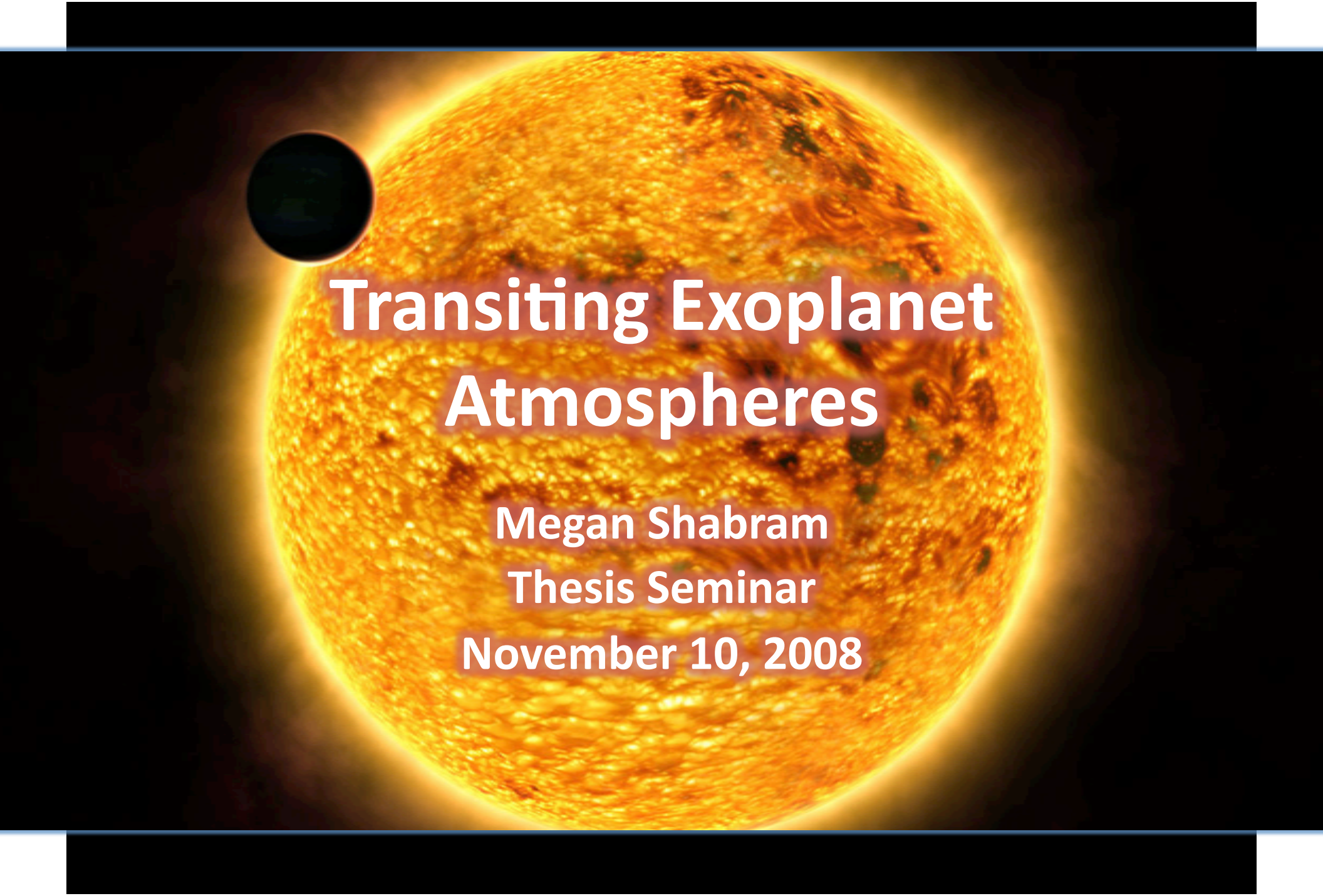


Transiting Exoplanet Atmospheres

Megan Shabram

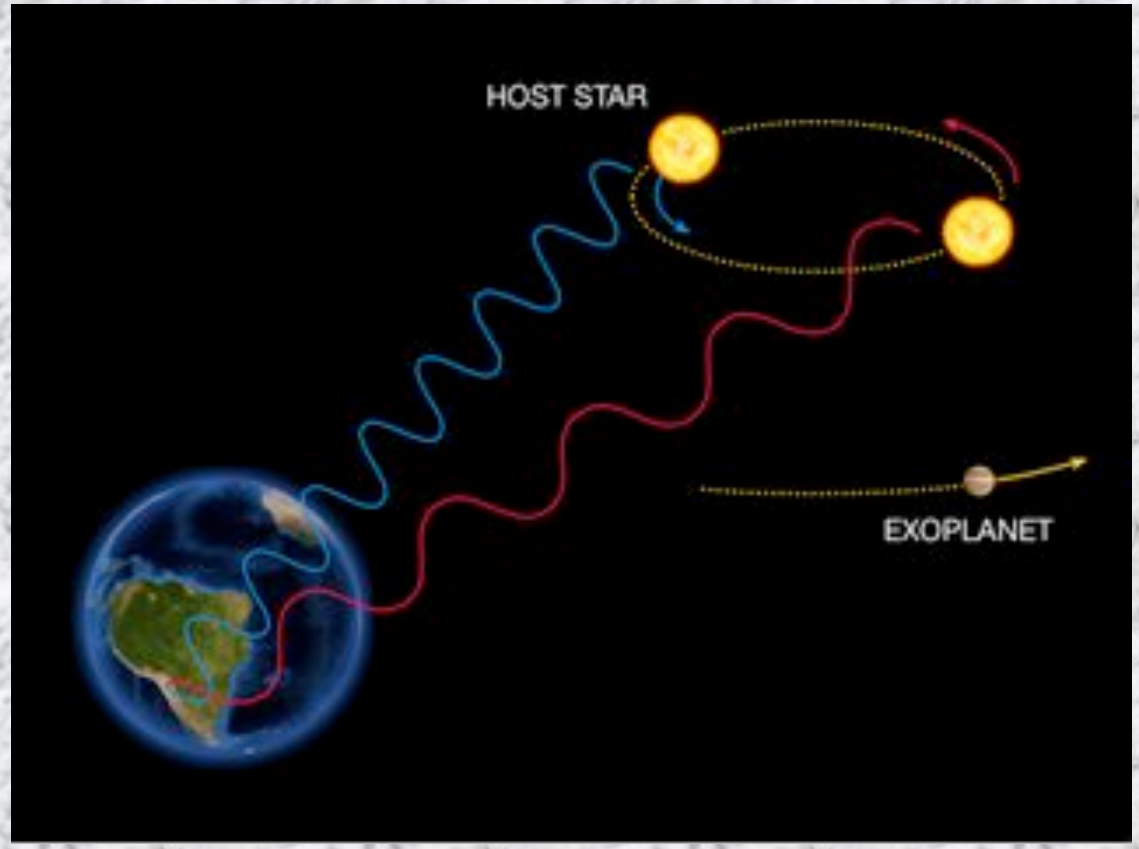
Thesis Seminar

November 10, 2008

What Are These Planets Like?

