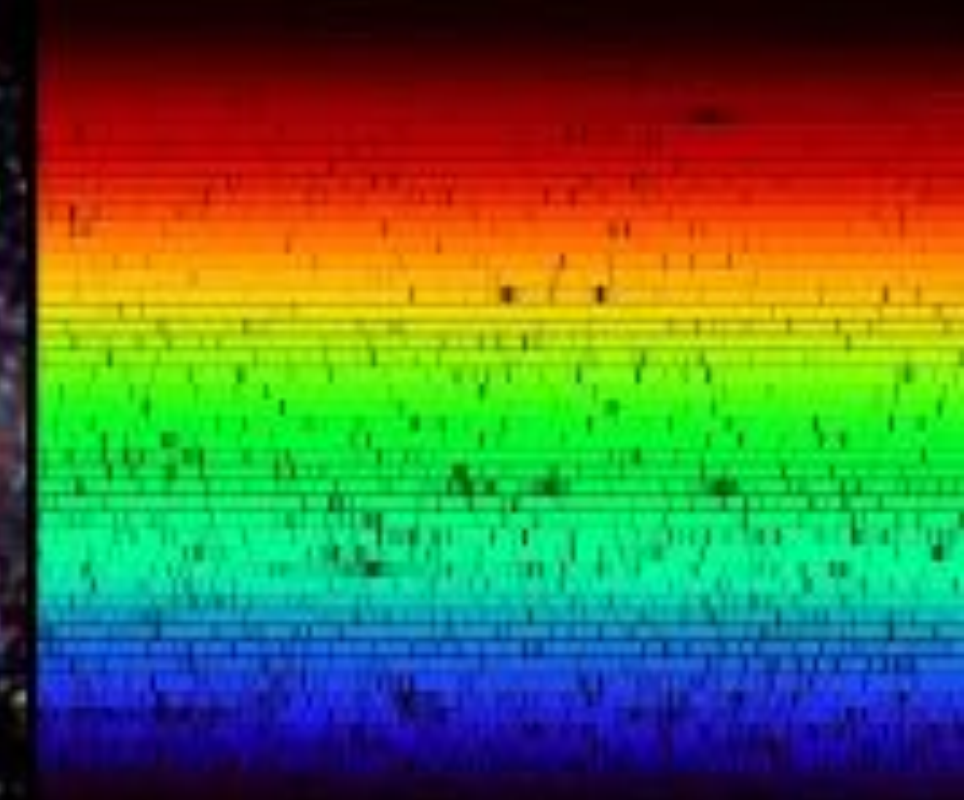




ASTR/PHYS 2500: Foundations Astronomy



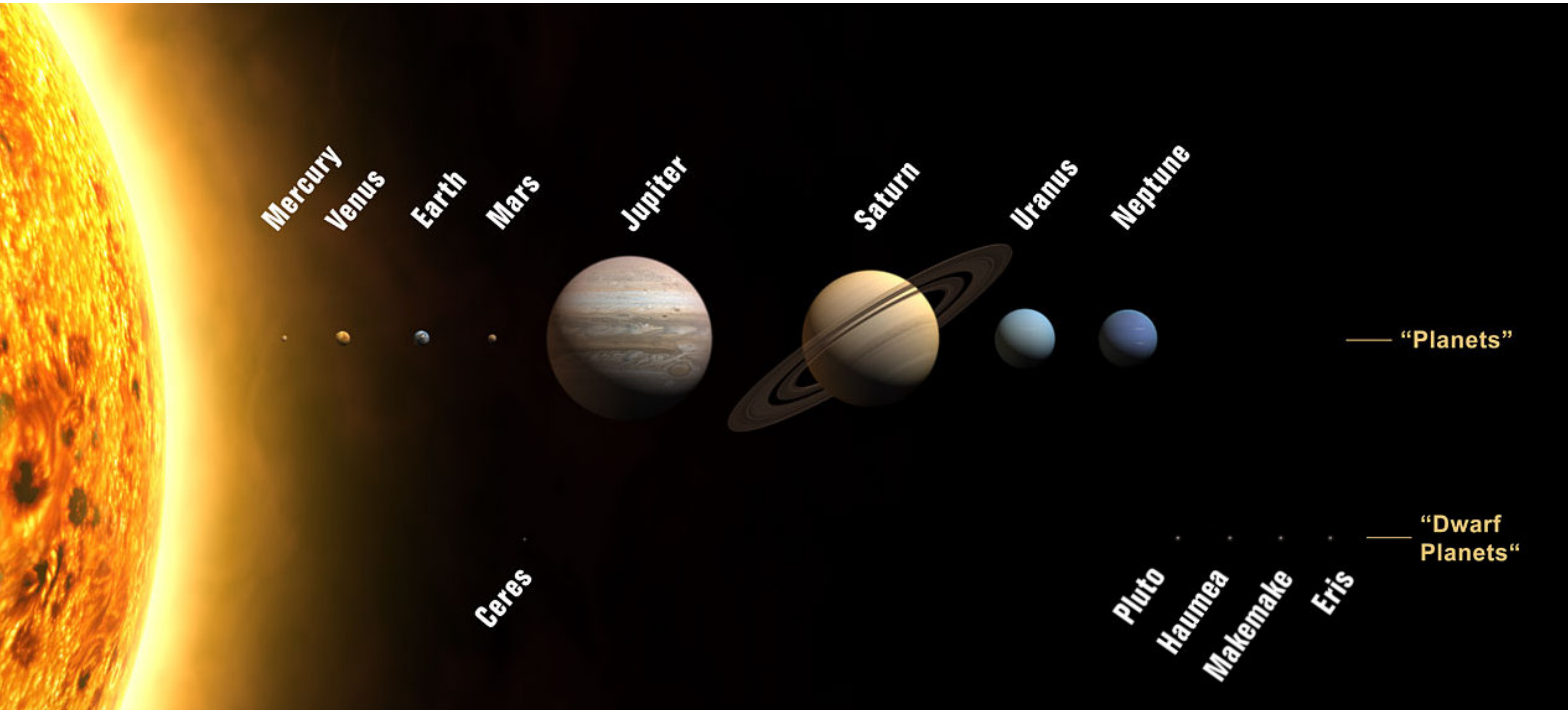
Week 4: Light / Solar System

HW 3 due now!

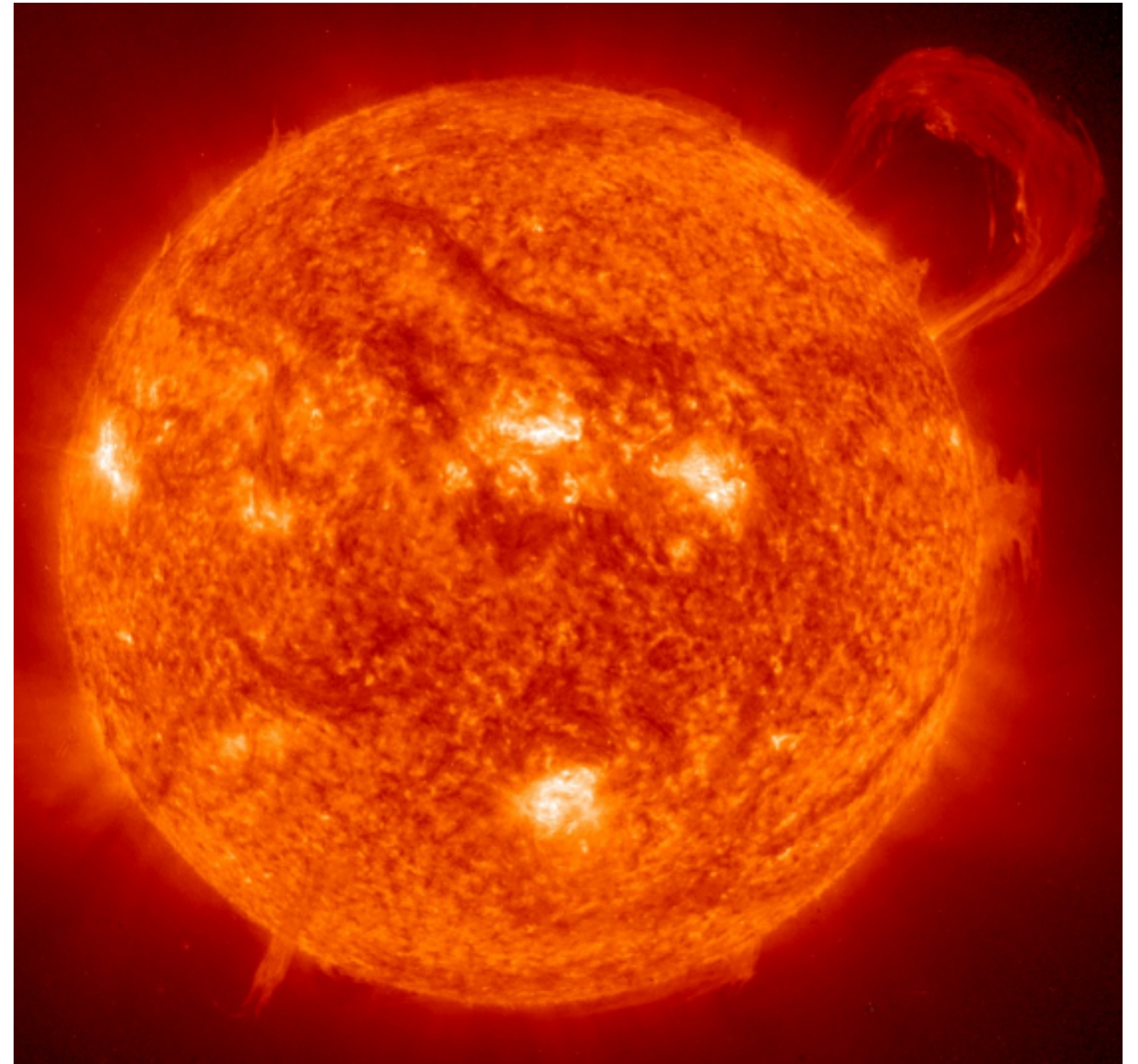
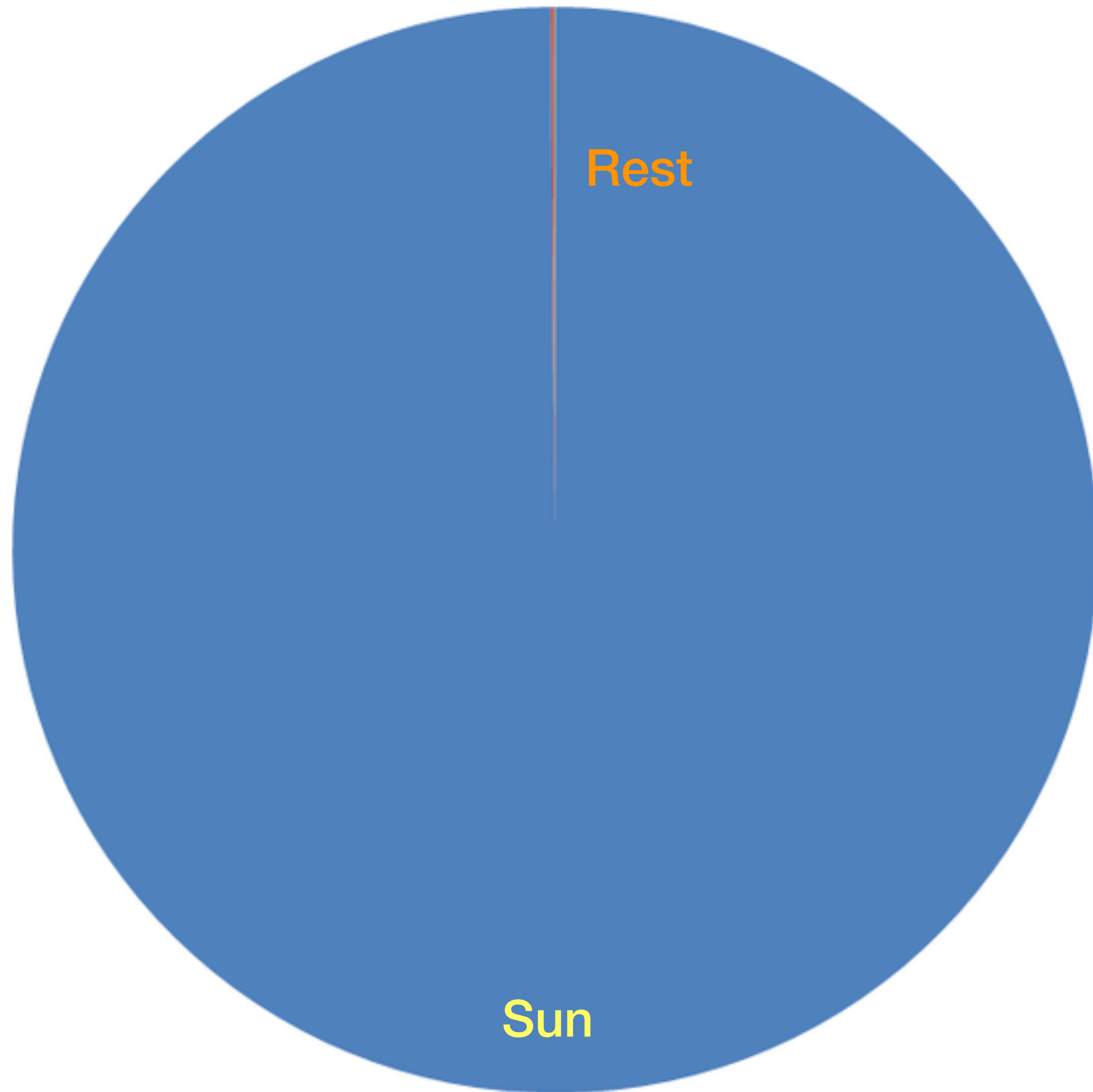
HW 4 due next Thursday @ 10:45am

