

The Observing Portion

Amanda Winans
Missouri State University

Overview

- What we hope to measure
 - Transiting system
 - Planet vs. star brightness contributions
 - Current targets
 - Blue exoplanet
- Observing strategy
- Computer model

What we hope to measure

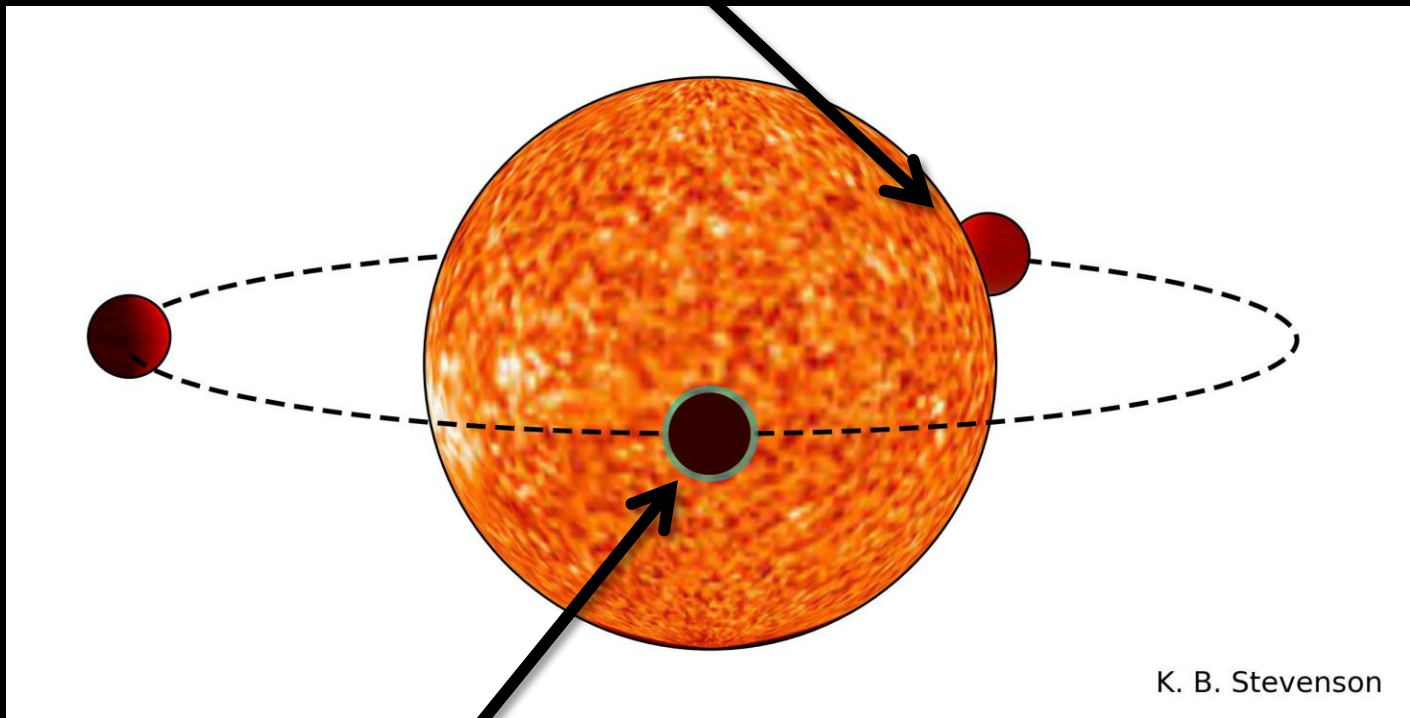
- The reflected light from the planet
- Wavelength dependent reflection
 - Indicates structure and composition
- Planet much dimmer than star
 - We see a dot

Star Field



Transiting System

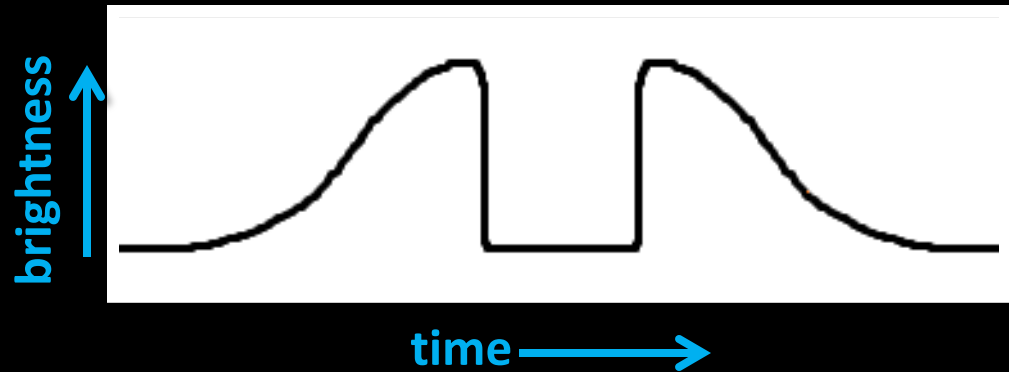
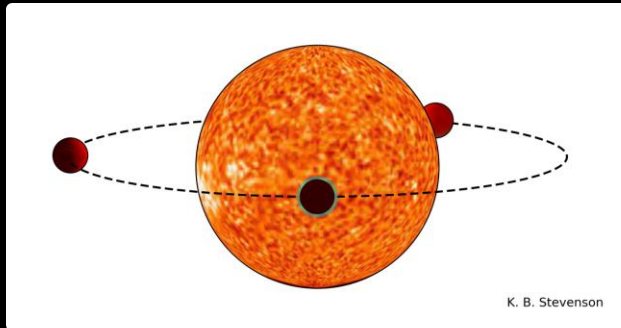
- **Secondary eclipse: star blocks planet**