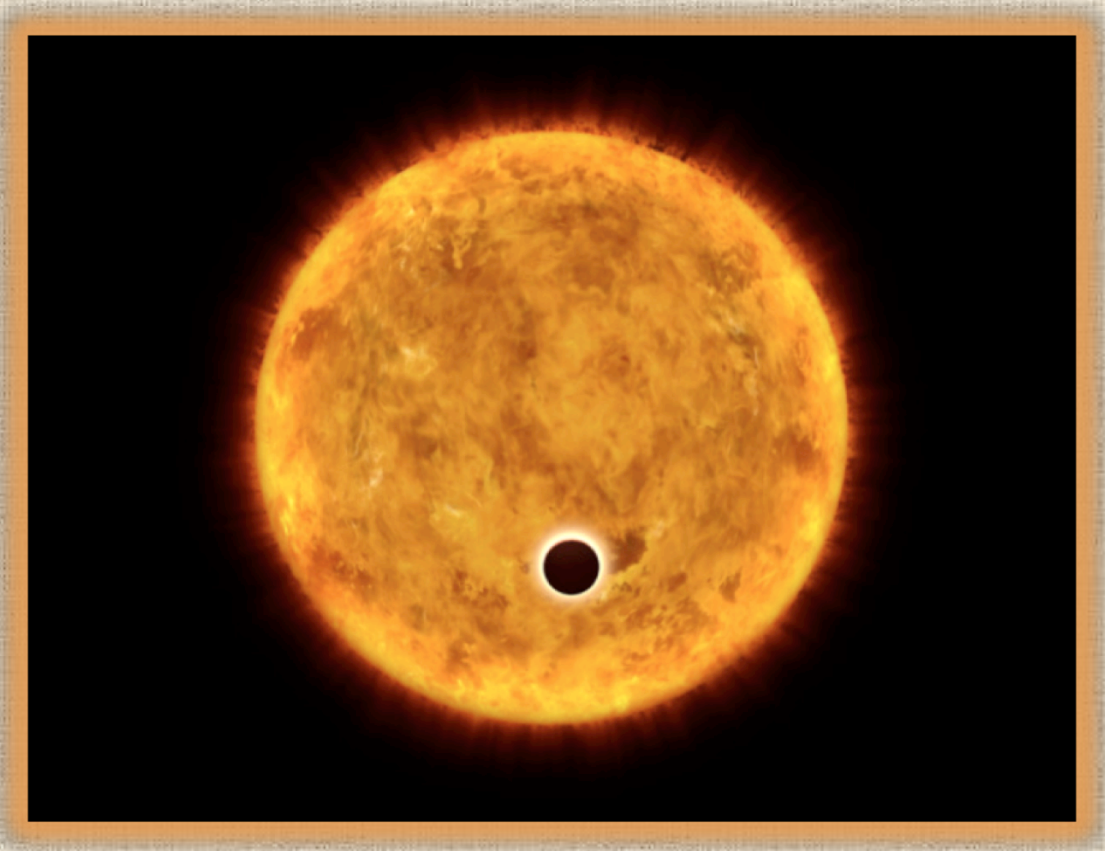
- Large planets on the order of the mass of Jupiter
- Very close to parent star
- Tidally locked
- Recently detecting smaller Neptune class planets