Read Ch. 7.1, 8.1-2, 11.1-2, 12.3-4

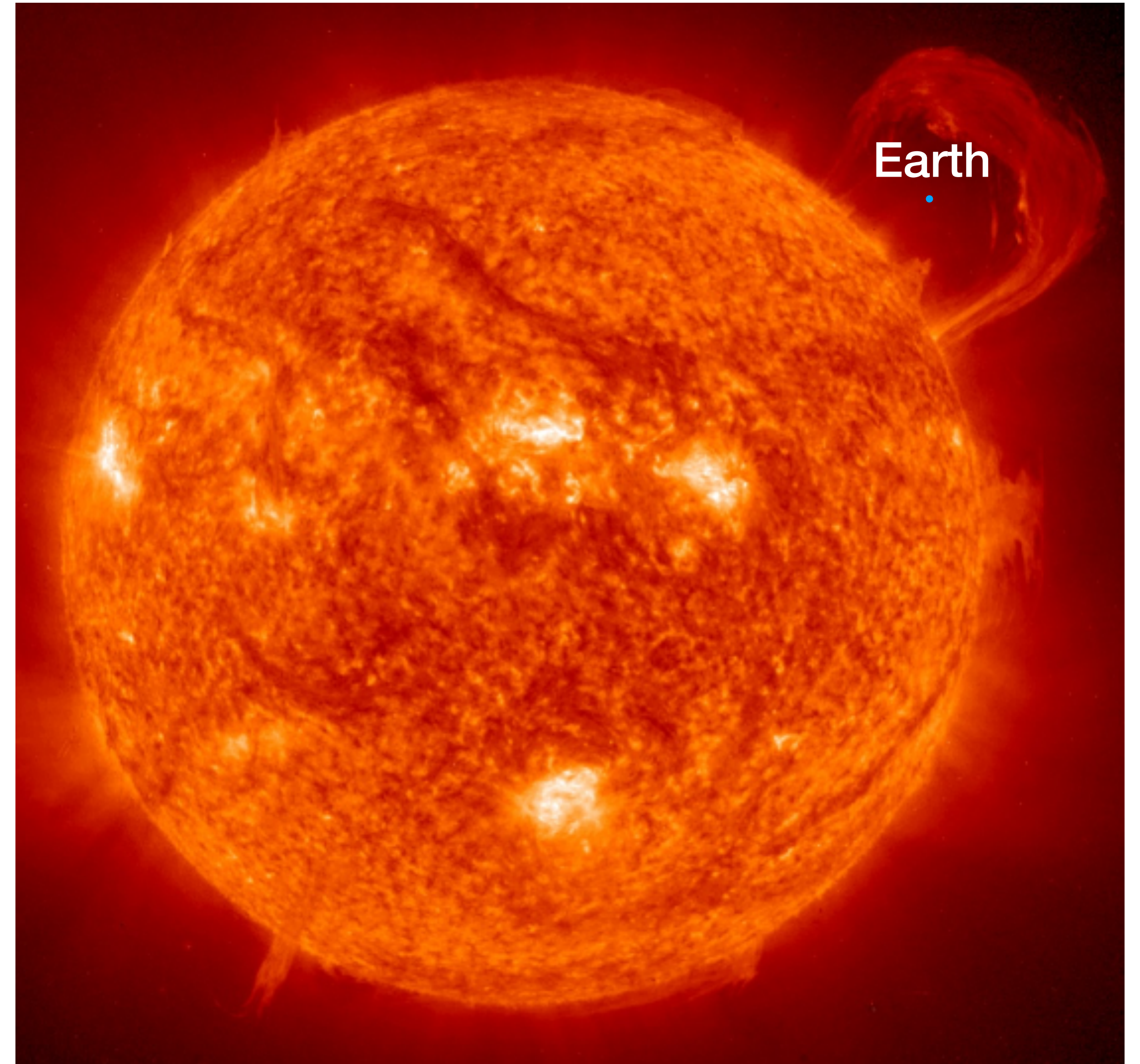
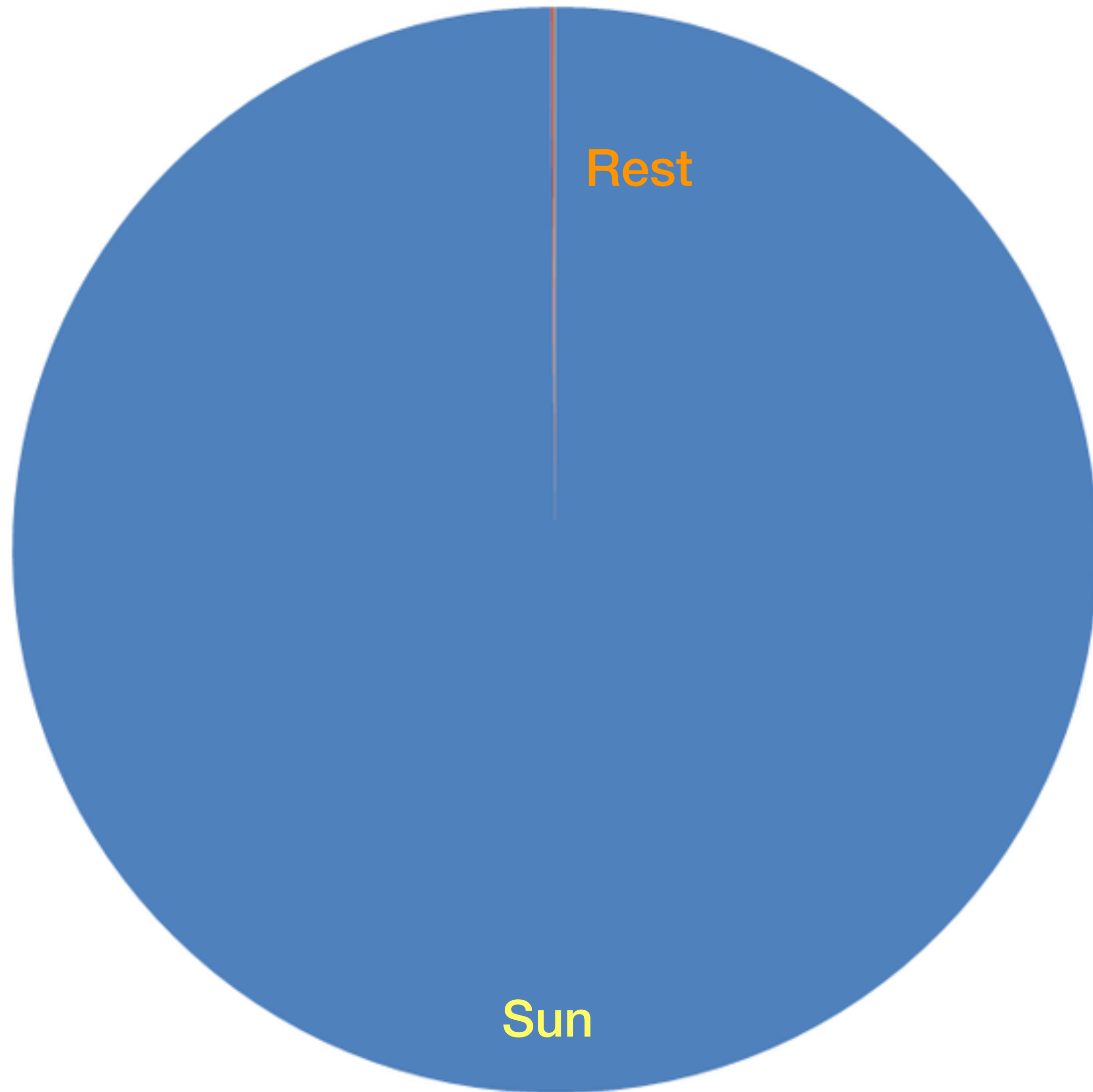
Solar System



Mass Fractions



Mass Fractions



Structure of the Sun

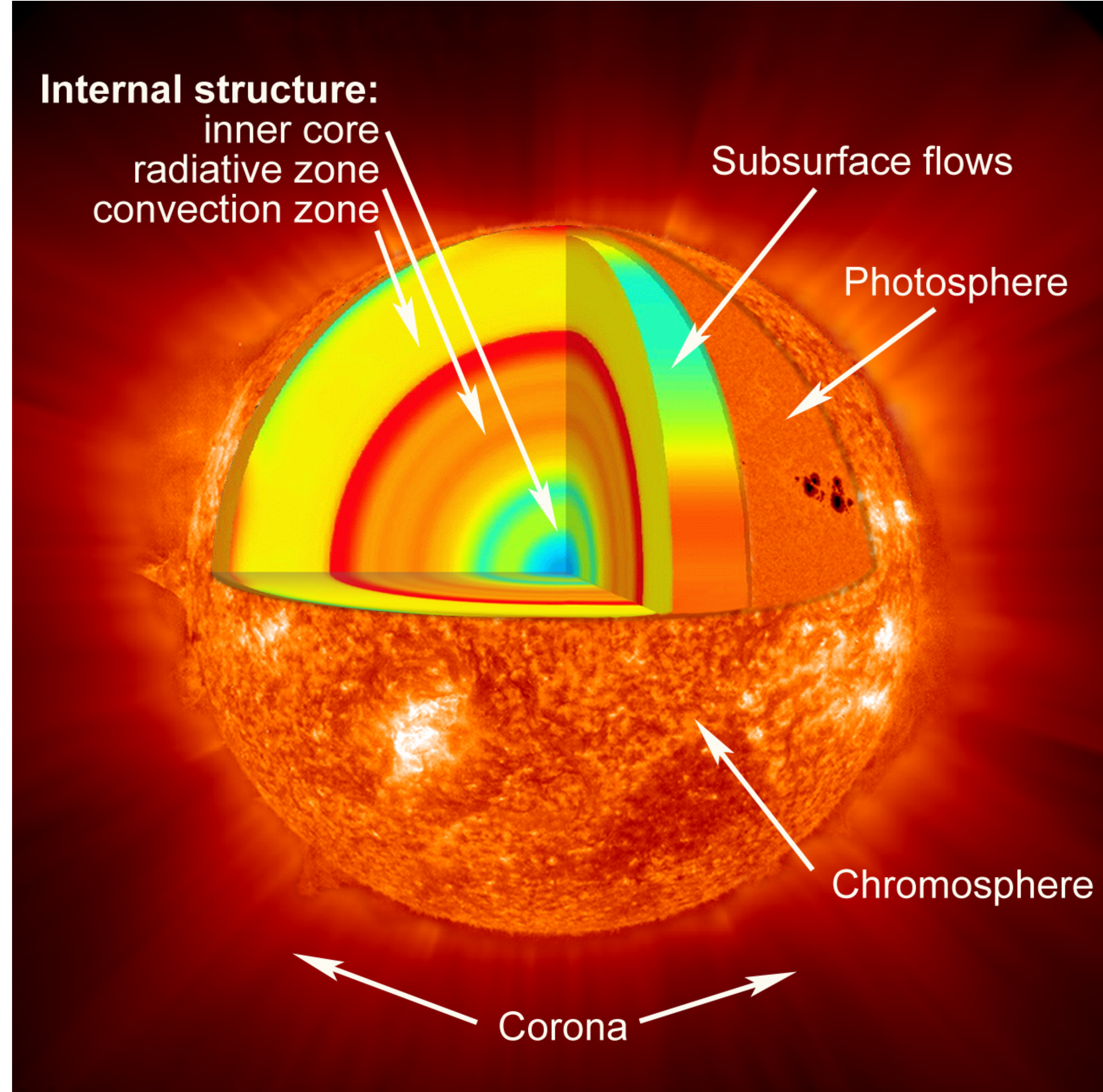
Core:

~15 million K

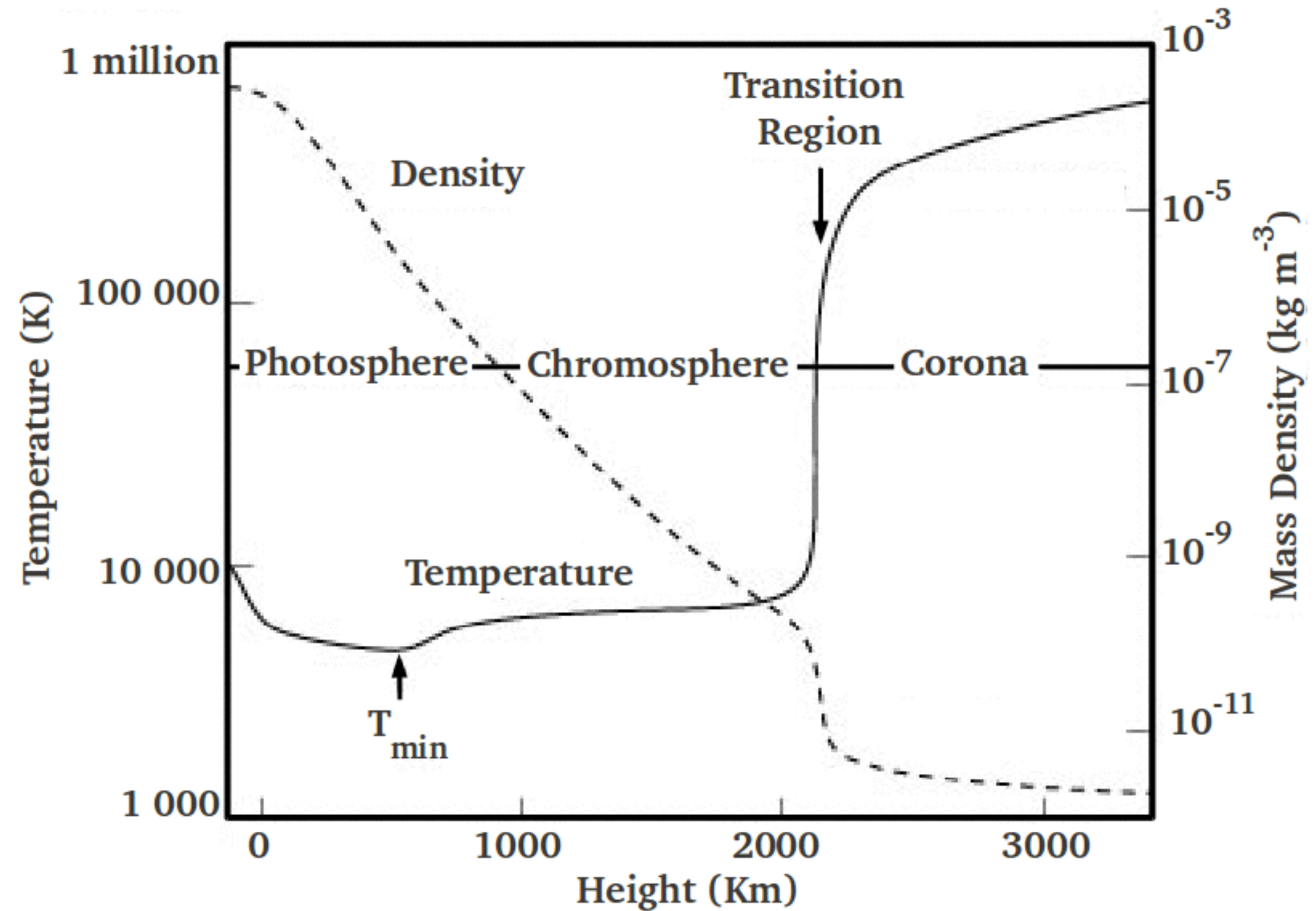
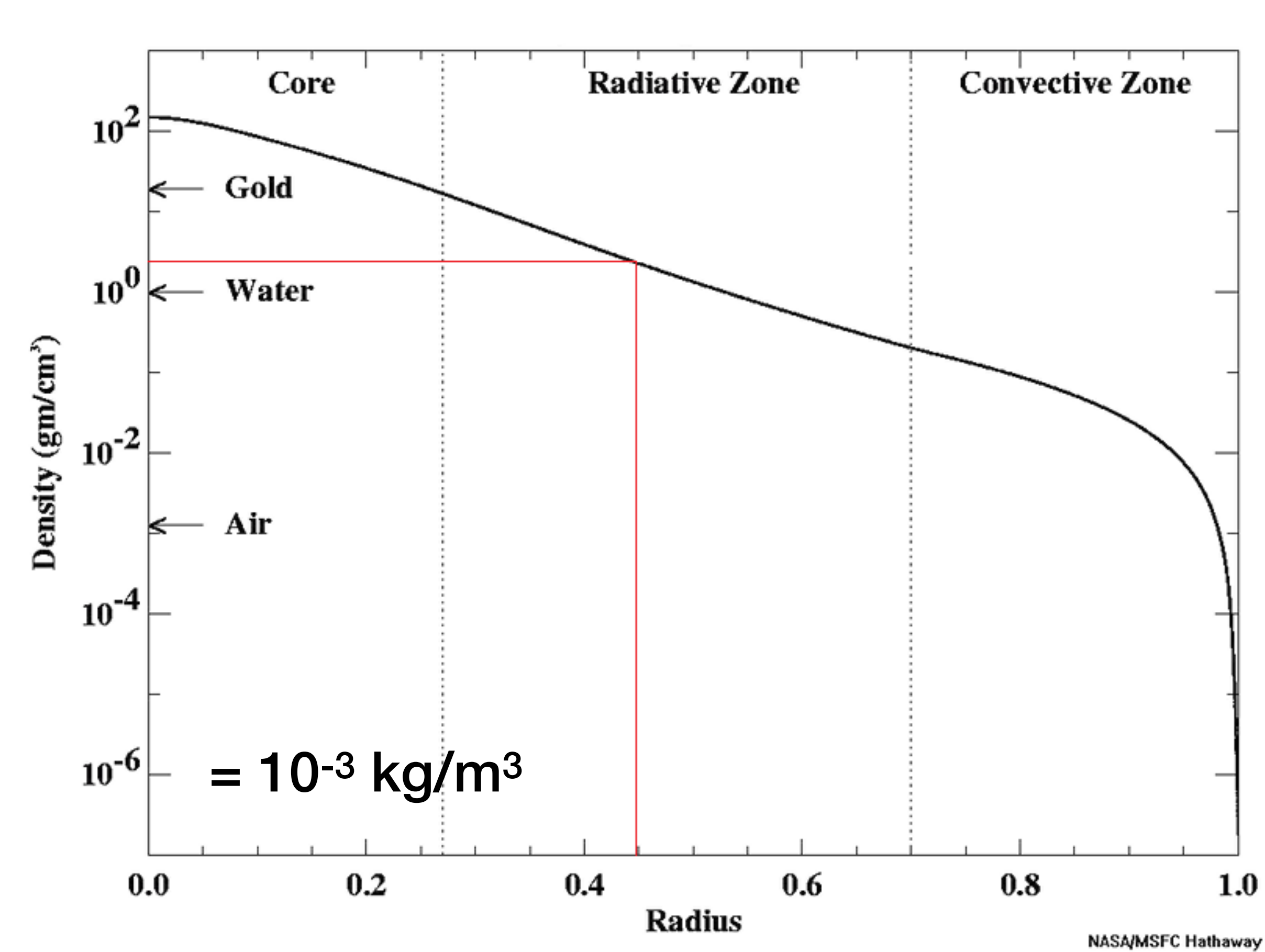
H \rightarrow He fusion produces Sun's photons

Photons take ~100,000 years to travel through the Sun, then take 8 min to reach the Earth

