FLAMES OBSERVATIONS OF PLANETS TRANSITS

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A ‘new’ use of FLAMES?
Accurate Photometry + Simultaneous
Accurate Rv

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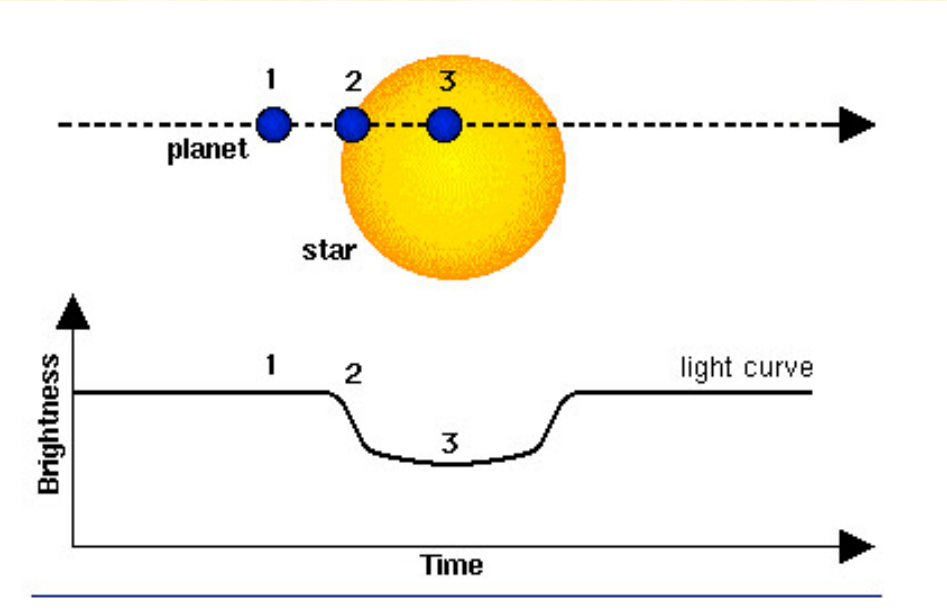
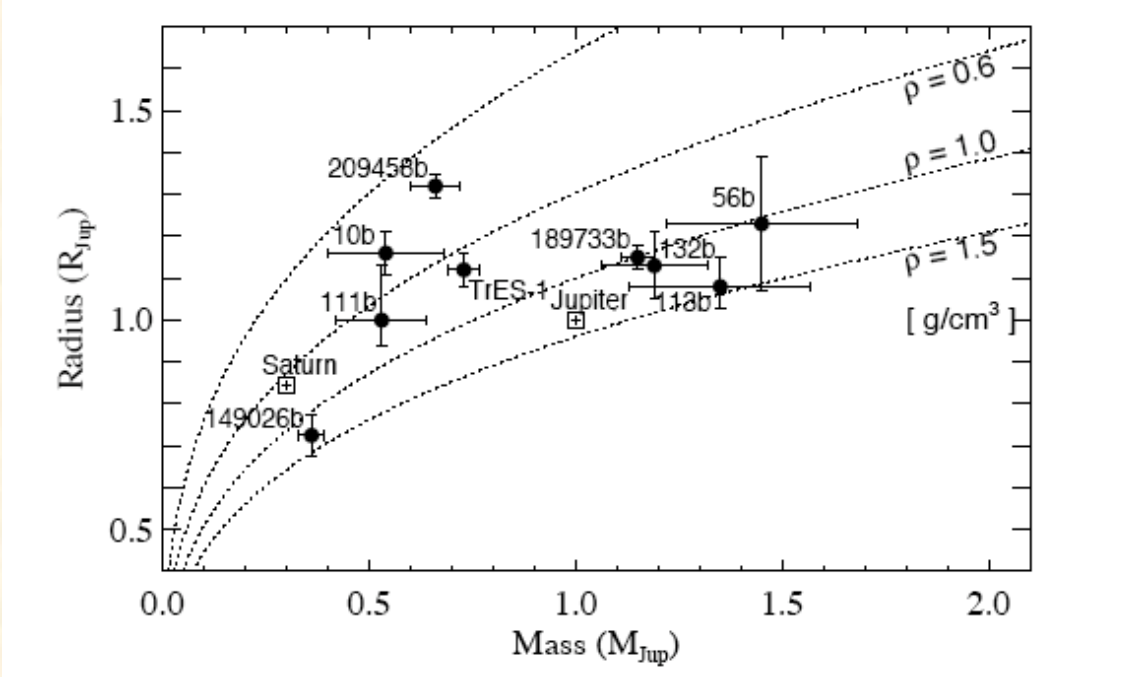
Transits