Detection by Radial Velocity Technique



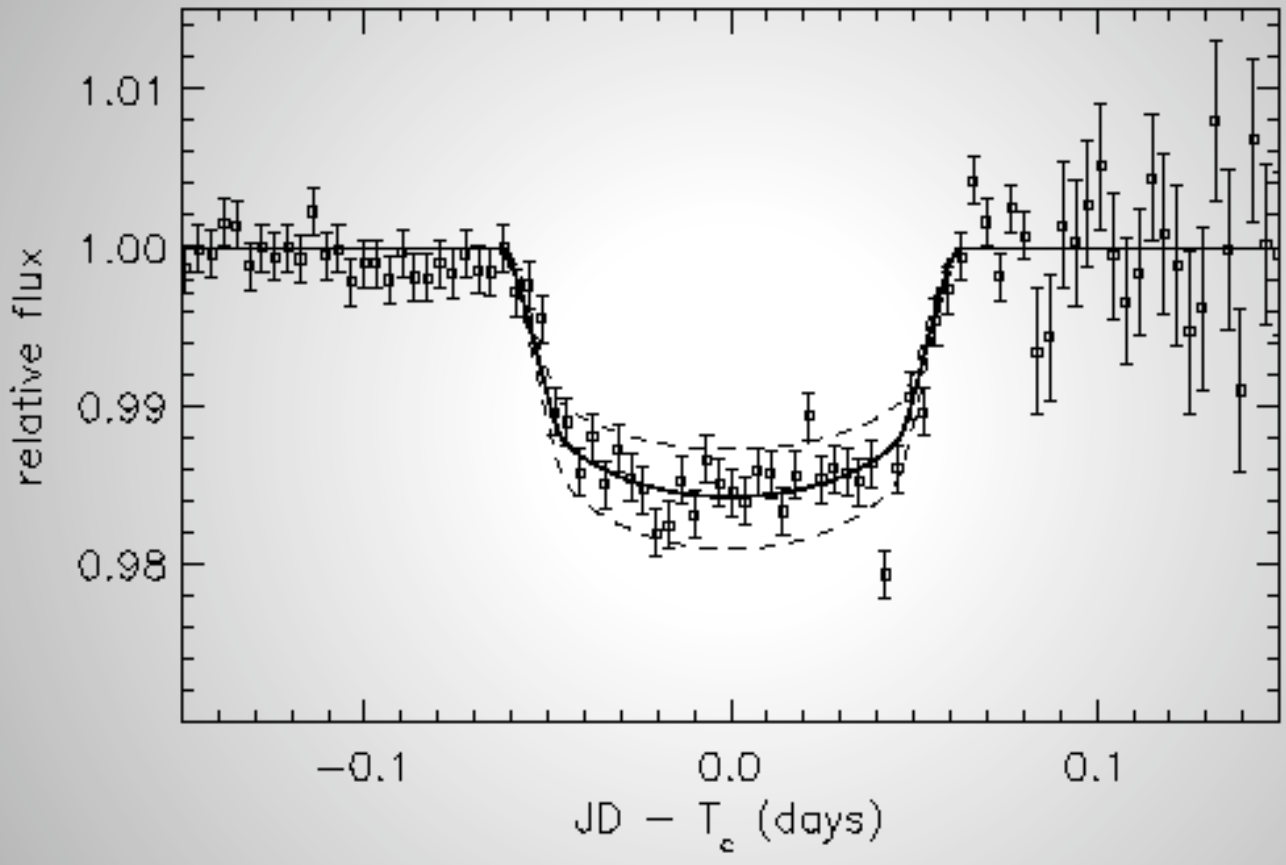
- Star wobbles in response to orbiting planets
- Wobble detected by Doppler effect

Transiting Planets



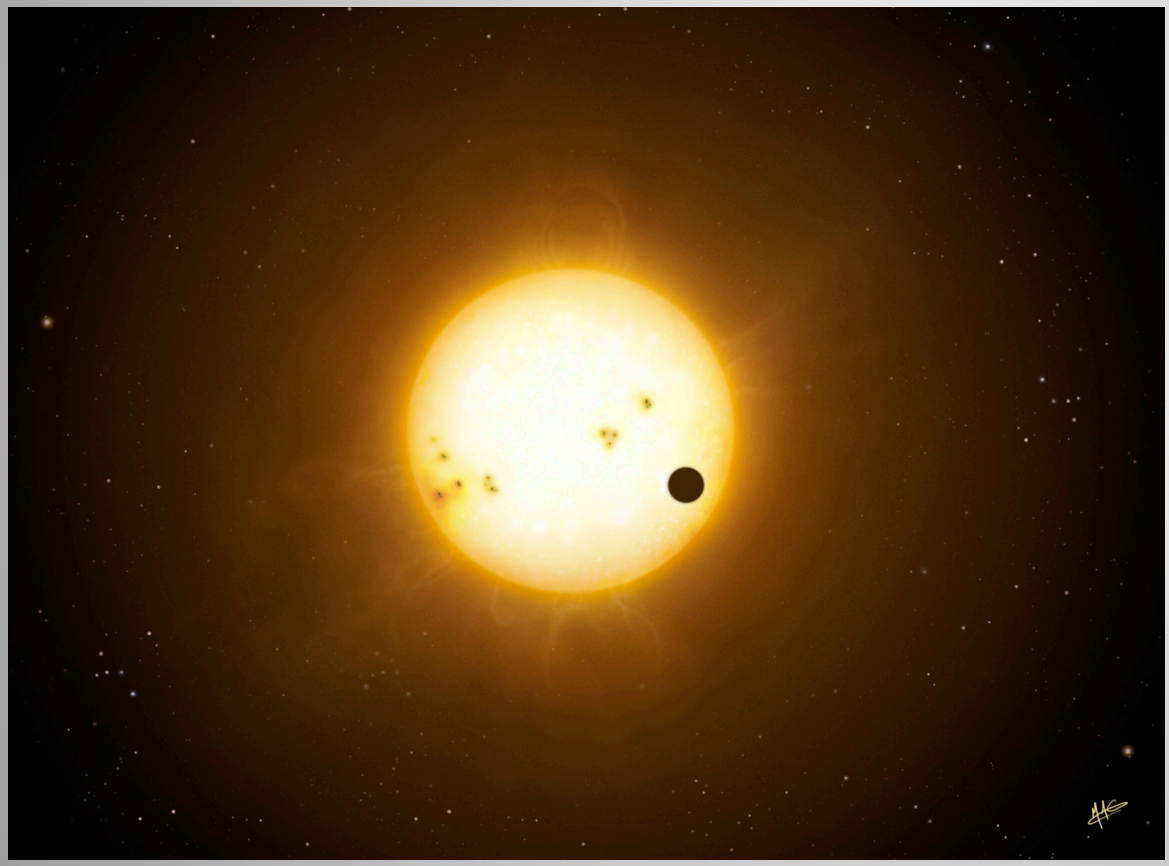
- Transmission and absorption spectrum can tell us about atmosphere

