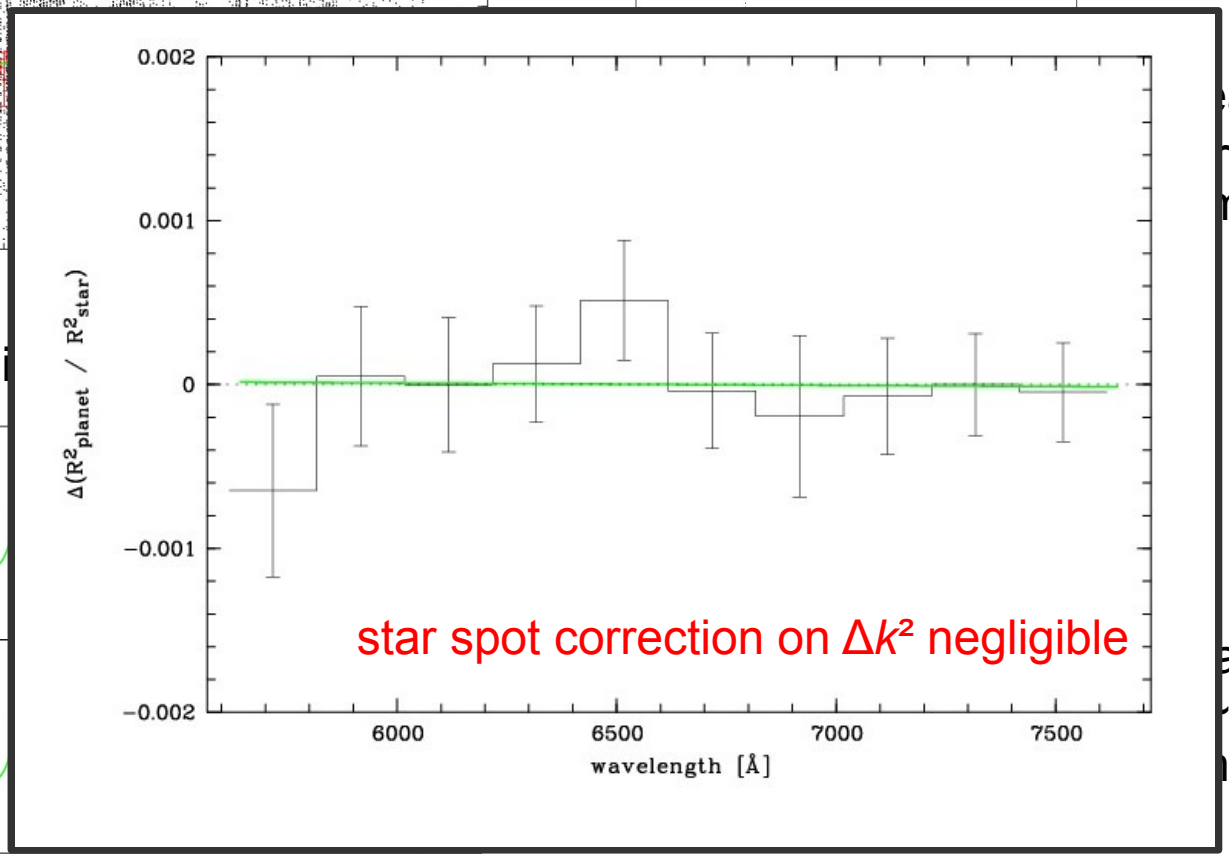
P ~ 36 days
Amplitude: 5 mmag

Long term variability of the host star – star spot correction

HATnet photometry from Hartman et al. 2011





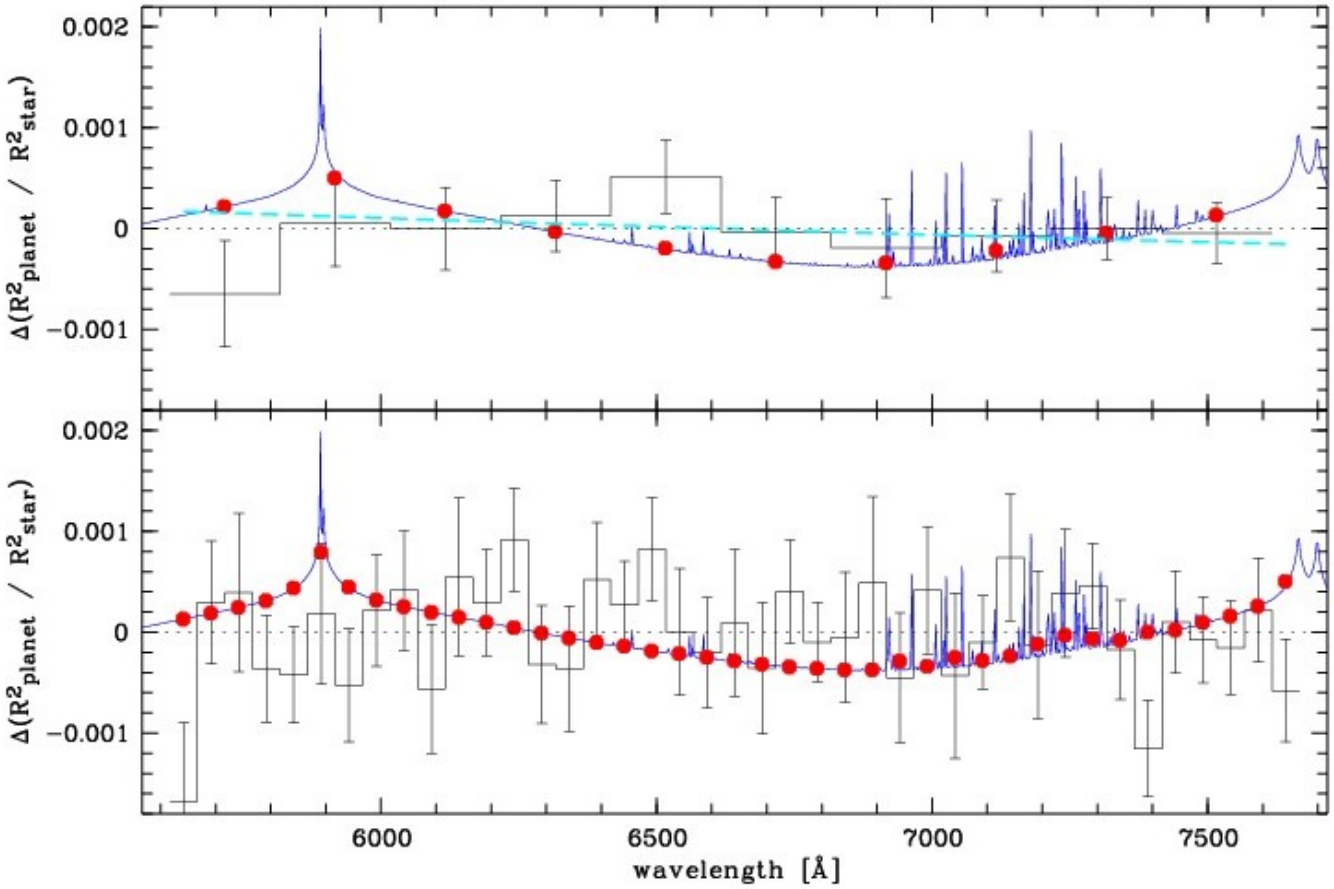


ear 2007/2008
~ 38 days
mplitude: 1 mmag

Own moni

ar 20011 + 2012
~ 36 days
mplitude: 5 mmag

Comparison with a theoretical spectrum



	χ^2 reduced
flat line	0.4
Fortney	1.0
Rayleigh	0.5

flat line	0.7
Fortney	1.2

Conclusion

- For HAT-P-19b a flat transmission spectrum is favored, but a broad sodium absorption feature is not ruled out
- Partial transit are worth analyzing
- For transmission spectroscopy reaching far in the blue, for exceptional accuracy or for host stars with known strong activity a star spot correction is advisable, for all the rest it is probably negligible
- For all the rest, transit observations from different epoches can be compared or combined without prior star spot correction
- For favorable targets (transit depth, scale height) the HD189733b-like Rayleigh-slope is larger than the spot-introduced slope