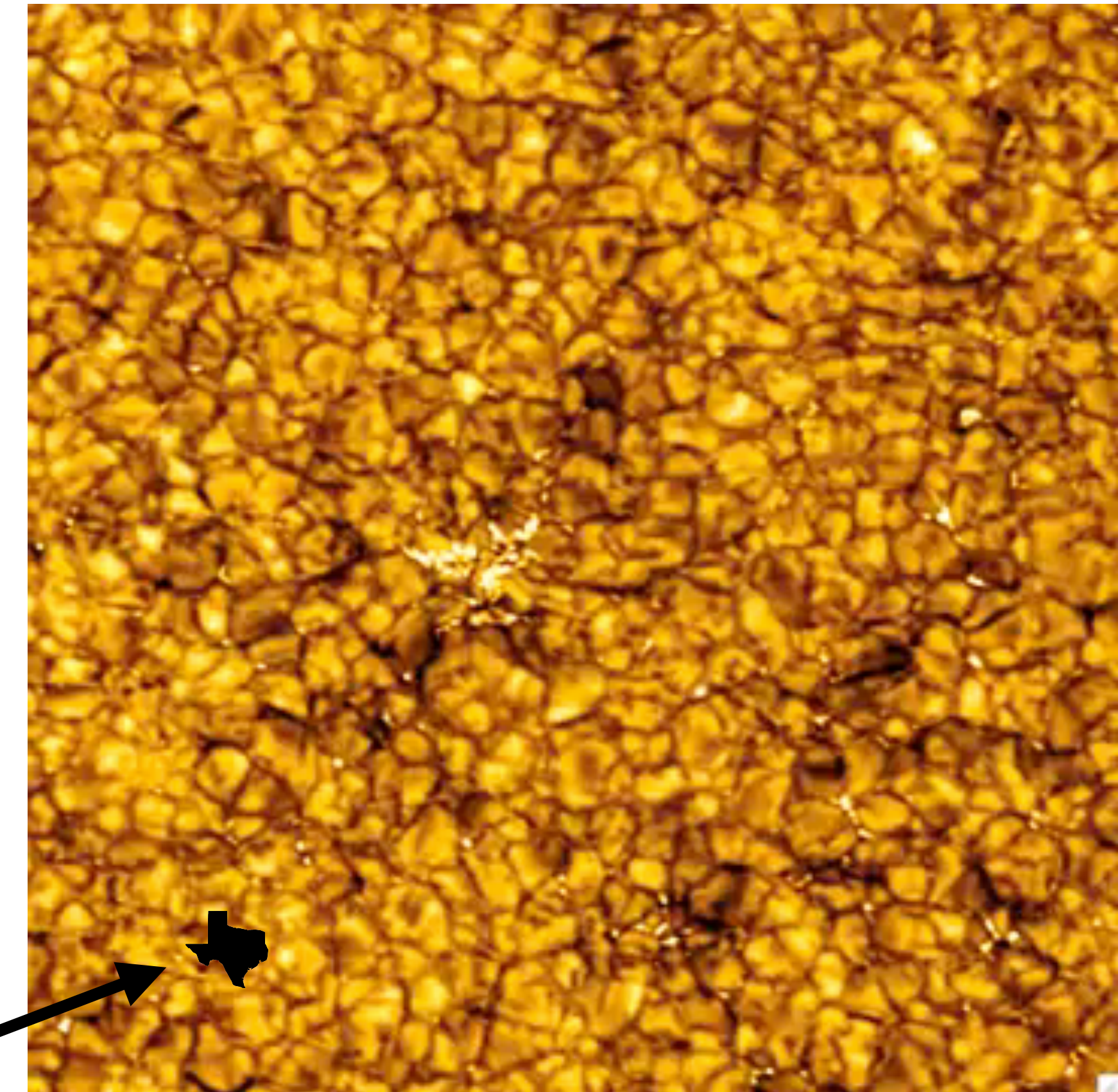
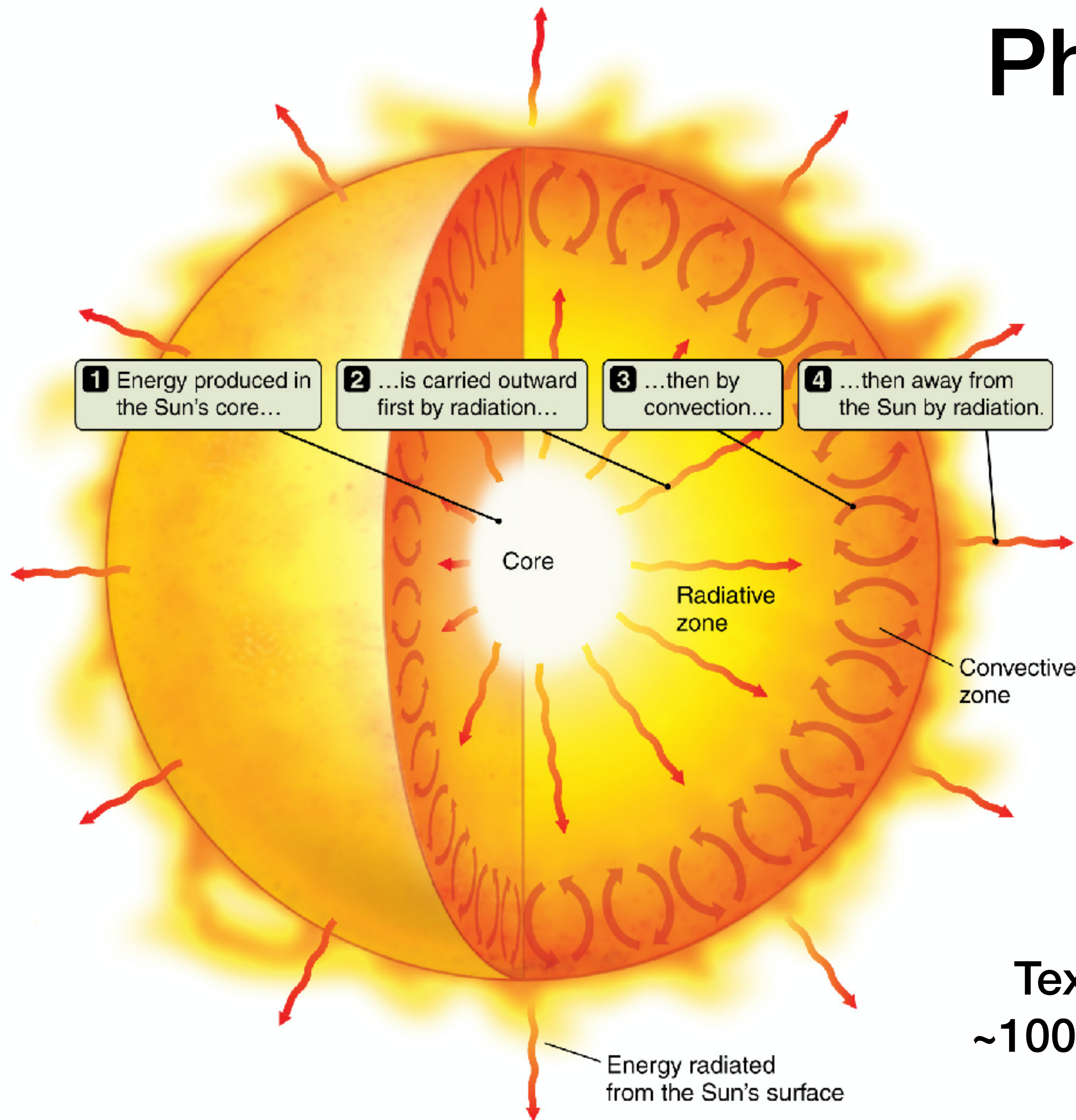
Temperature decreases outside the core until it falls to 5780 K at the "surface"



Temperature & Density Profiles of the Sun



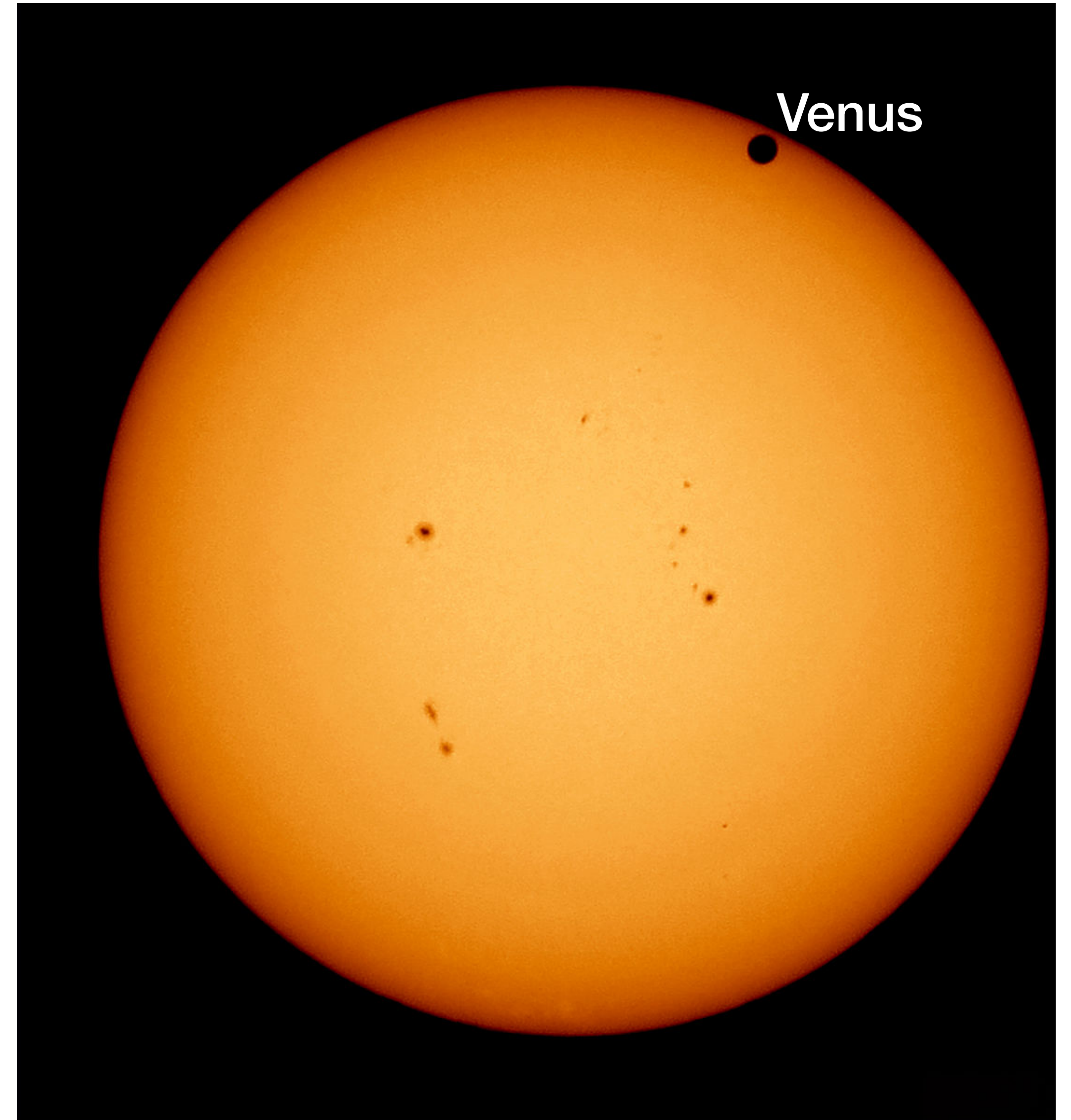
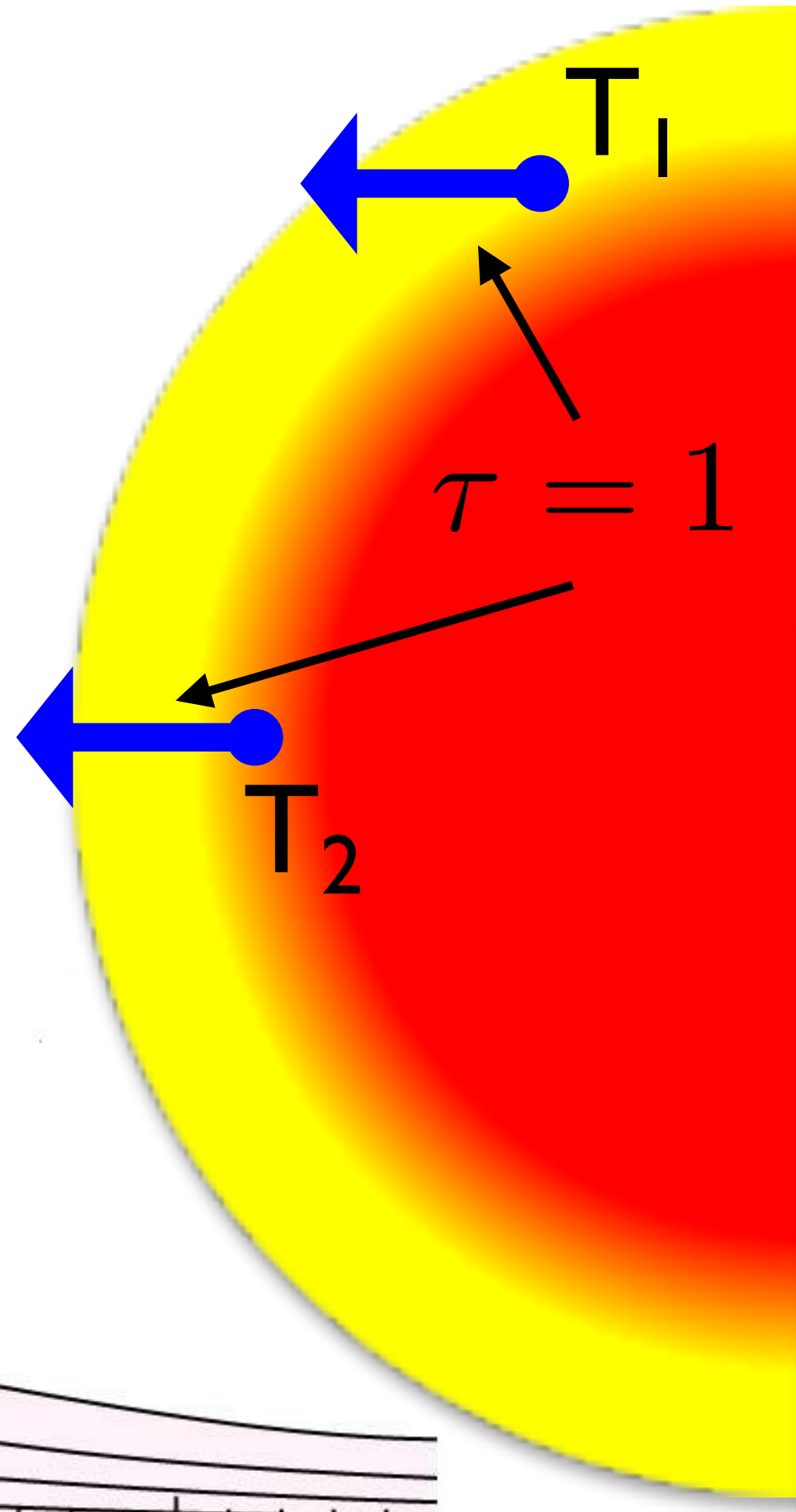
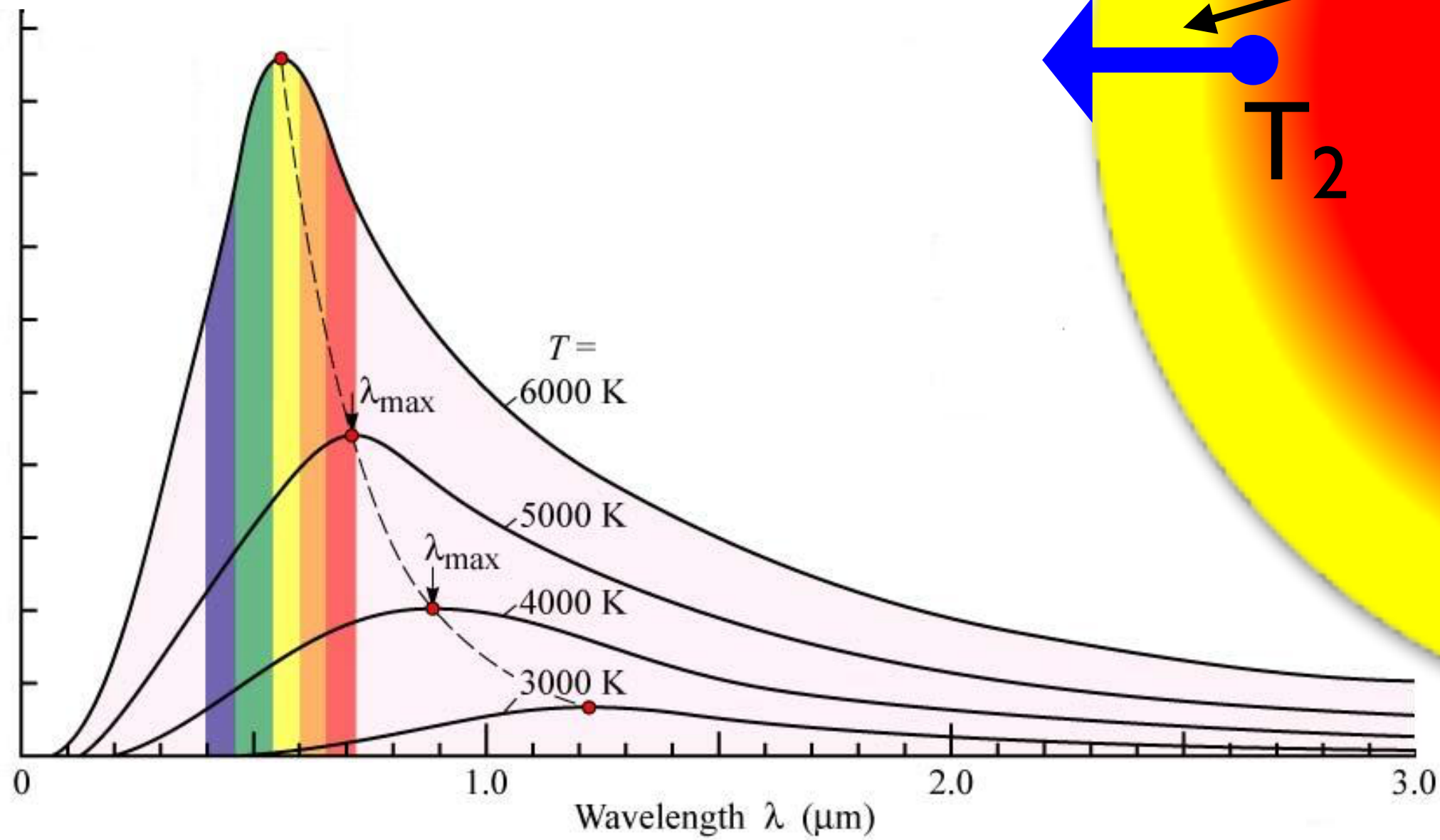
Photons ultimately brought by convection cells