Transits



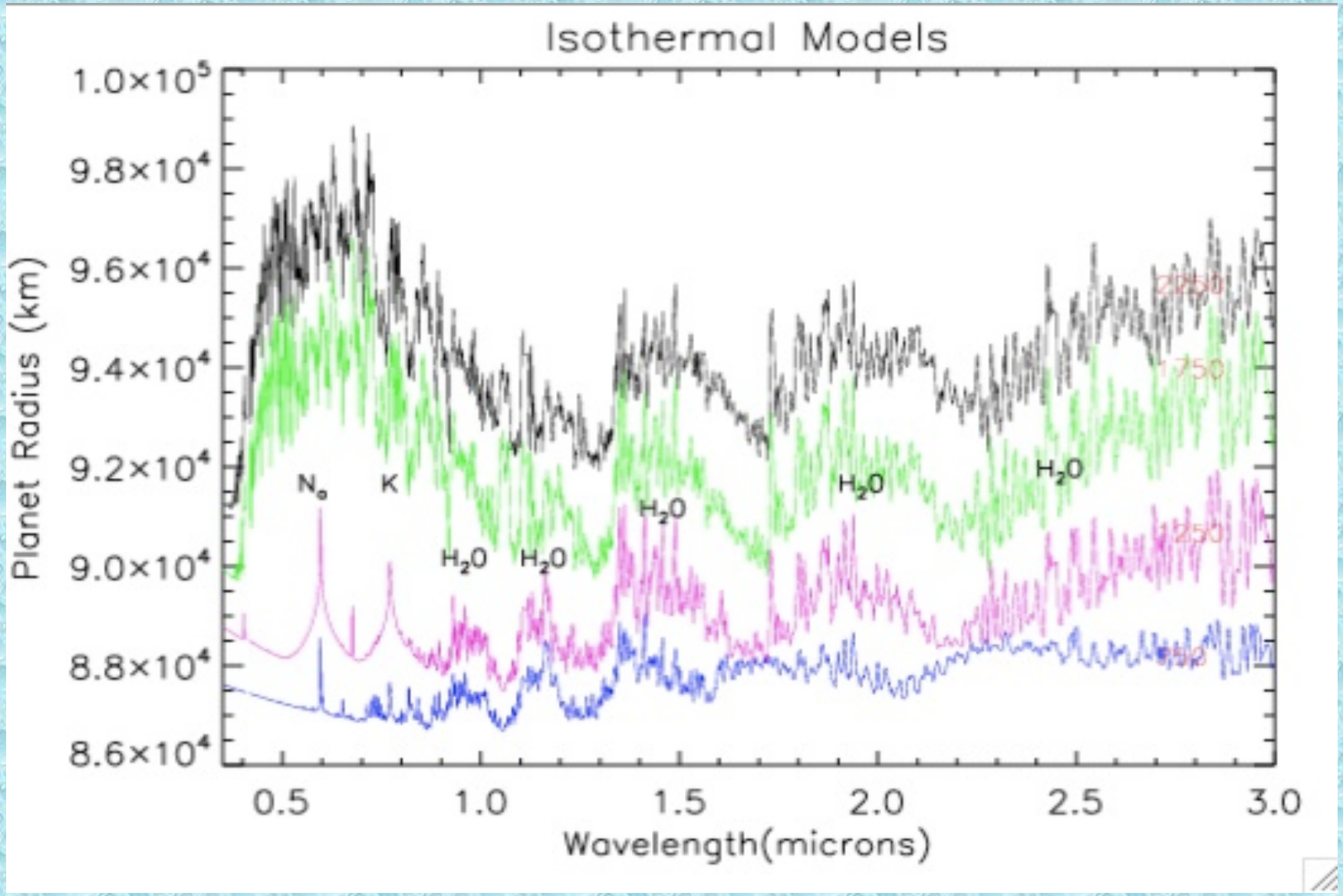
- **Light Curve:** Intensity of the star versus time as planet occults star

What Can We Infer About Their Atmospheres?

