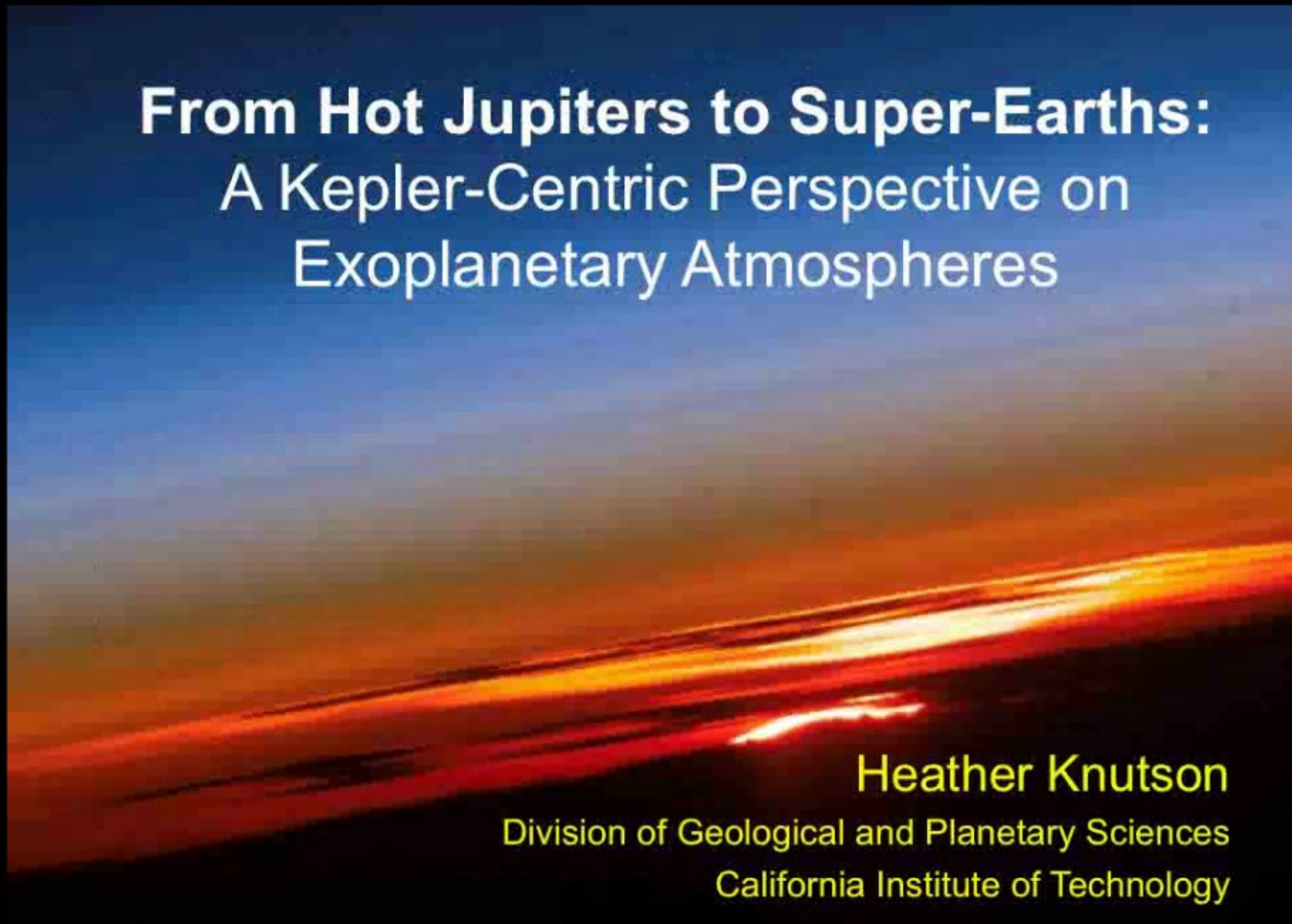

From Hot Jupiters to Super-Earths:
A Kepler-Centric Perspective on
Exoplanetary Atmospheres
Heather Knutson
Division of Geological and Planetary Sciences
California Institute of Technology

Video

KSC II

Chat (Everyone)

Valentin: After some point averaging more observaitons doens't help - the noise is dominated by the so-called red noise, i.e. systematics.

Thomas: Indeed, noise averaging only works if the noise is uncorrelated.

JBurns: what is 'red noise'?

JBurns: what is it correlated with?

JBurns: in this case

Valentin: See fig. 2 here: http://www.aanda.org/articles/aa/full_html/2011/06/aa16231-10/aa16231-10.html

Valentin: ... for the red noise effect.

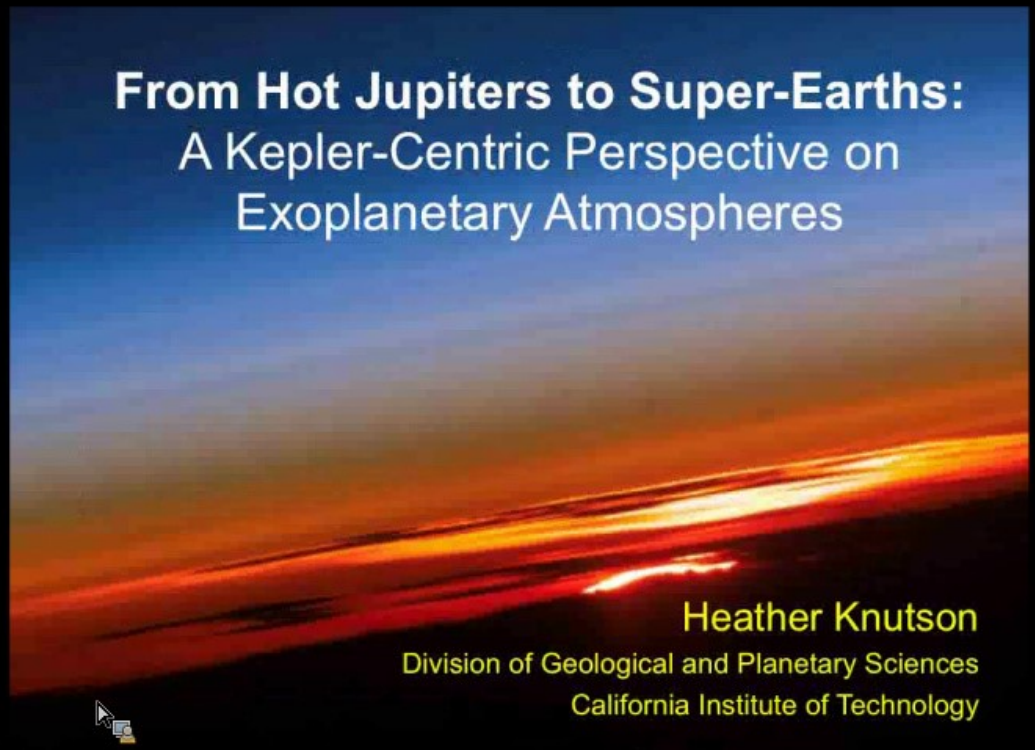
Thomas: Basically noise that isn't random. Could be temperature changes in the CCD, pressure changes in the air changing the refractivity of light (though that's more an issue

NASA Chat Guidelines

NASA Chat Guidelines: Be courteous. • Use respectful language. • Stay on topic. • Protect your private information.