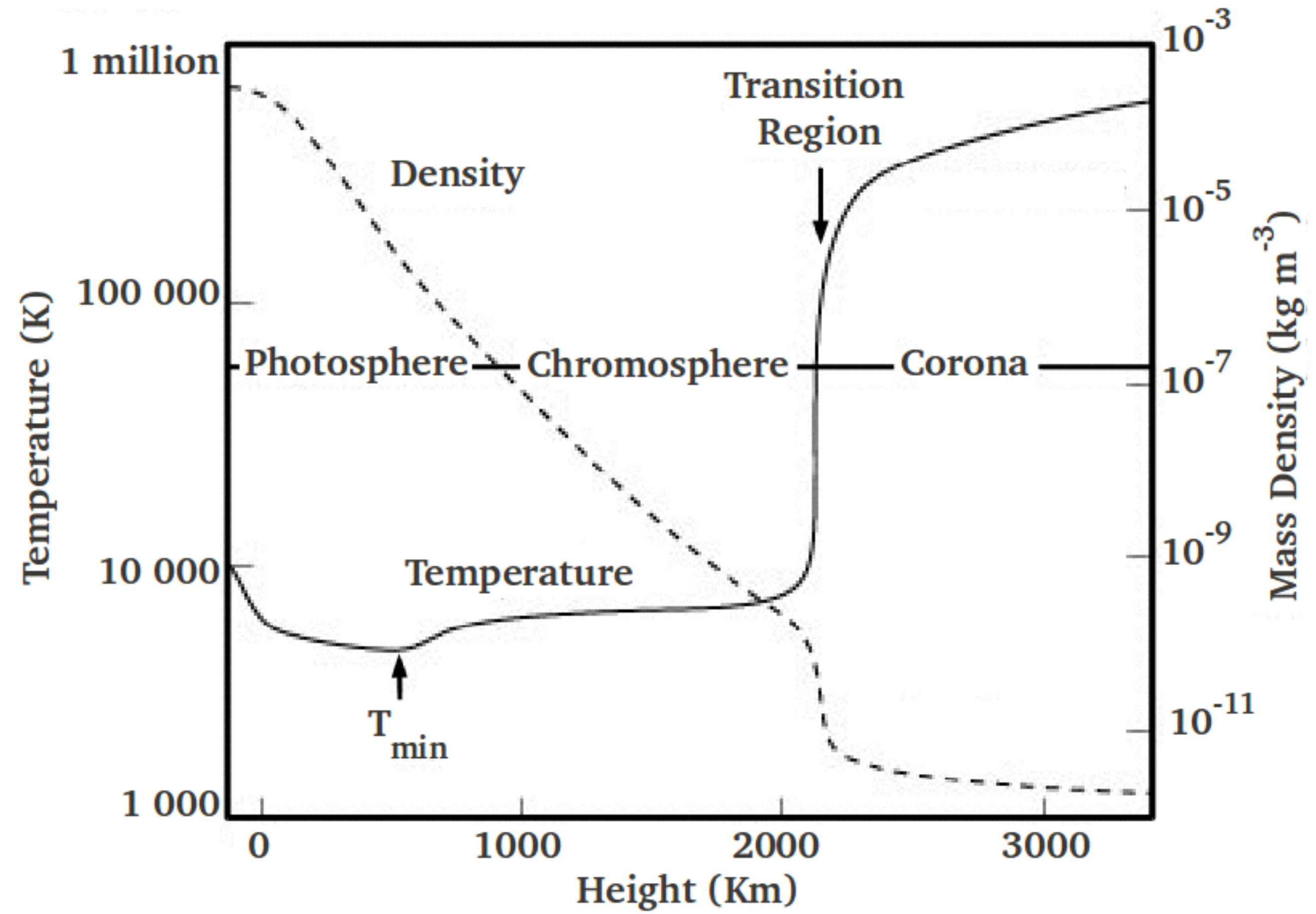
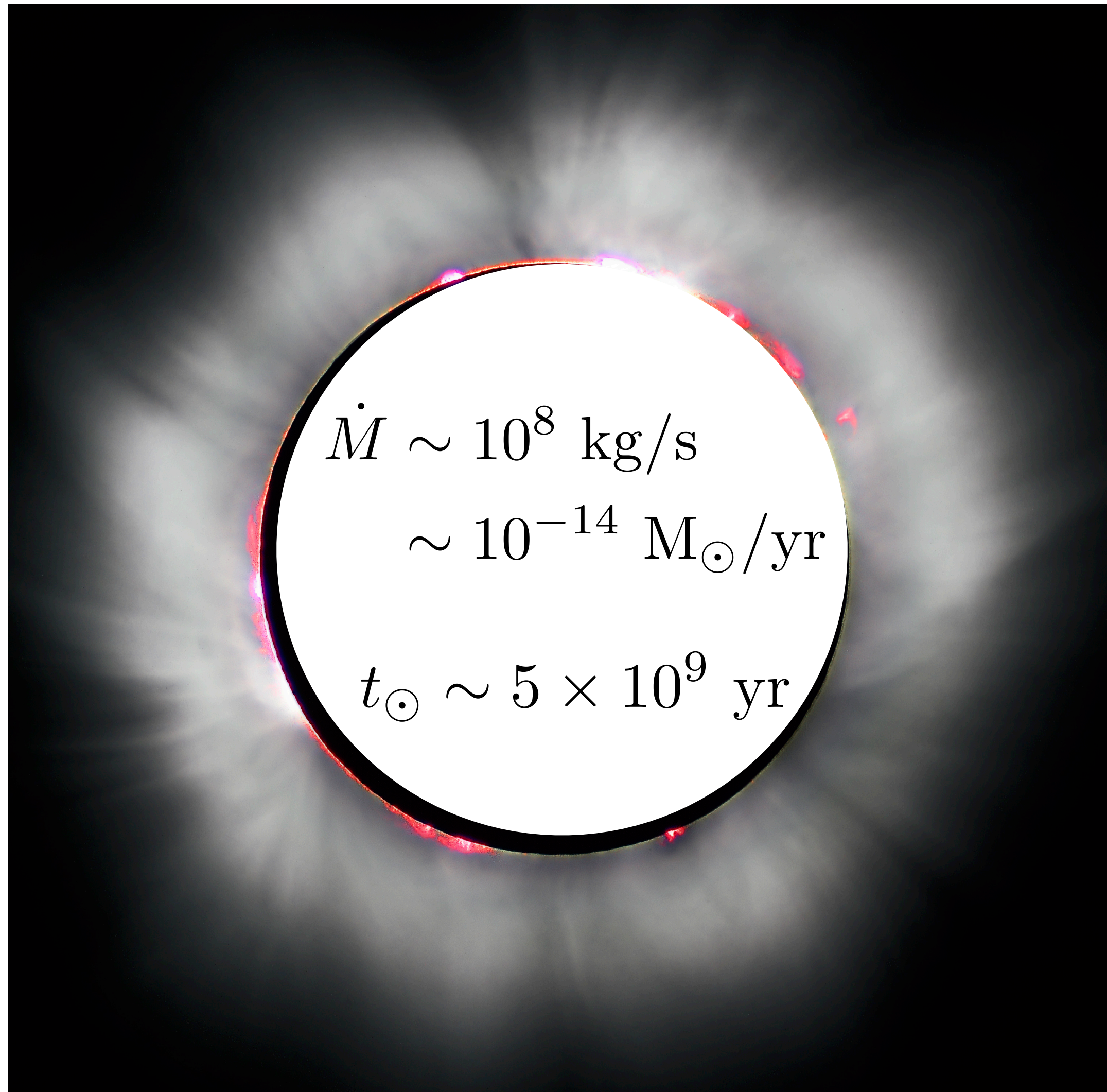
https://www.youtube.com/watch?v=W_Scoj4HqCQ