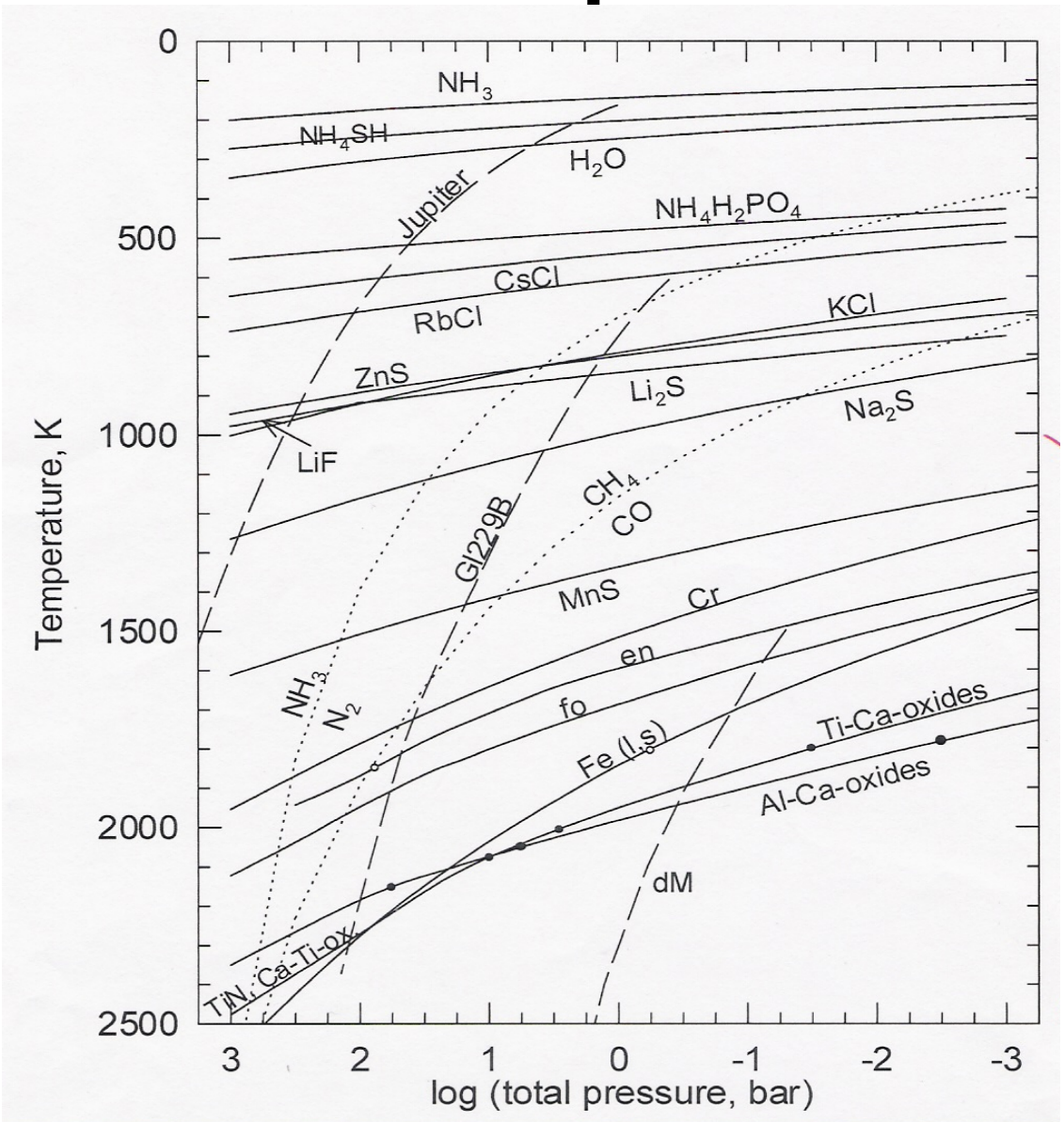


- Hot day side; cooler night side
- Absorption features differ with temperature

Spectrum


Isothermal Models
Planet Radius (km)
1.0×10^5
9.8×10^4
9.6×10^4
9.4×10^4
9.2×10^4
9.0×10^4
8.8×10^4
8.6×10^4
0.5
1.0
1.5
2.0
2.5
3.0
Wavelength(microns)
Na
K
H2O
H2O
H2O
H2O
H2O
2250
1750
1250
750