- **Primary transit: Planet passes in front of star**

Planet's Contribution

- Observe stars with constant brightness
- During some planet phases, only the star contributes
- Subtract from all phases

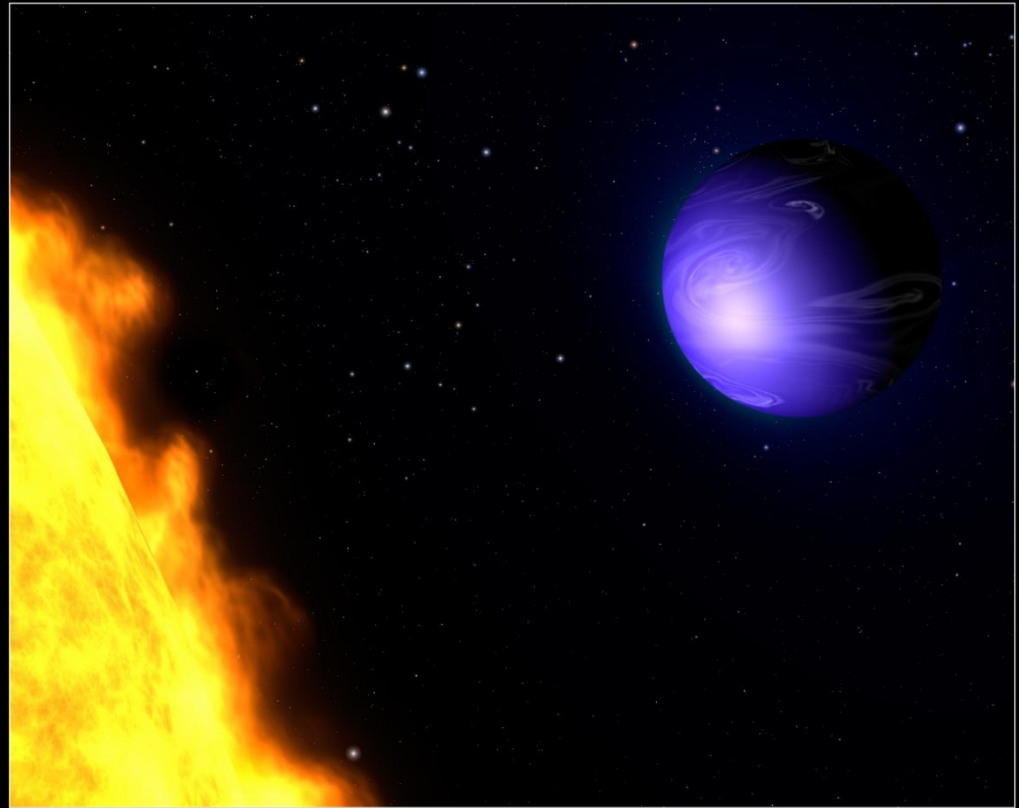


Targets

Target	Planet's mass (in M_J)	Period (in days)	Transit Duration (in hrs)
WASP-14b	7.341	2.24	3.06
WASP-38b	2.712	6.87	4.6608
GJ 1214b	0.0197	1.58	-
Kepler-62b	0.028	5.71	2.31
Kepler-62c	0.0126	12.44	3.02
Kepler-4b	0.077	3.21	3.62
Kepler-10b	0.0143	0.84	1.81
Kepler-21b	0.033	2.79	3.438666
Kepler-20b	0.027	3.70	2.4
Kepler-50b	0.024	7.81	4.2439
Kepler-50c	0.022	9.38	2.6022