Photosphere: Limb Darkening

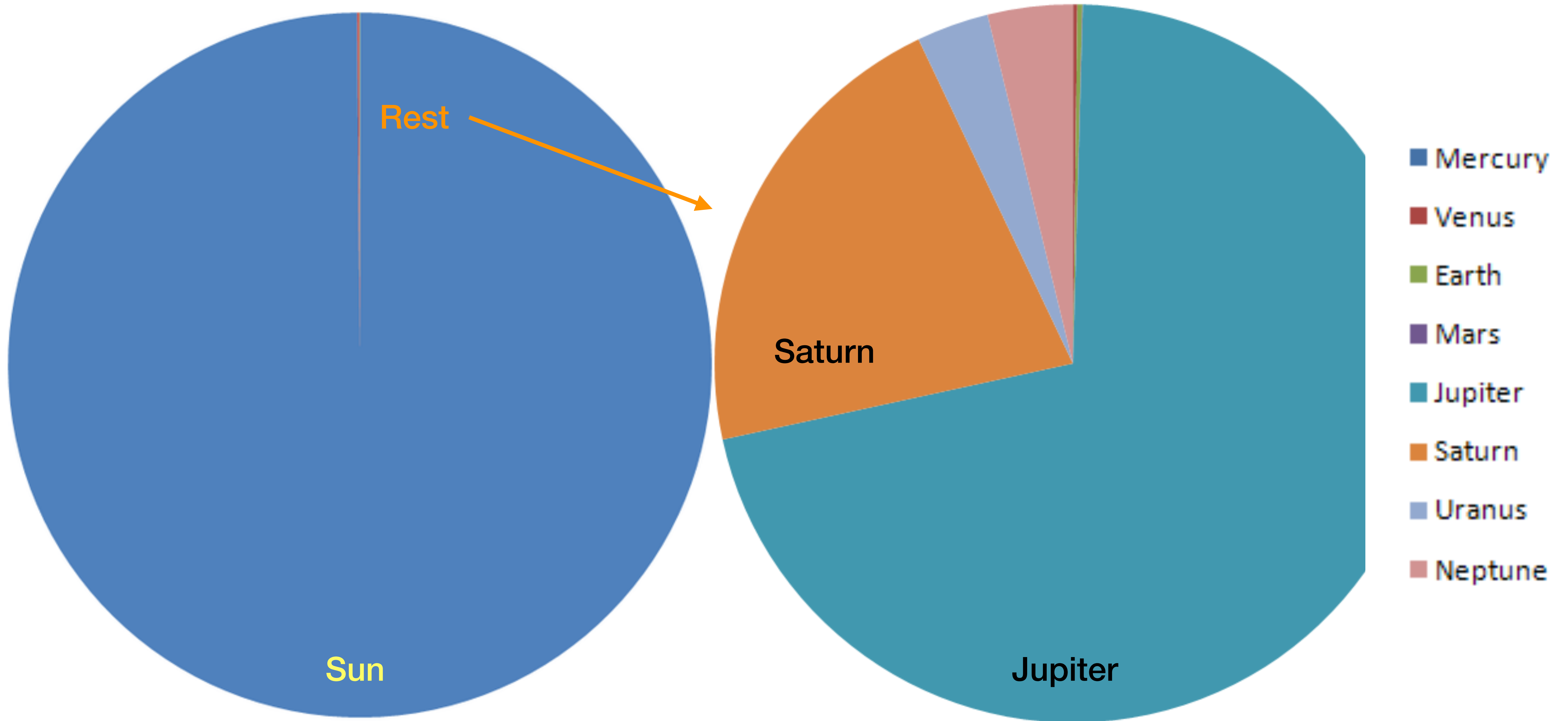
$$T_2 > T_1$$
$$I_\lambda(T_2) > I_\lambda(T_1)$$



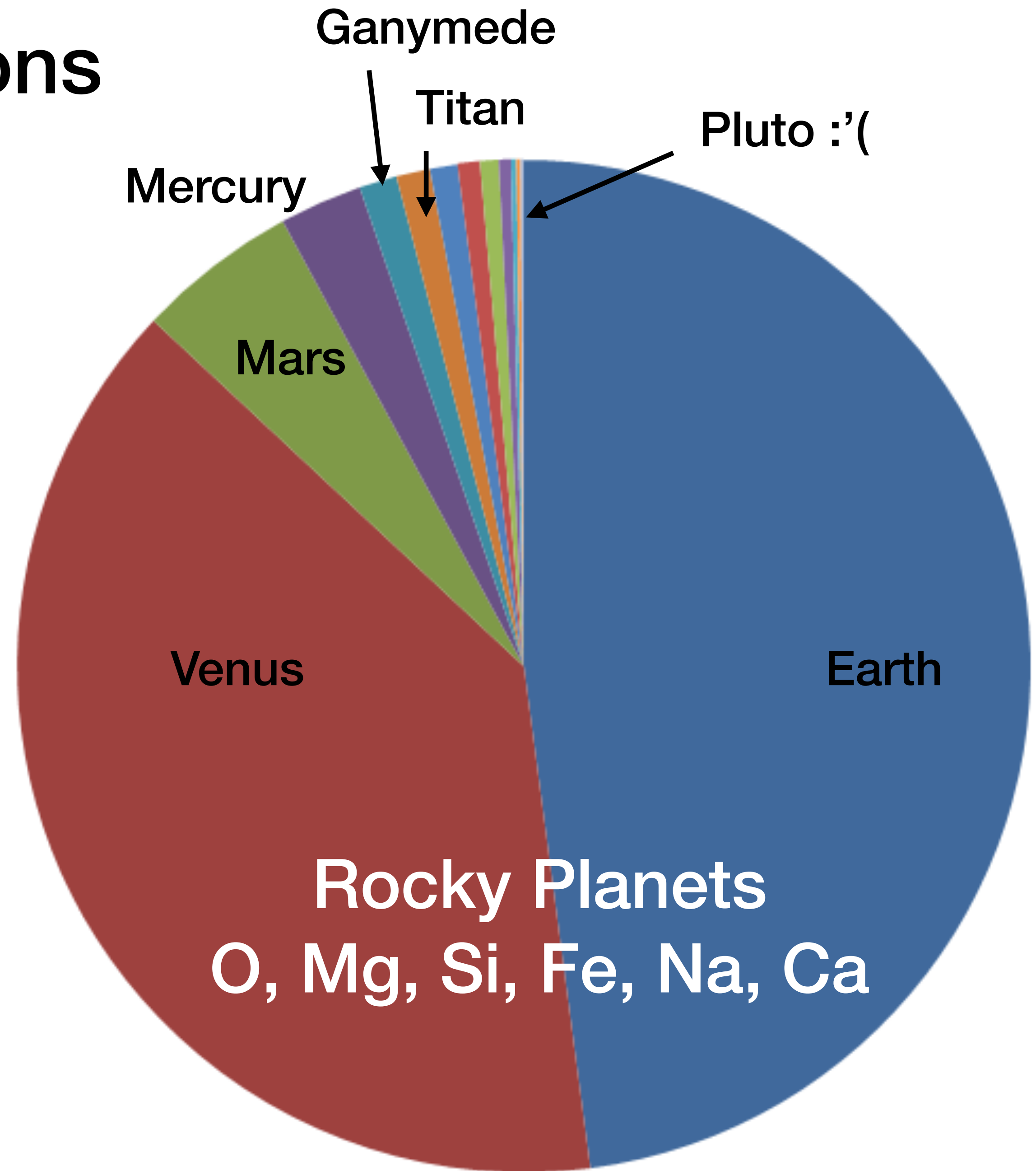
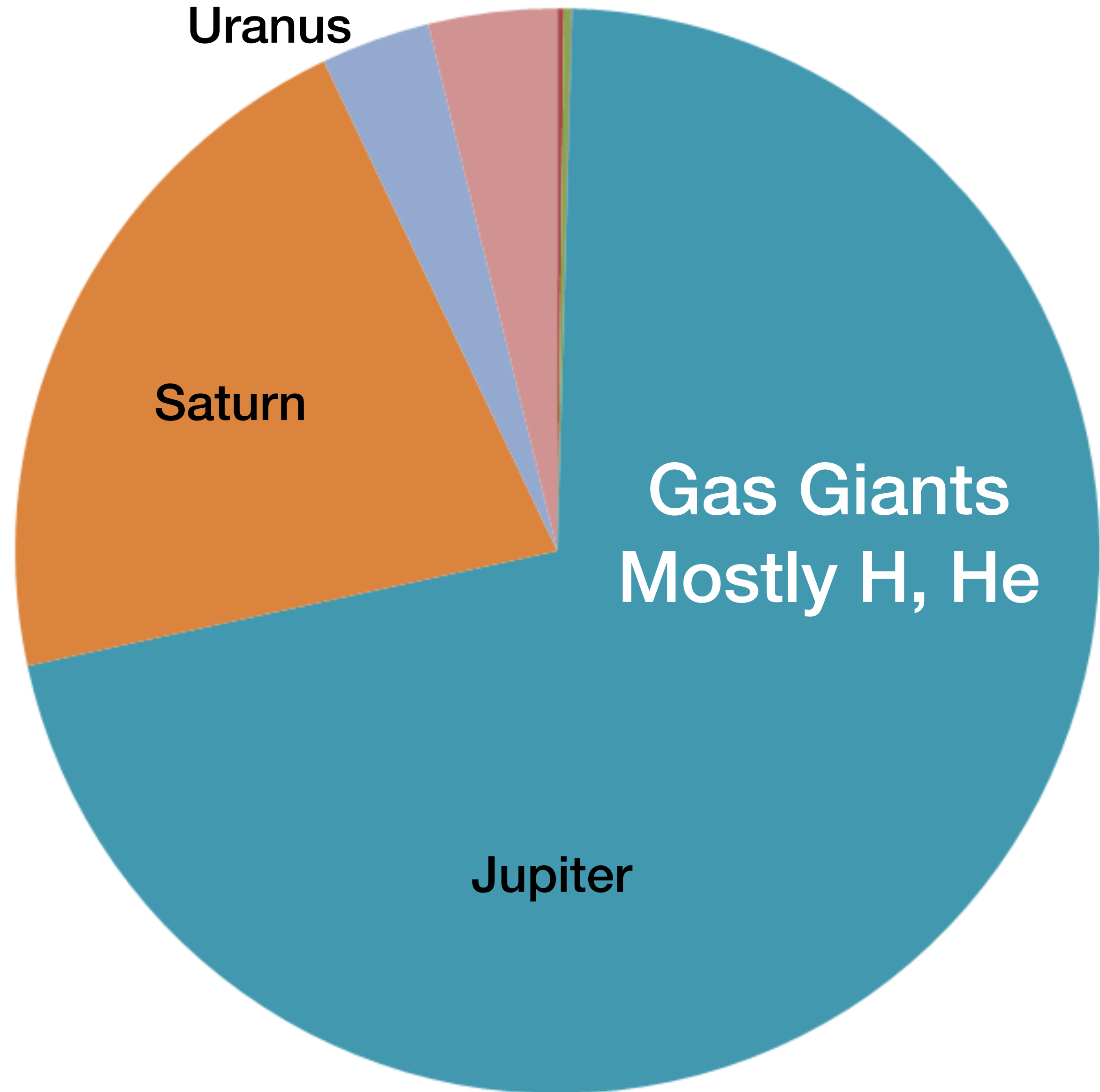
Corona: high T allows particles to reach v_{esc}