Transits: great potential

Constrain Geometry of the system

Planets masses and radii



Charbonneau et al. 2007

Transits follow-up

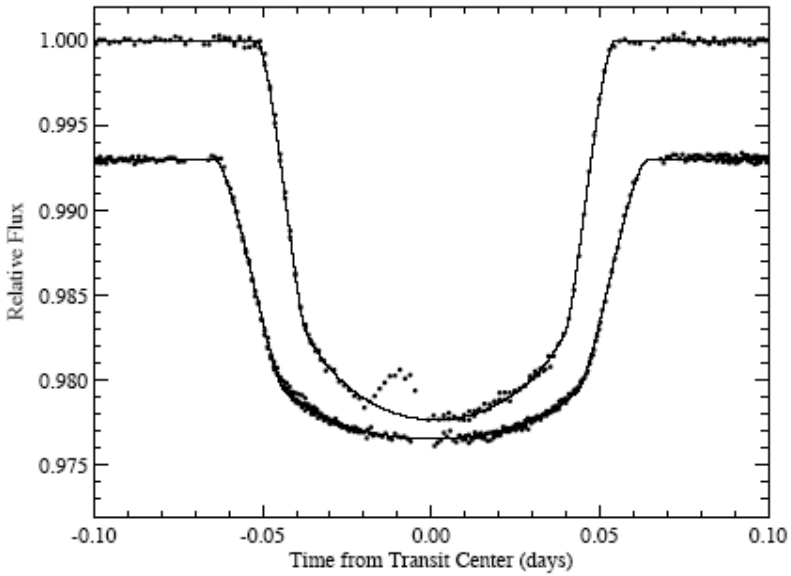
Planets' atmosphere and emission ...

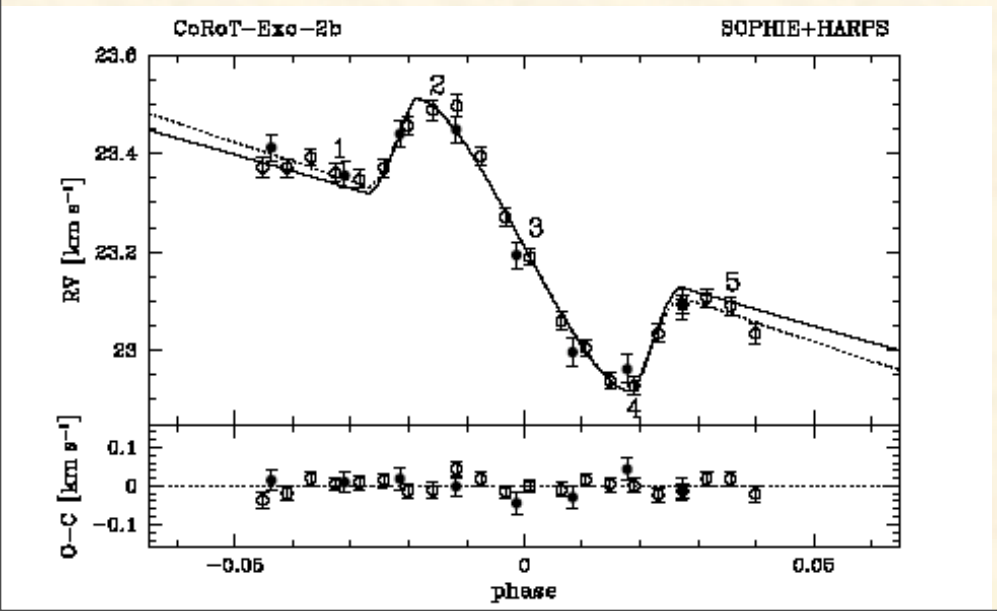
Presence of stellar Spots (and their migration)

Rossiter-McLaughin Modeling:
1) Inclination Angle between Planet orbit and stellar Rotation,
2) Stellar rotation is prograde relative to planet orbit

Some results…

Spots.
Charbonneau et al. 07





Rossiter-McLaughin
(Bouchy et al. 2008)

What is needed?

Very Accurate photometry (**from space**: HST, Corot..)