Share - KSC Mac

Full Screen



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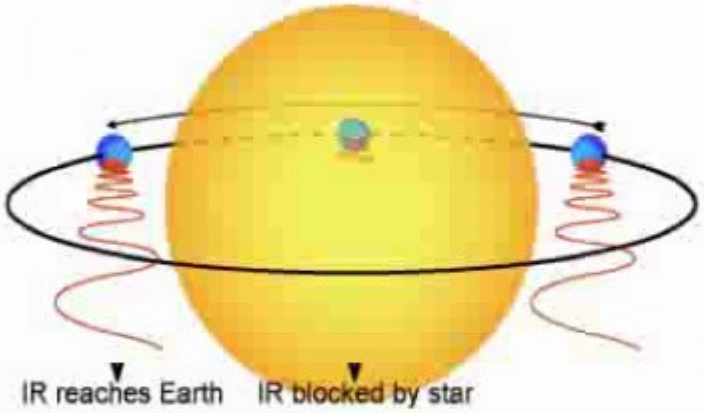
Project #1: Survey Hot Jupiter Albedos



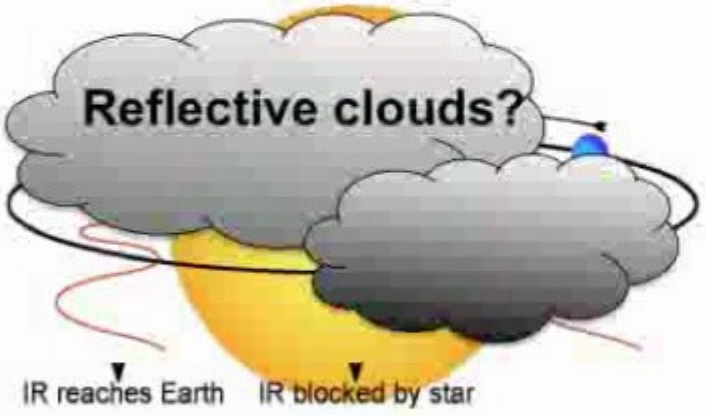
Observe the decrease in light as the planet disappears behind the star and then reappears.

Measure visible (reflected + thermal) emission with Kepler.

Measure infrared (thermal) emission using Spitzer.

Project #1: Survey Hot Jupiter Albedos

The presence or absence of a **high, reflective cloud deck** is the single biggest contributor to variations in albedo.



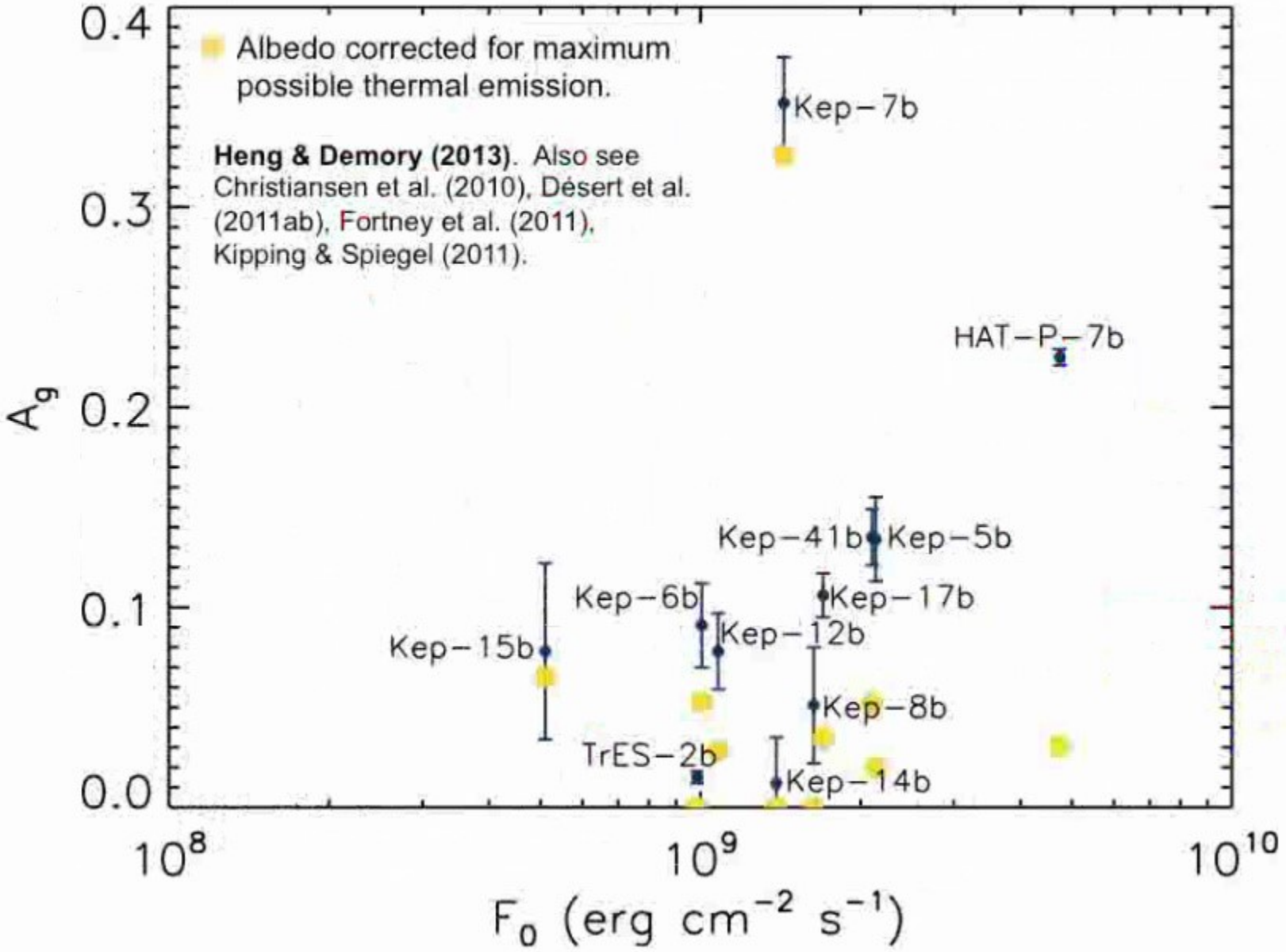
Observe the decrease in light as the planet disappears behind the star and then reappears.

Measure visible (reflected + thermal) emission with Kepler.