Mass Fractions

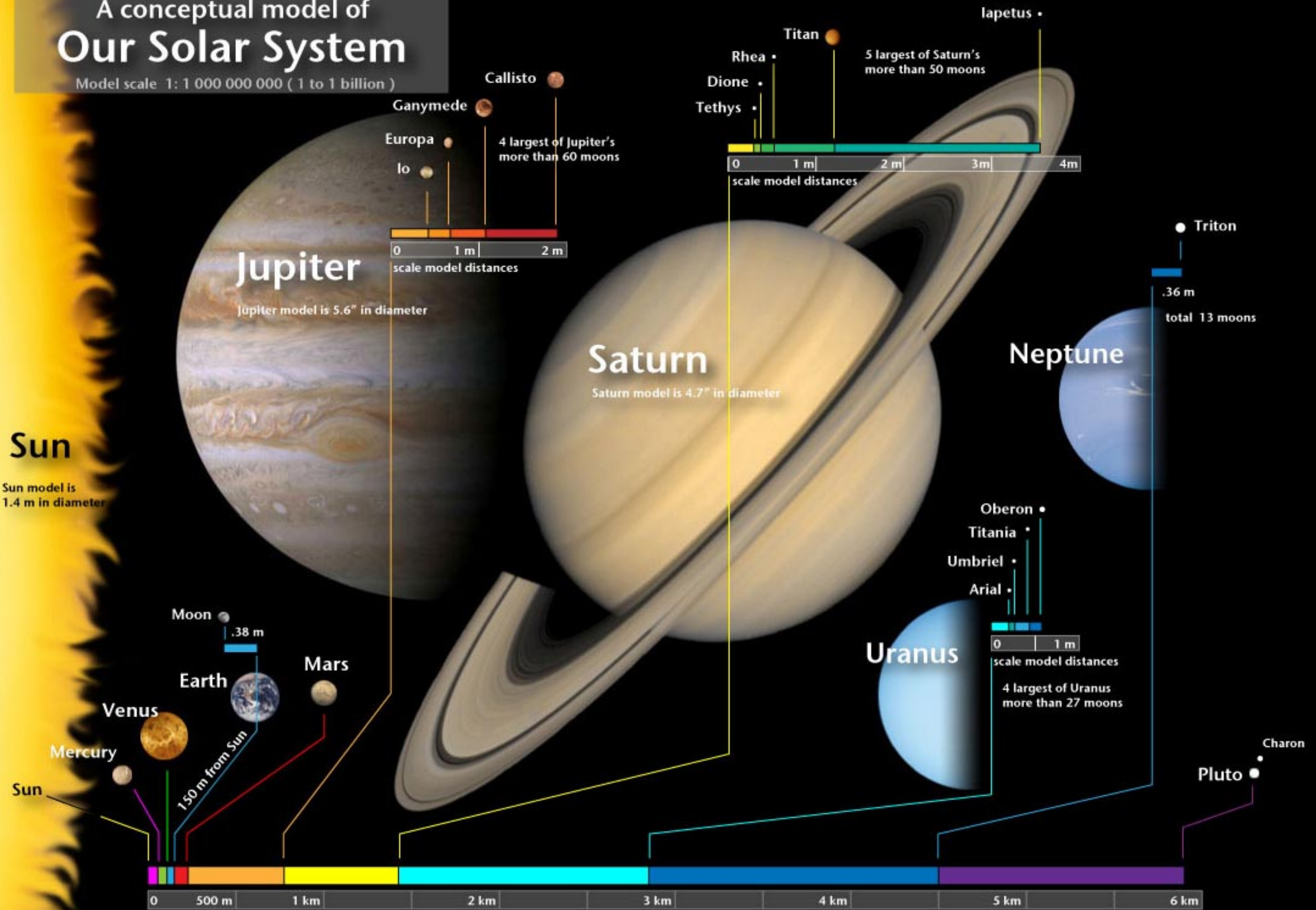


Mass Fractions



A conceptual model of Our Solar System

Model scale 1: 1 000 000 000 (1 to 1 billion)



Interplanetary distance scale. The orbit of model Pluto (just 2.3 mm across) averages almost 6 kilometers from the model Sun.

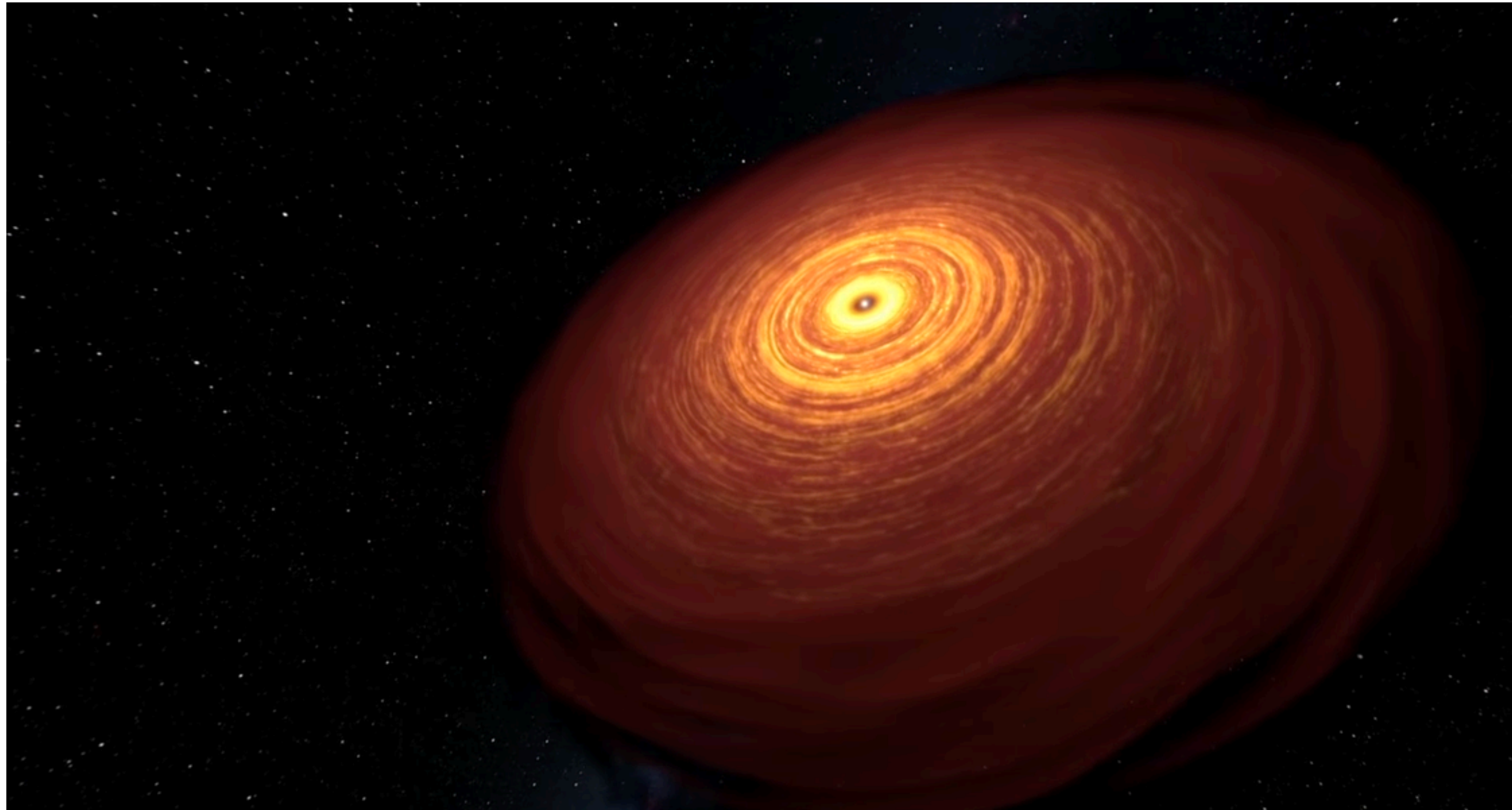
Oort Cloud
(origin of long-period comets)