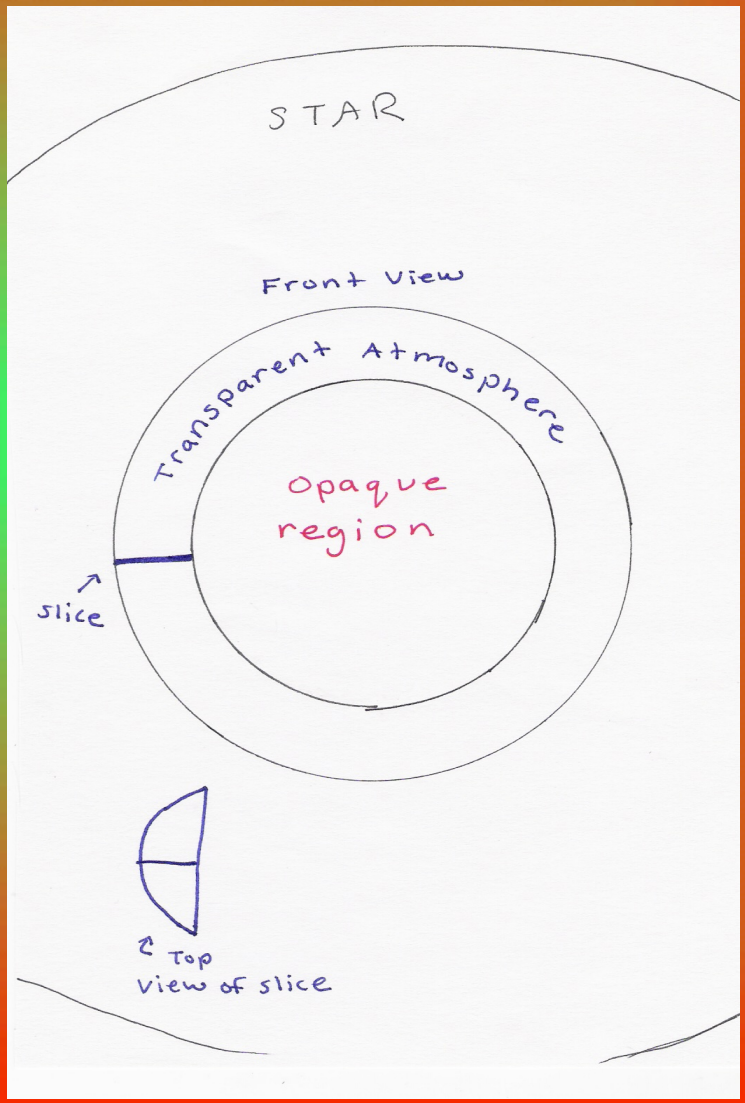
From the Lab: Chemistry as a Function of Temperature and Pressure



- CO and CH4 curve
- Hot Jupiter's: 1000-2500 K
- Certain molecules exist at specific Temperatures and pressures