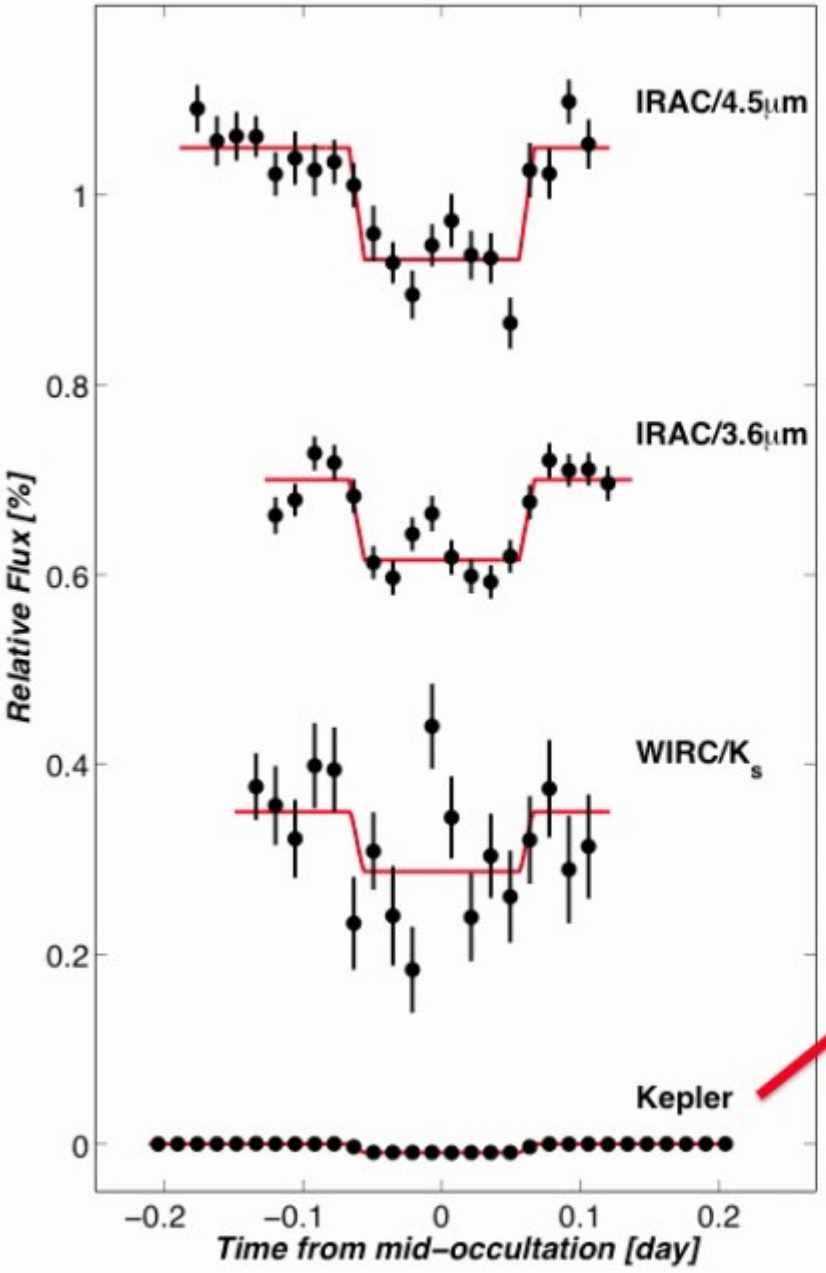
Measure infrared (thermal) emission using Spitzer.

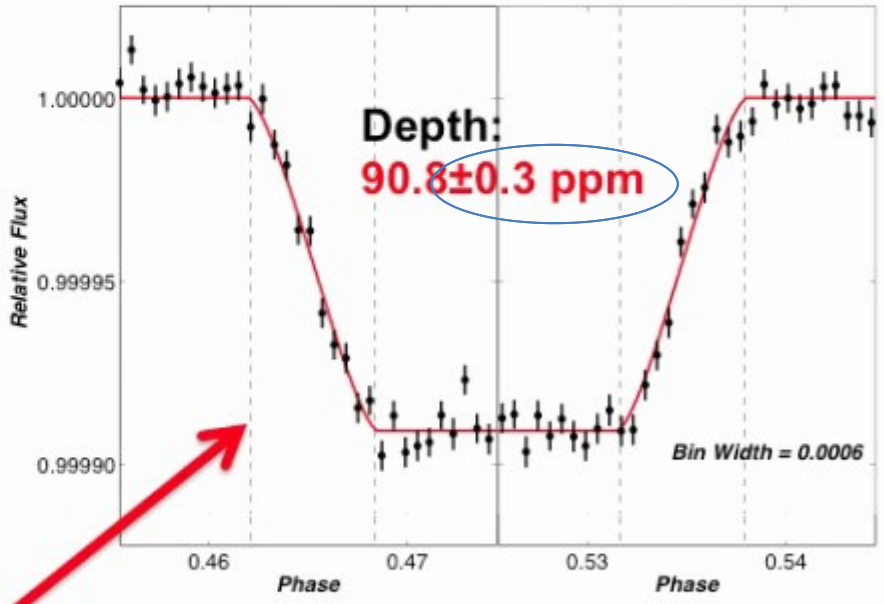
Visible emission – thermal contribution = geometric albedo

The Big Picture: Statistics of Hot Jupiter Albedos



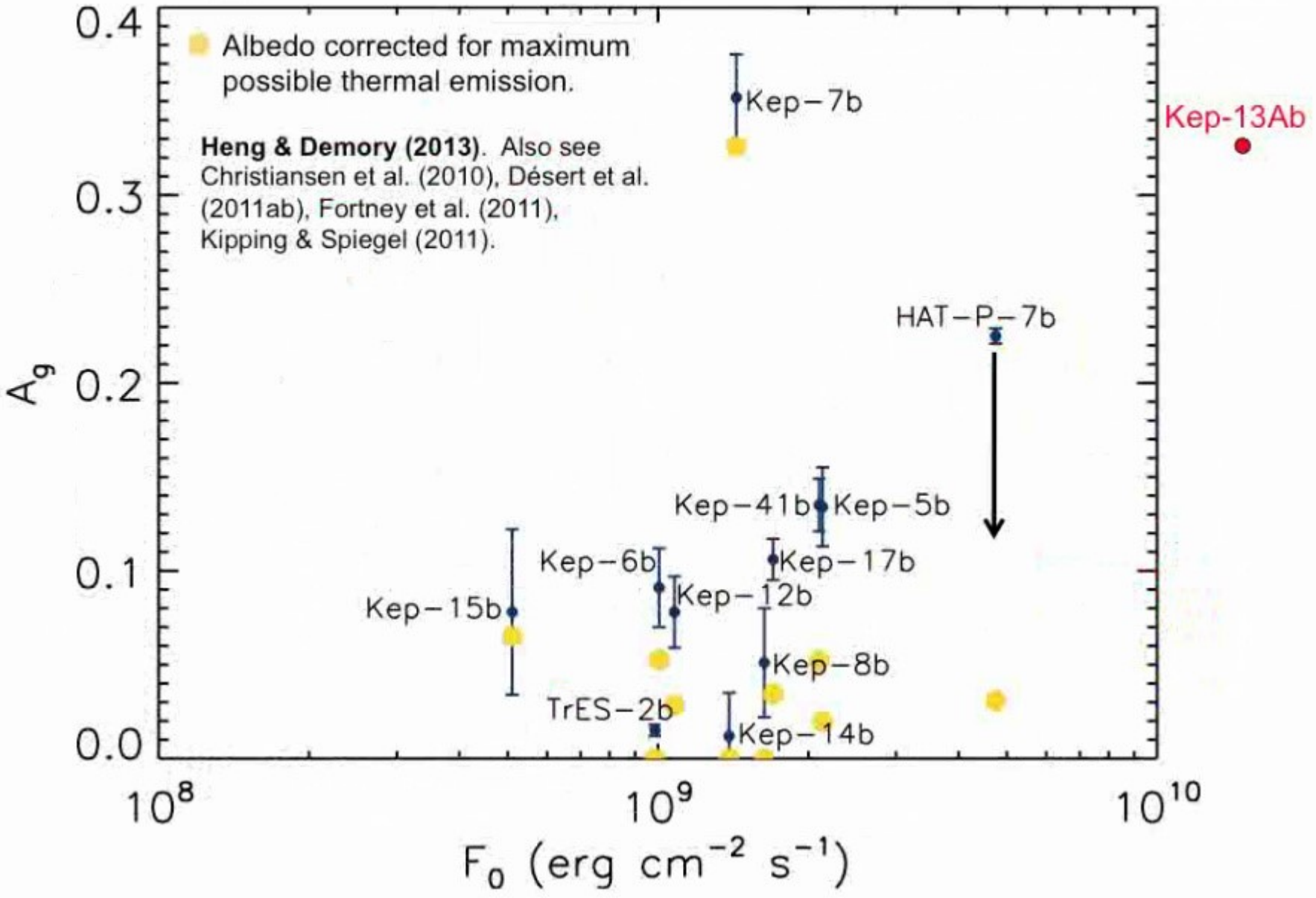
Kepler-13Ab: Measuring Emission from the Most Highly Irradiated Hot Jupiter