Accurate Radial velocity, with good time sampling

Using **HST spectroscopy** a photometric precision few units in 10^{-4} has been obtained with Cycles varying from ~20 secs to a few min

Some Limitations from the ground

Results so far have been obtained from space

Limitations form the ground:

Scintillation
Variations in sky transparence
Variation with Airmass
Variable aperture efficiency (seeing, differential refraction)

VLT spectroscopy is a powerful tool

Large Aperture; transits may be rather faint

Many Photons can be collected on a timescale of about 1 min
e.g.: 10^7 for a 12.6 magnitude star in 2 minutes and
high resolution spectroscopy (FLAMES H-R)

Good duty cycle if fast Read Out could be used

Scintillation is negligible: ~10^{-4}

$$\sigma = 0.09 D^{-2/3} (\sec Z)^{1.75} \exp(-h/h_0)/(2T)^{1/2},$$

Dravins et al. 1998

T=Exp. Time (s)
D= Telescoep Diameter

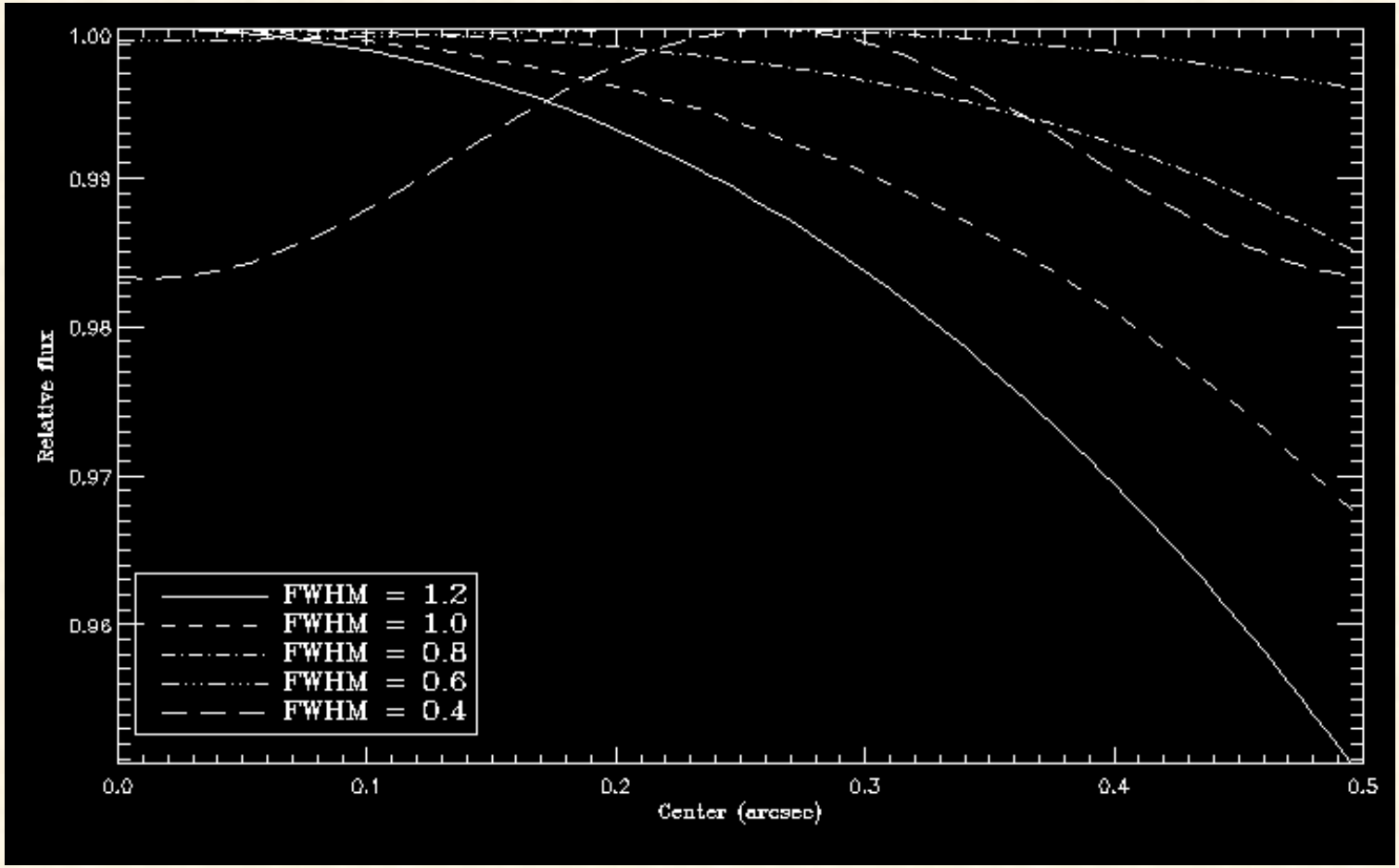
FLAMES IFU

Minimize the effects of slit entrance:
Fairly Large Aperture 2x3 arcseconds at VLT