HD 189733b

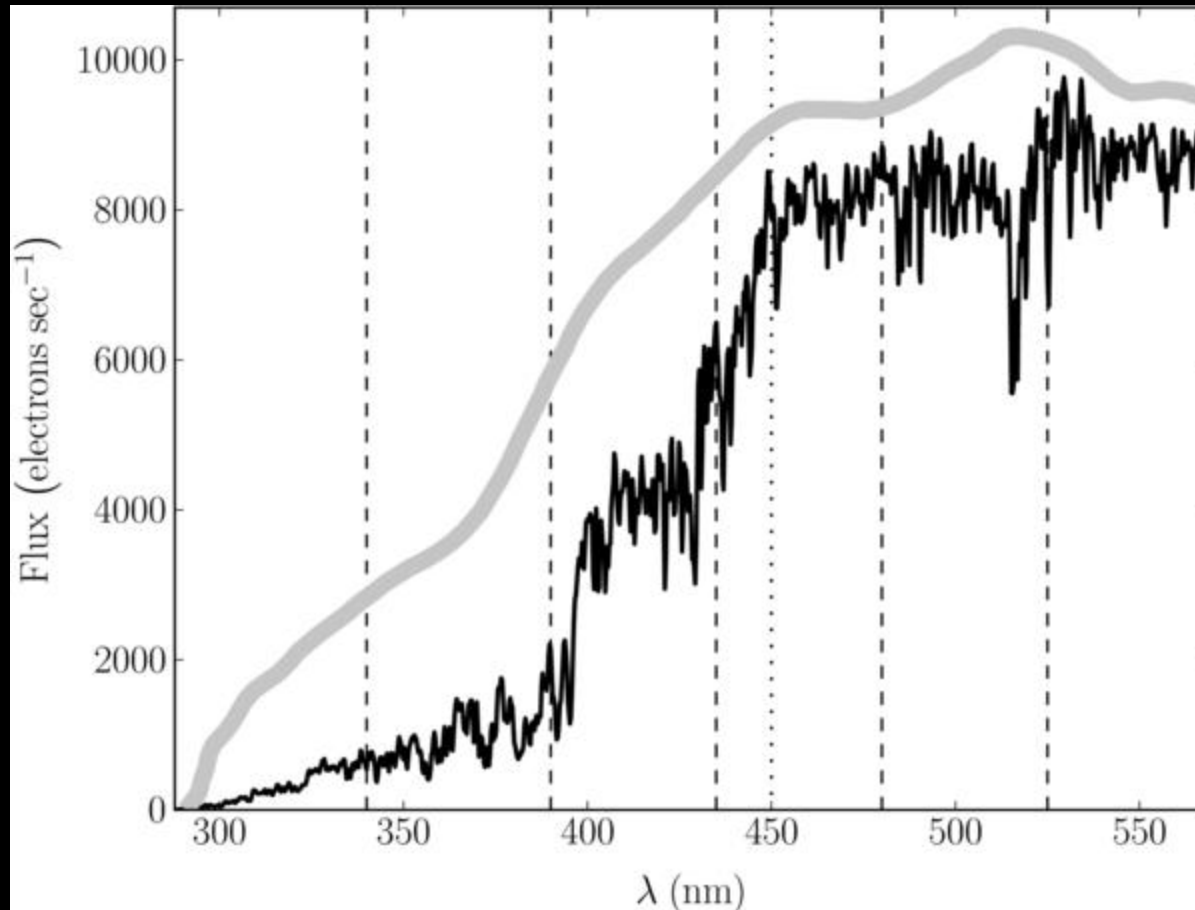
- Hot Jupiter
- Hubble Space Telescope



Artist's View of Extrasolar Planet HD 189733b

NASA, ESA, and G. Bacon (STScI) • STScI-PRC13-26a

HD 189733b – Flux Bins



HD 189733b – Albedo

Table 1
Visible Albedo Measurements for HD 189733b

$\Delta\lambda$ (nm)	λ_c (nm)	δ (ppm)	A_g
290–450	413	126^{+37}_{-36}	$0.40^{+0.12}_{-0.11}$
450–570	510	1^{+37}_{-30}	$0.00^{+0.12}_{-0.10}$
290–340	325	142^{+176}_{-175}	$0.45^{+0.55}_{-0.55}$
340–390	368	123^{+86}_{-87}	$0.39^{+0.27}_{-0.27}$
390–435	416	102^{+48}_{-48}	$0.32^{+0.15}_{-0.15}$
435–480	459	53^{+37}_{-36}	$0.17^{+0.12}_{-0.11}$
480–525	502	-35^{+45}_{-36}	$-0.11^{+0.14}_{-0.11}$
525–570	547	7^{+43}_{-36}	$0.02^{+0.14}_{-0.12}$

Notes. $\Delta\lambda$ and λ_c are, respectively, the wavelength range and flux-weighted central wavelength for each channel. Uncertainties for A_g have been propagated in quadrature.

HD 189733b – Atmosphere

- Visible wavelengths are dependant on the presence of reflective clouds
- Could be sodium or some other red absorber
- Could suggest a higher altitude haze which absorbs red

Observing Strategy

- Multiple filters
- Multiple images
- Many comparison stars



Computer Model

- Read stellar spectra, filter spectra, known star and planet parameters
- Luminosity equation – solve for planet
- Output expected ratio of planet's to star's luminosity