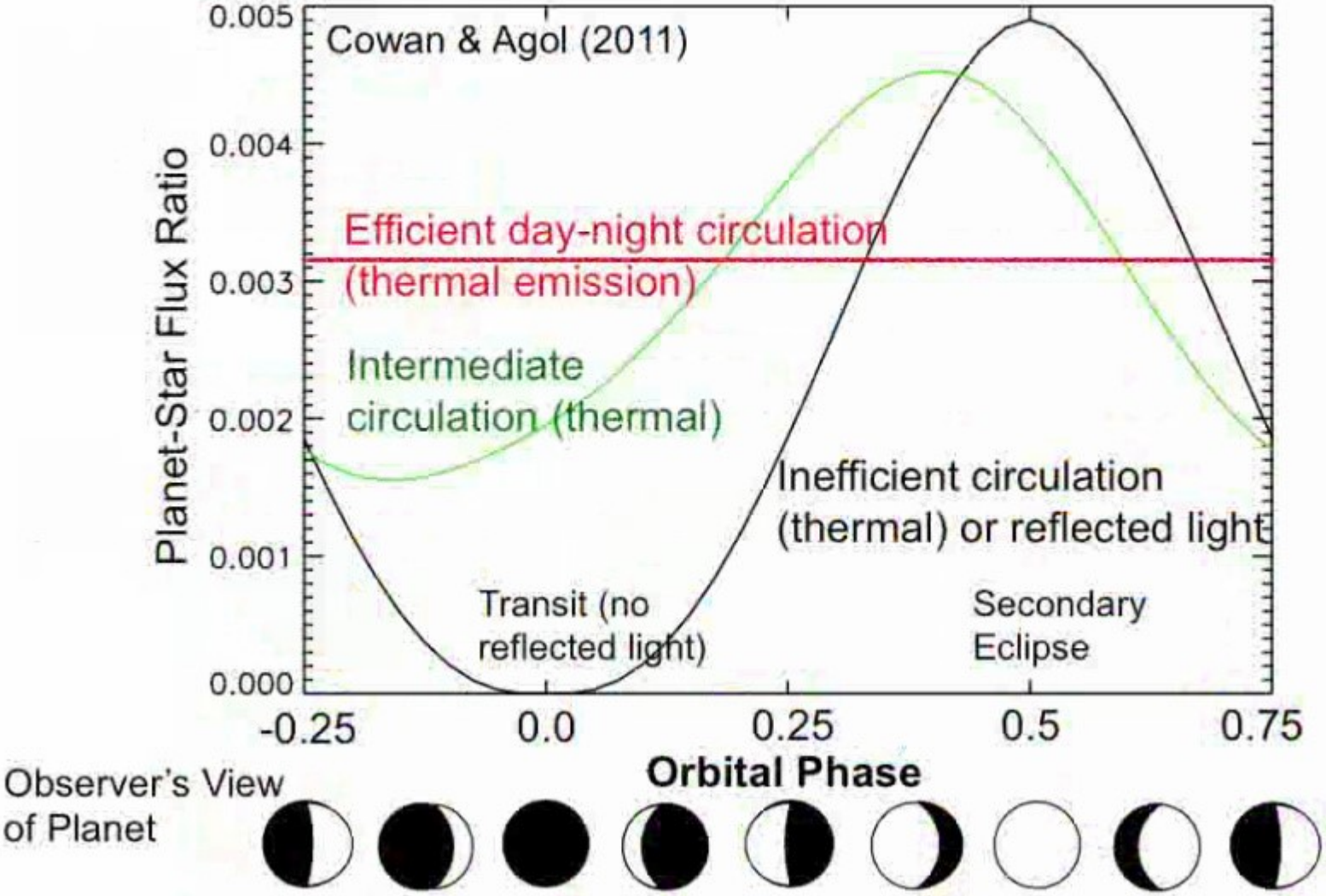


Shporer et al. (2013), in prep. **See poster 2-101.**

The Big Picture: Statistics of Hot Jupiter Albedos



Measuring Visible-Light Reflected + Thermal Phase Curves With Kepler



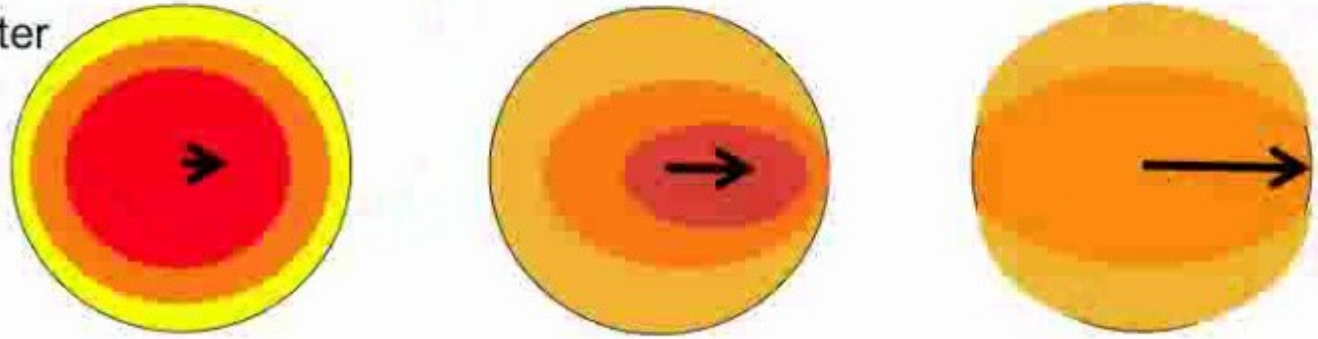
Atmospheric Circulation Models 101

To 0^{th} order, response of atmosphere to radiative forcing depends on two parameters:

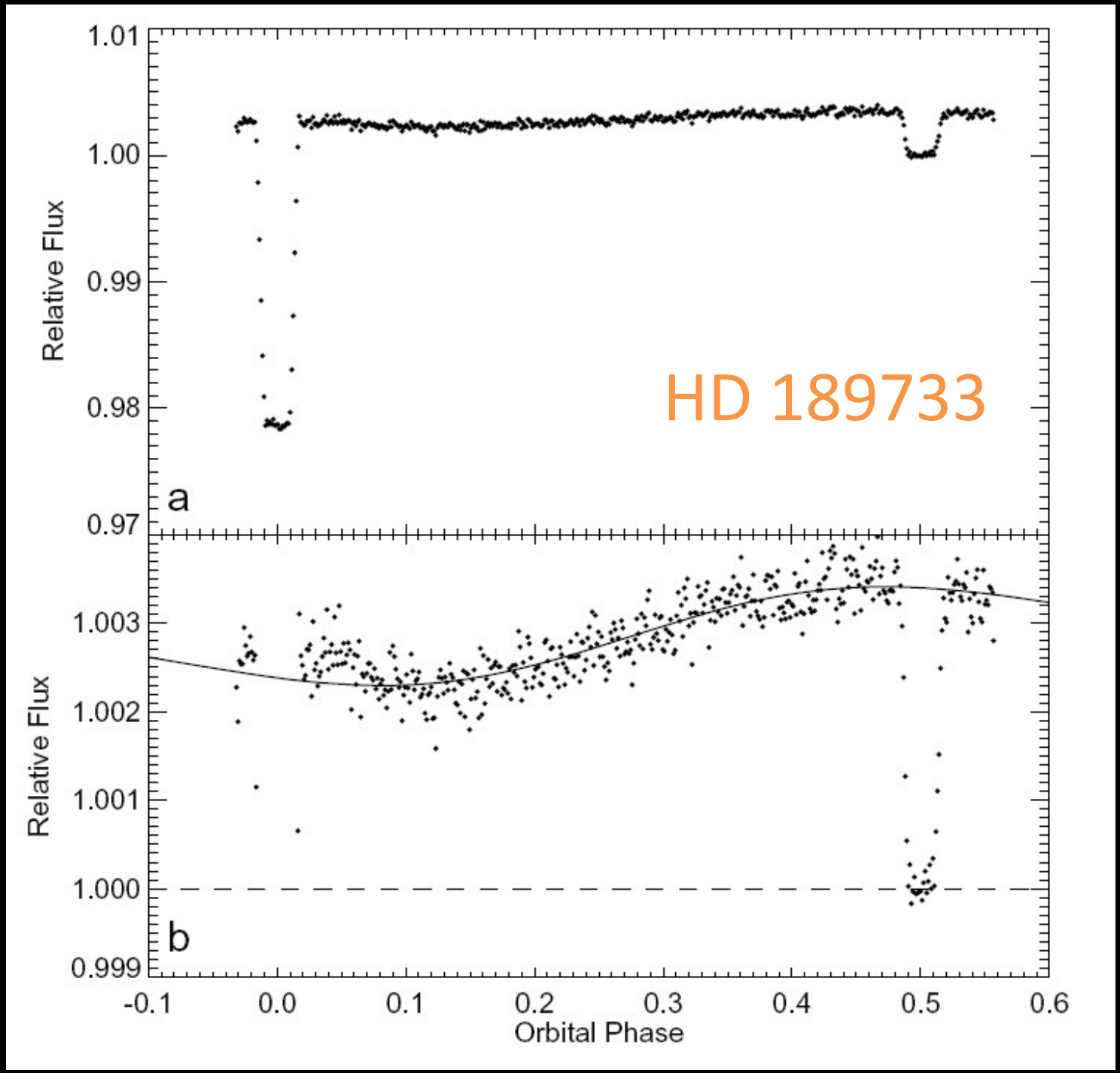
- *Radiative* time scale t_R set by atmospheric opacity (metallicity, chemistry)
- *Dynamical* time scale t_D encompasses wave propagation, winds, etc.

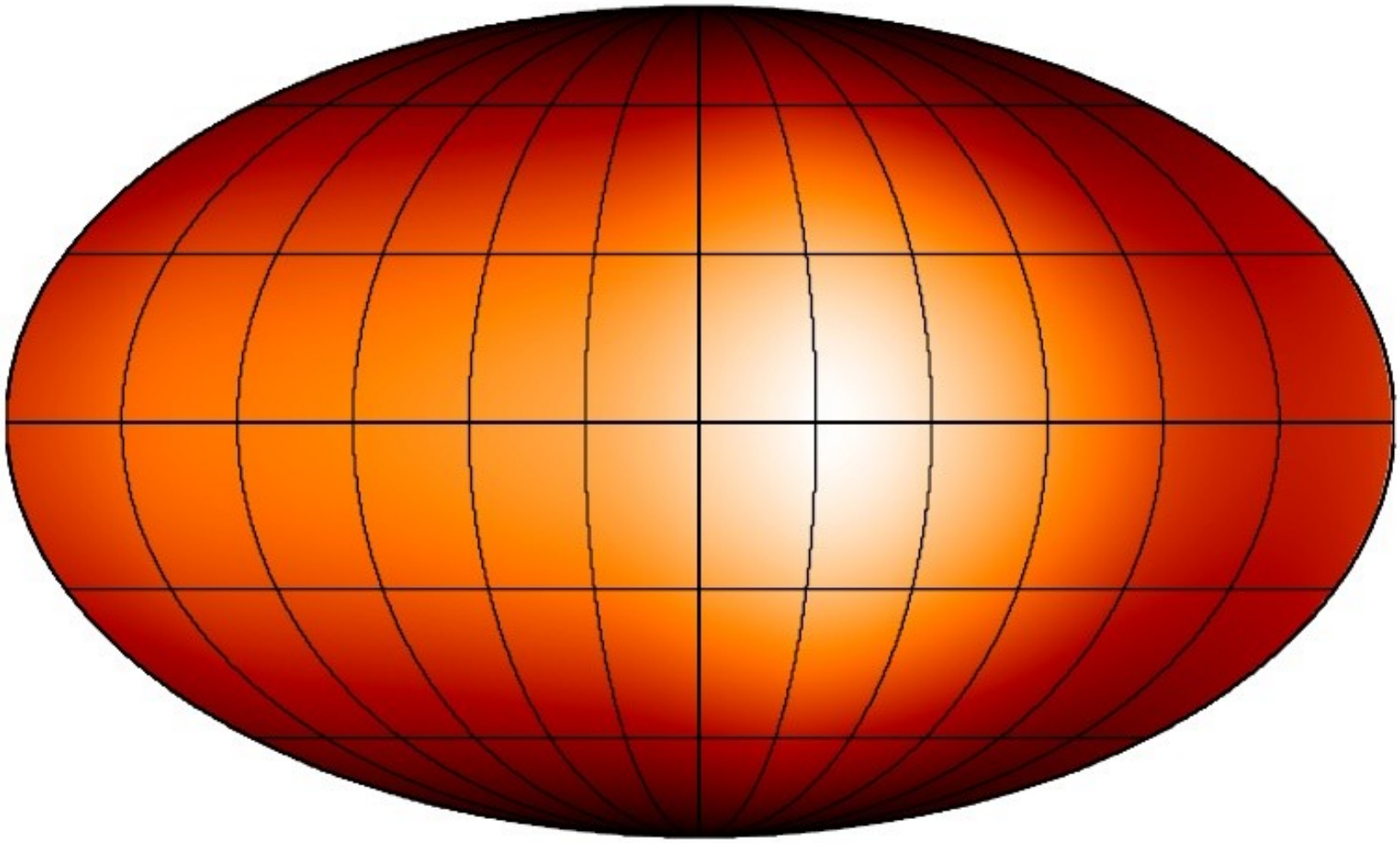
Day-night temperature gradient on tidally locked planets depends on ratio of *radiative* to *dynamical* time scales at photosphere