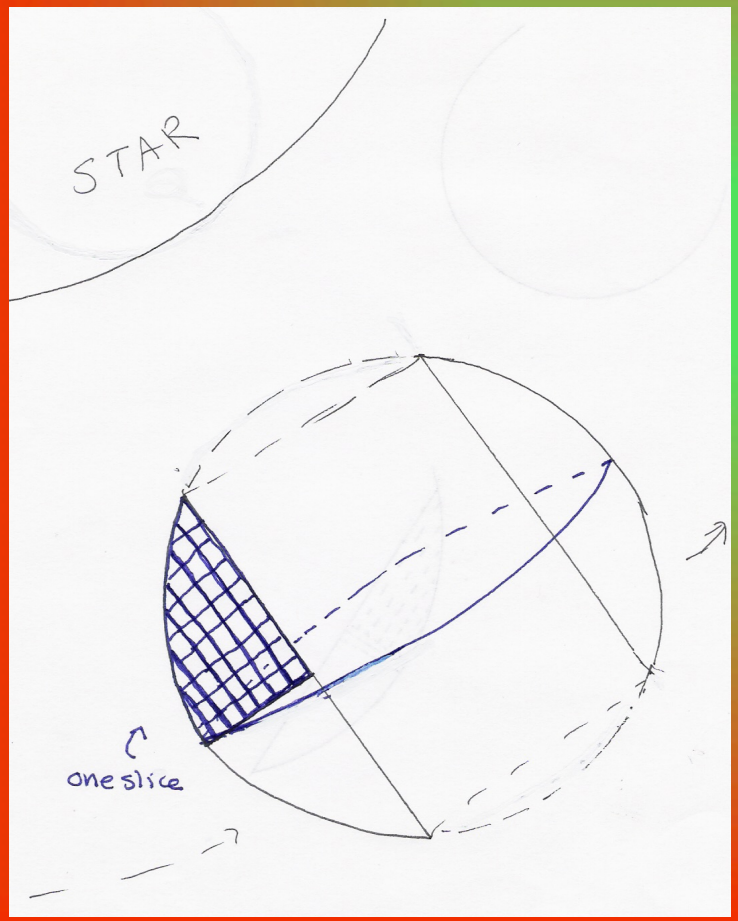
Atmospheric Opacity Models

- **Front View of planet (opaque region and transparent atmosphere)**

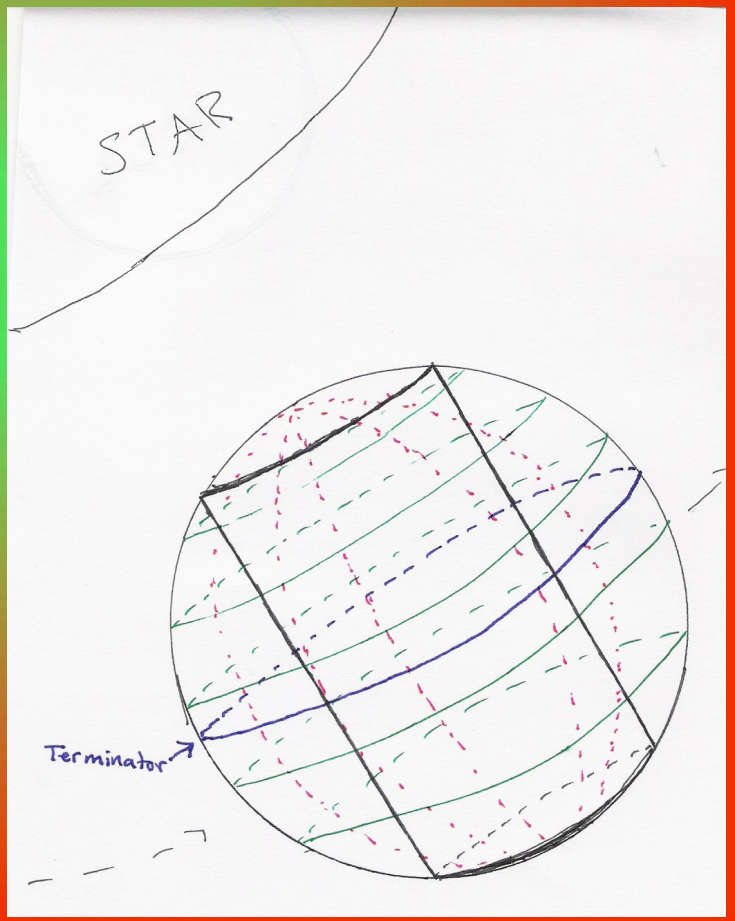


My Project and Where Isomodel Came From

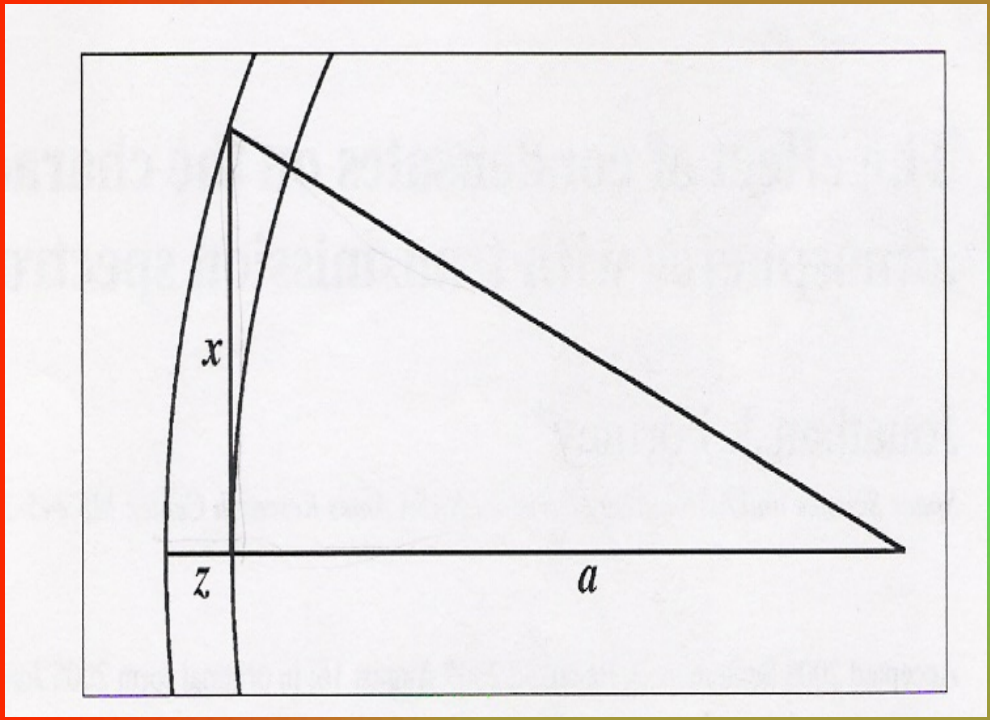
1-D model



3-D model

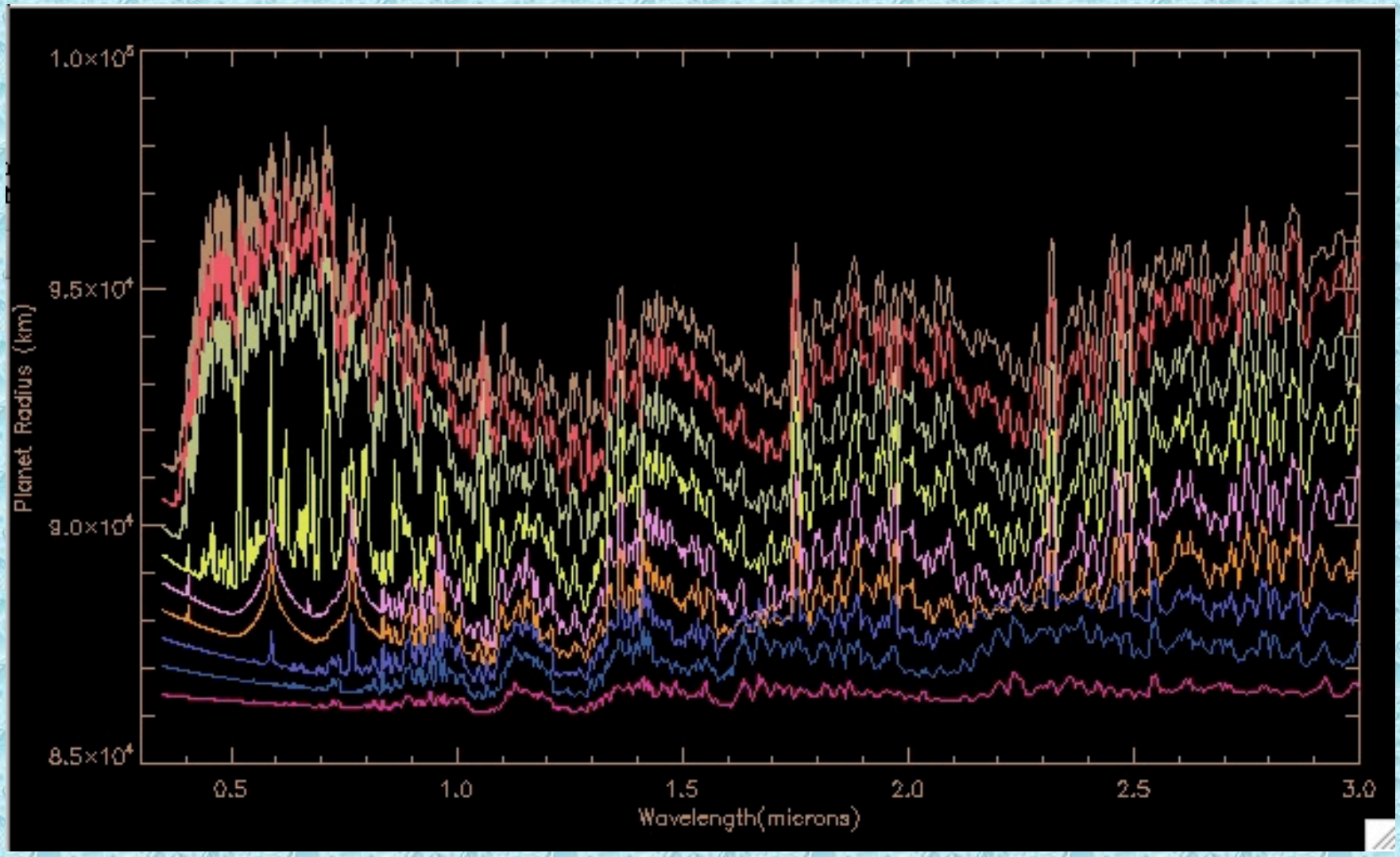