15 Objects: Possibility of using 14 stars
for control of Transparency, Seeing Variations…

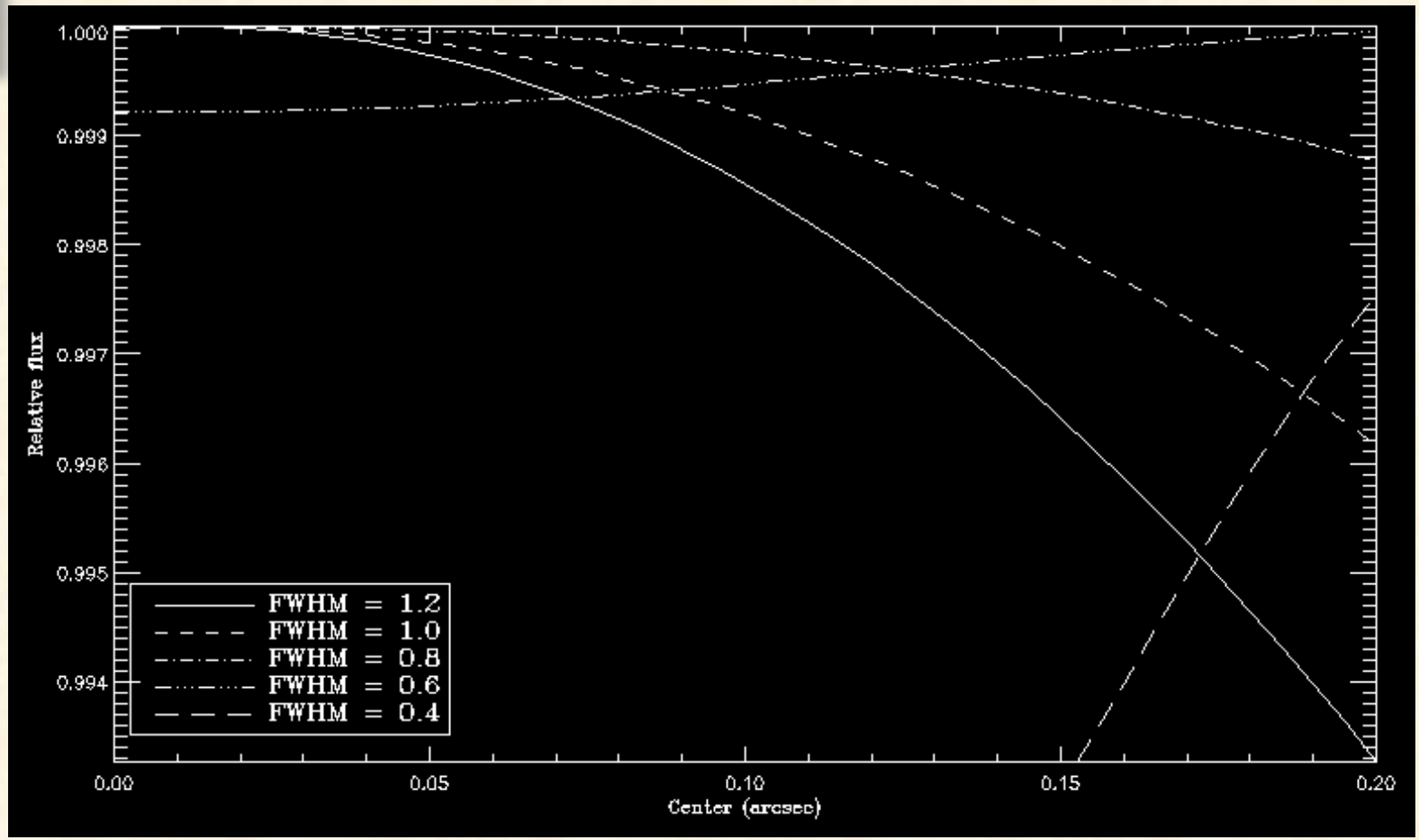
High Resolution: other stars plus Sim. Cal.
fibres can be used to trace Rv Zero Point
variations

IFU: stars displacement



Losses given by the IFU edges for different movements and seeing values

IFU: Stars displacements



Losses given by displacement of the star due to the gaps between the microlenses

Summary of pilot proposal

Goal: Obtain below 10^{-3} accurate photometry
Obtain 20 ms^{-1} Rv accuracy

Determine Position of the stars at better than 0.05 arcseconds in each observation