Hot Jupiter Dayside

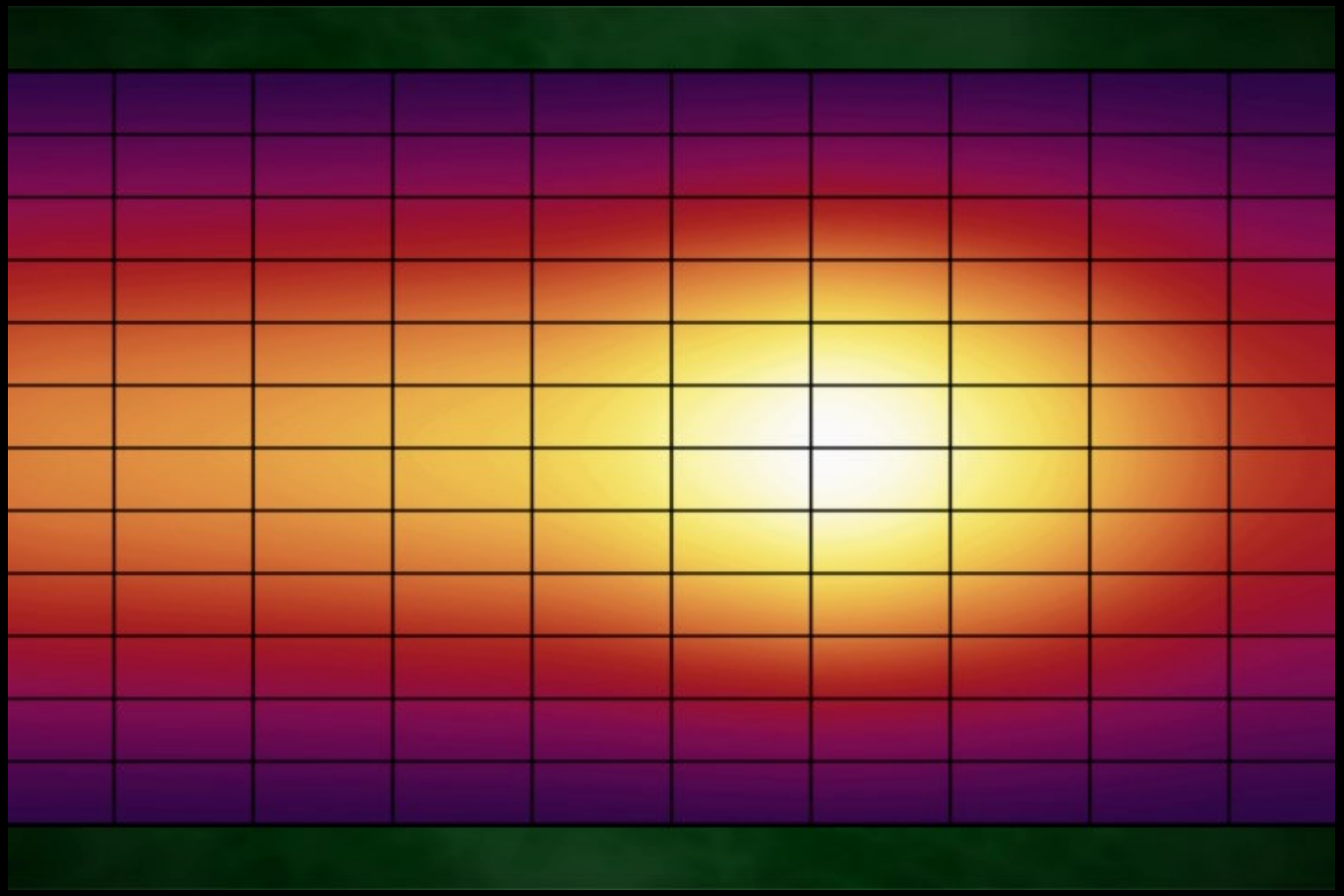


$t_R/t_D << 1$ $t_R/t_D \sim 1$ $t_R/t_D >> 1$

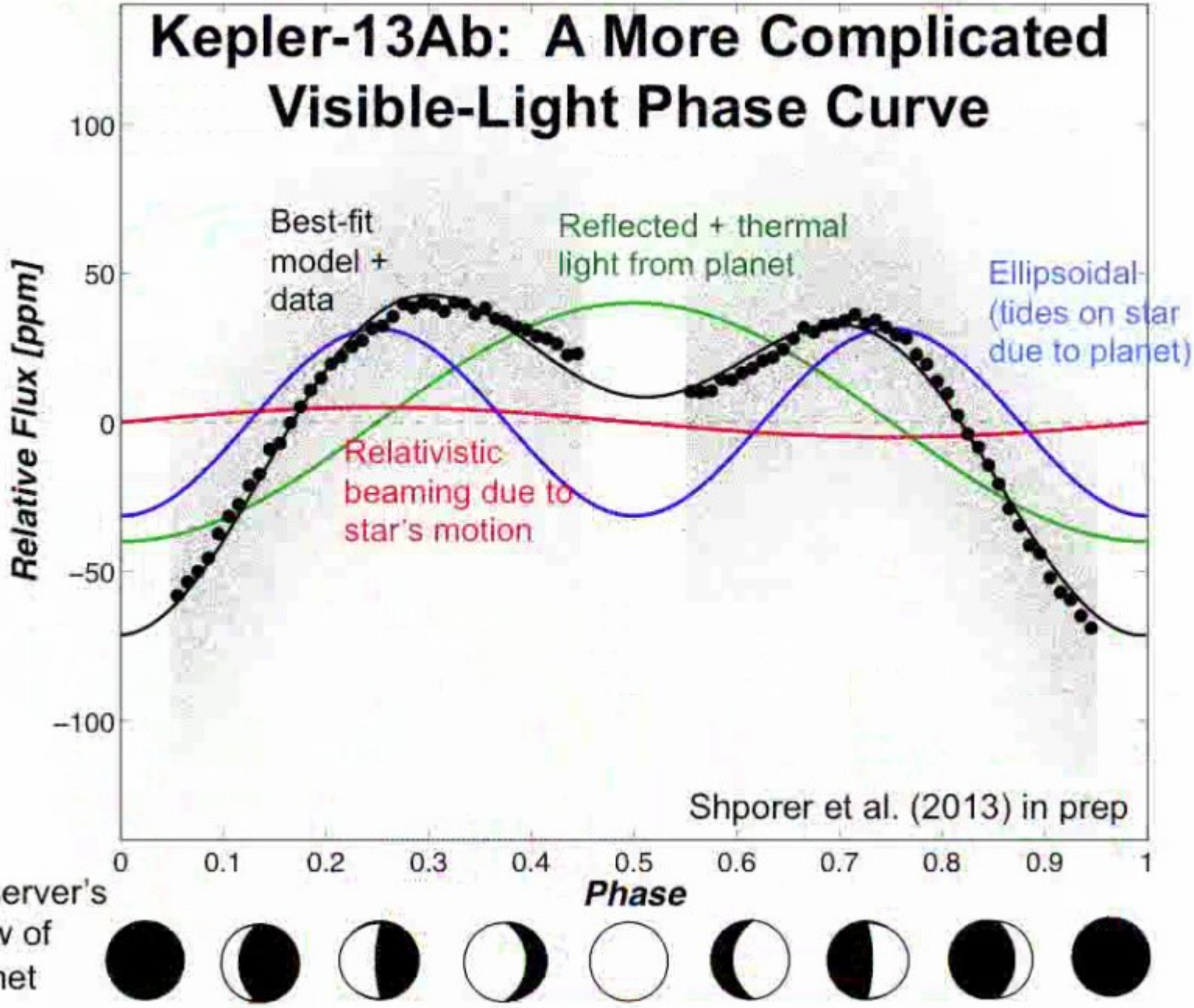

HD 189733
Relative Flux
1.01
1.00
0.99
0.98
0.97
a
Relative Flux
1.003
1.002
1.001
1.000
0.999
b
-0.1
0.0
0.1
0.2
0.3
0.4
0.5
0.6
Orbital Phase