Slant Optical Depth



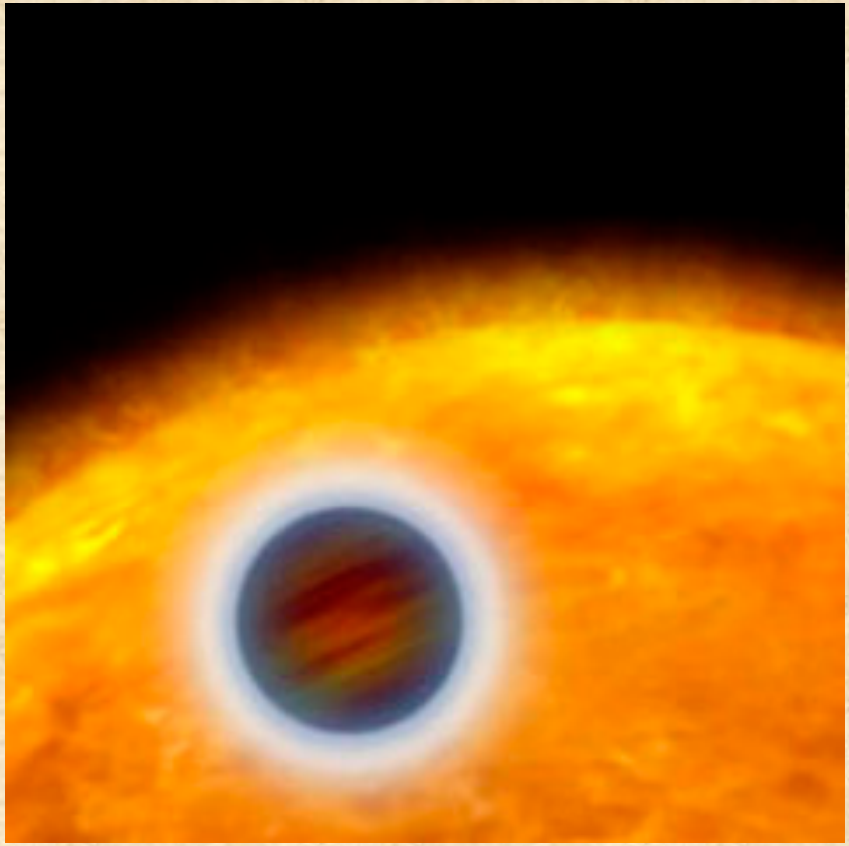
- X = the slant optical depth
- Z = the normal optical depth

Another Isomodel



Why is This Scientifically Interesting?

- Getting closer to characterizing exoplanet atmospheres
- A 3-D model will allow for day/night absorption features to be considered simultaneously



The Near Future