Use Simulations to determine aperture losses

Use other stars to determine seeing, and atmospheric losses, verify modeling

Use other stars to confirm Rv zero point corrections

RESULTS …

WASP - 4 ; V=12.6
Transit Duration: 2.22 Hours
Period= 1.34 days
Mass = 1.22 M_{jup}
Radius=1.44 R_{jup}
Expected RM effect: 160 ms^{-1}

Proposal: 9 hours (2 x 4.5) around transit, data taken in October 2008

186 exposures of 2 min each (no fast CCD readout applied)

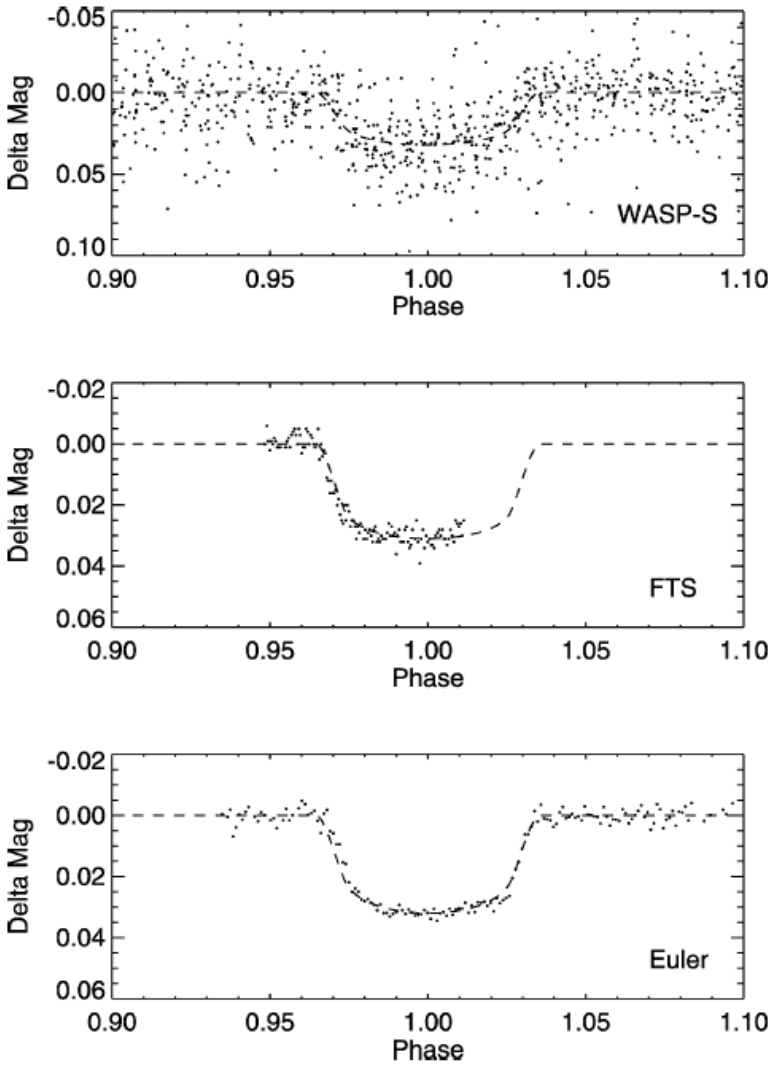


FIG. 2.—WASP-S, FTS, and EulerCam light curves showing the transit of WASP-4b. The data are shown folded on the orbital period together with the best-fitting model determined from a simultaneous MCMC fit of the photometric and radial velocity data. The rms scatter to the model fit of the WASP-S, FTS, and EulerCam light curves is 15.3, 2.7, and 1.8 mmag, respectively. Phase 1 for the EulerCam light curve occurred at HJD = 2,454,368.59121 UT, and that the FTS light curve at HJD = 2,454,371.26766 UT.

Wilson et al. 2008

DISCUSSION

MANY APPPLICATIONS :
YOU ARE THE EXPERTS !!!

Instrument: Equivalent widths (RGR), Lamp Too Bright,
Which are the limits and the causes
in RV (high accuracy, long term)?

SKY SUBTRACTION

Pipeline: How many are using the ESO Pipeline??
Limitations ?

What about sharing critical tools - experiences??

DISCUSSION (2)

Not real requests for upgrades (2-3 maybe ??
All different??)

Scientific Proposals: 12 hours are too long …
why a SURVEY never made ??

Archive is a mine ..