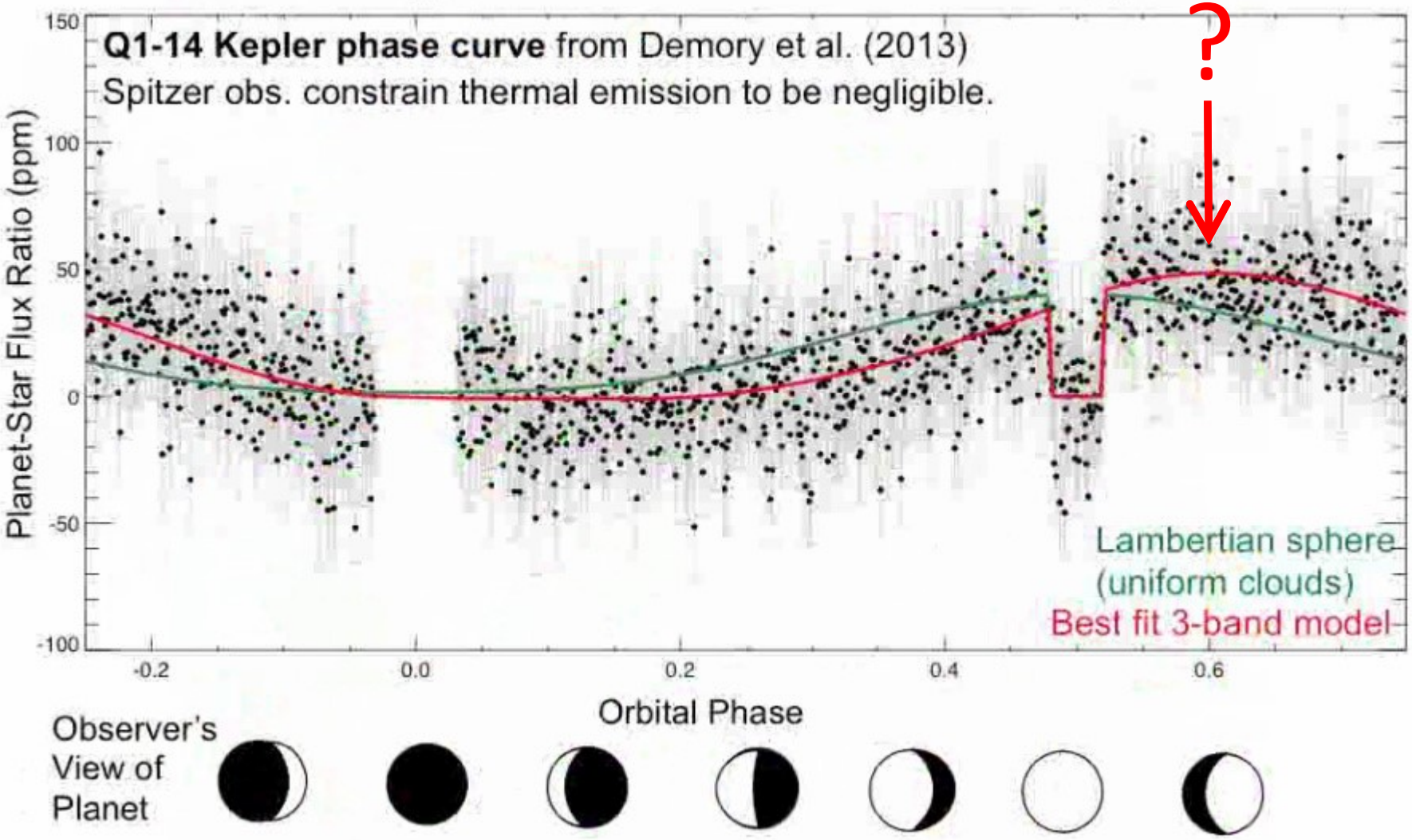
W → E



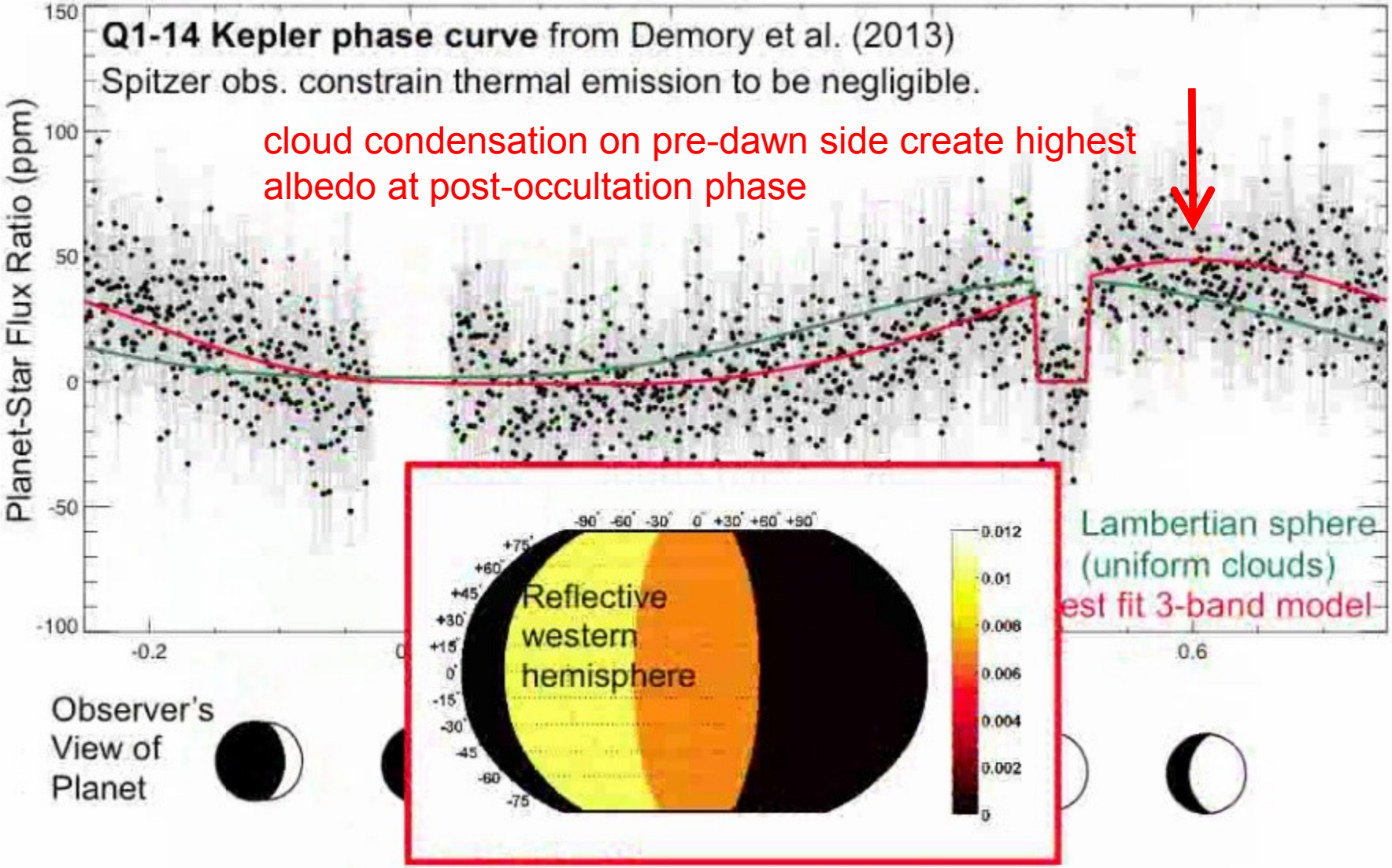
Kepler-13Ab: A More Complicated Visible-Light Phase Curve

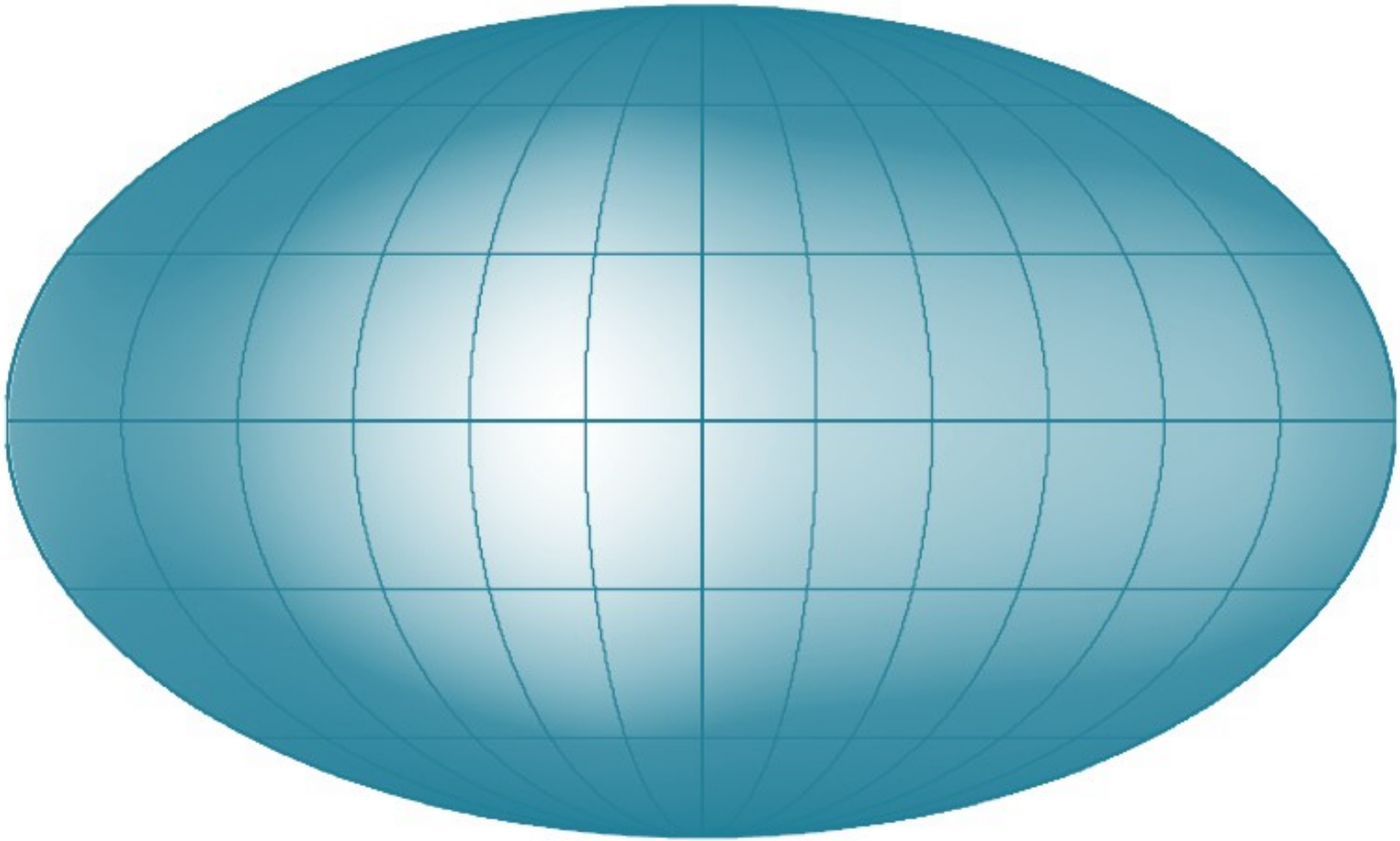


Kepler-7b: Evidence for Spatially Inhomogeneous Clouds from Kepler



Kepler-7b: Evidence for Spatially Inhomogeneous Clouds from Kepler





my version of the Knutson figure, showing cloud condensation in the W

W → E