Outer planets
& Kuiper belt

Inner planets
& asteroid belt

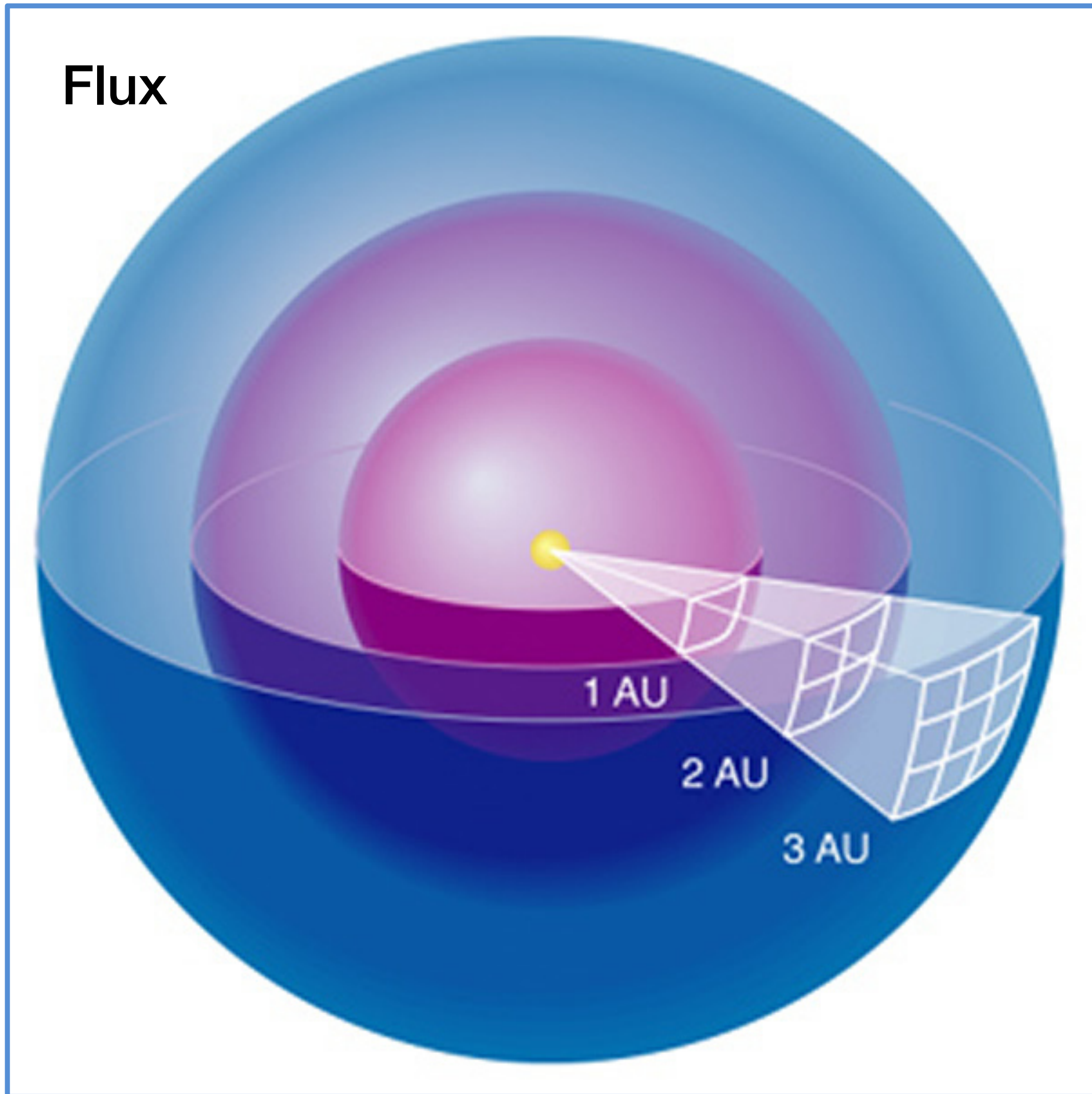


<https://www.youtube.com/watch?v=yXq1i3HlumA&feature=youtu.be>

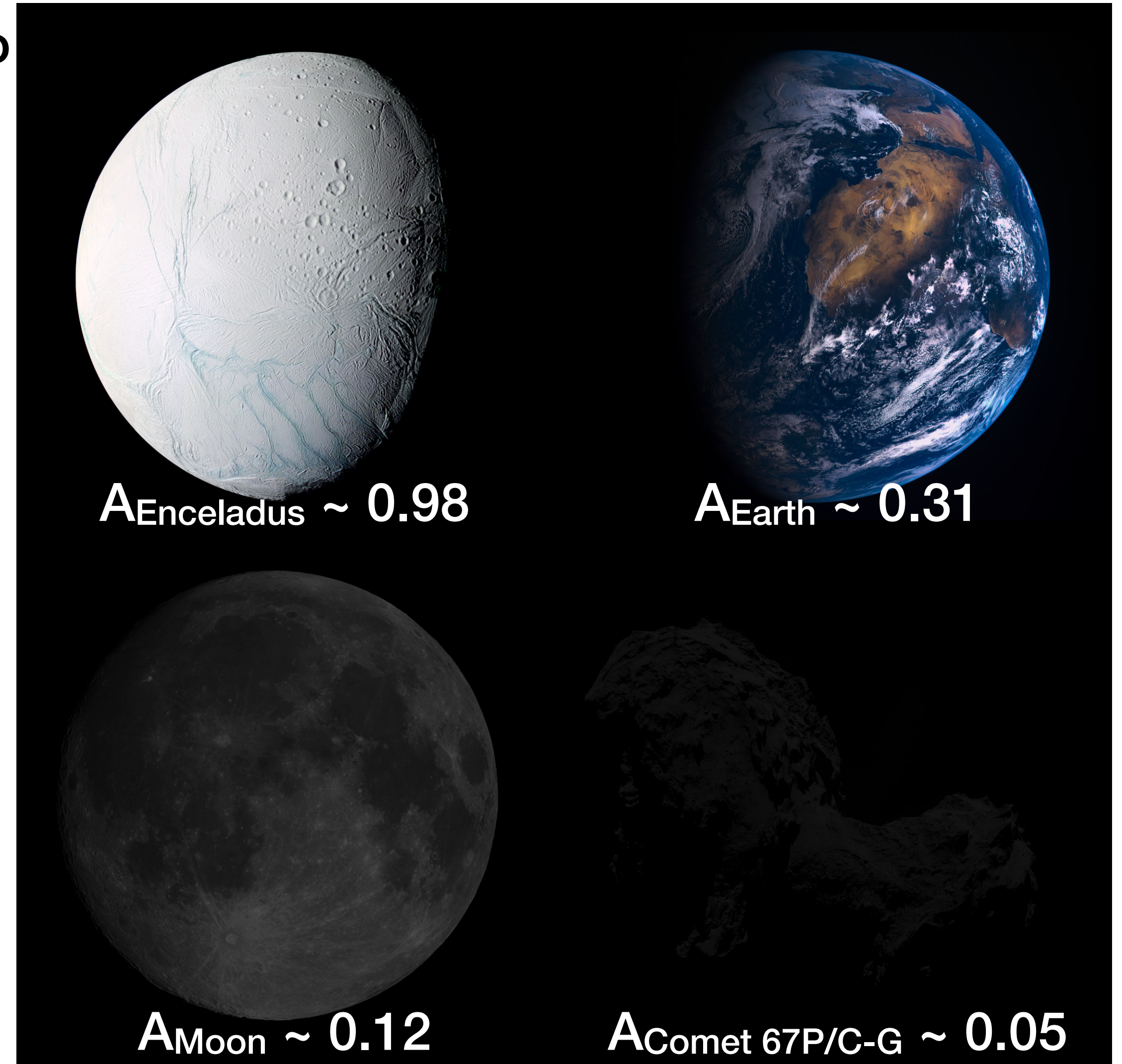


How do we learn about solar system objects?

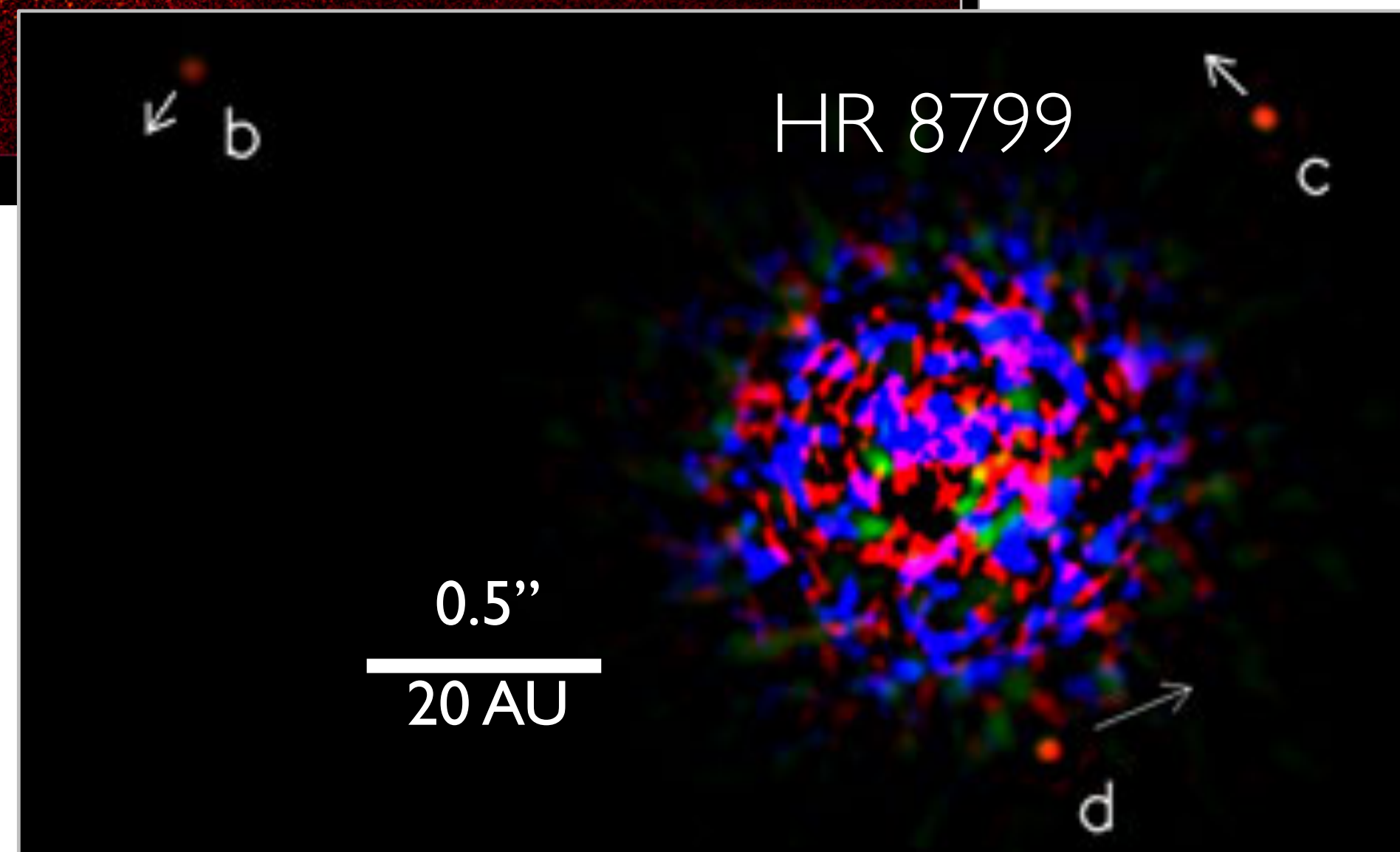
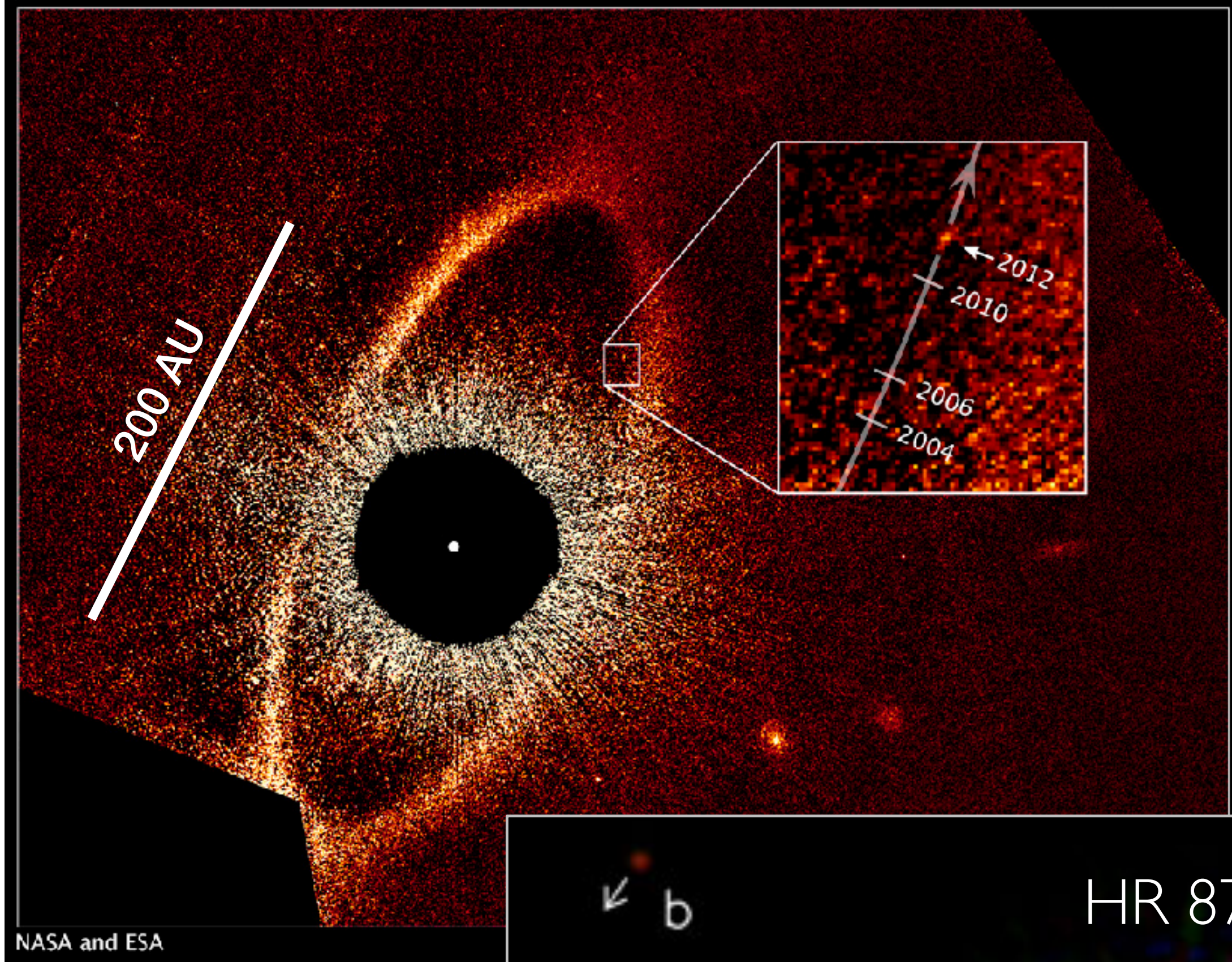
Flux



Albedo

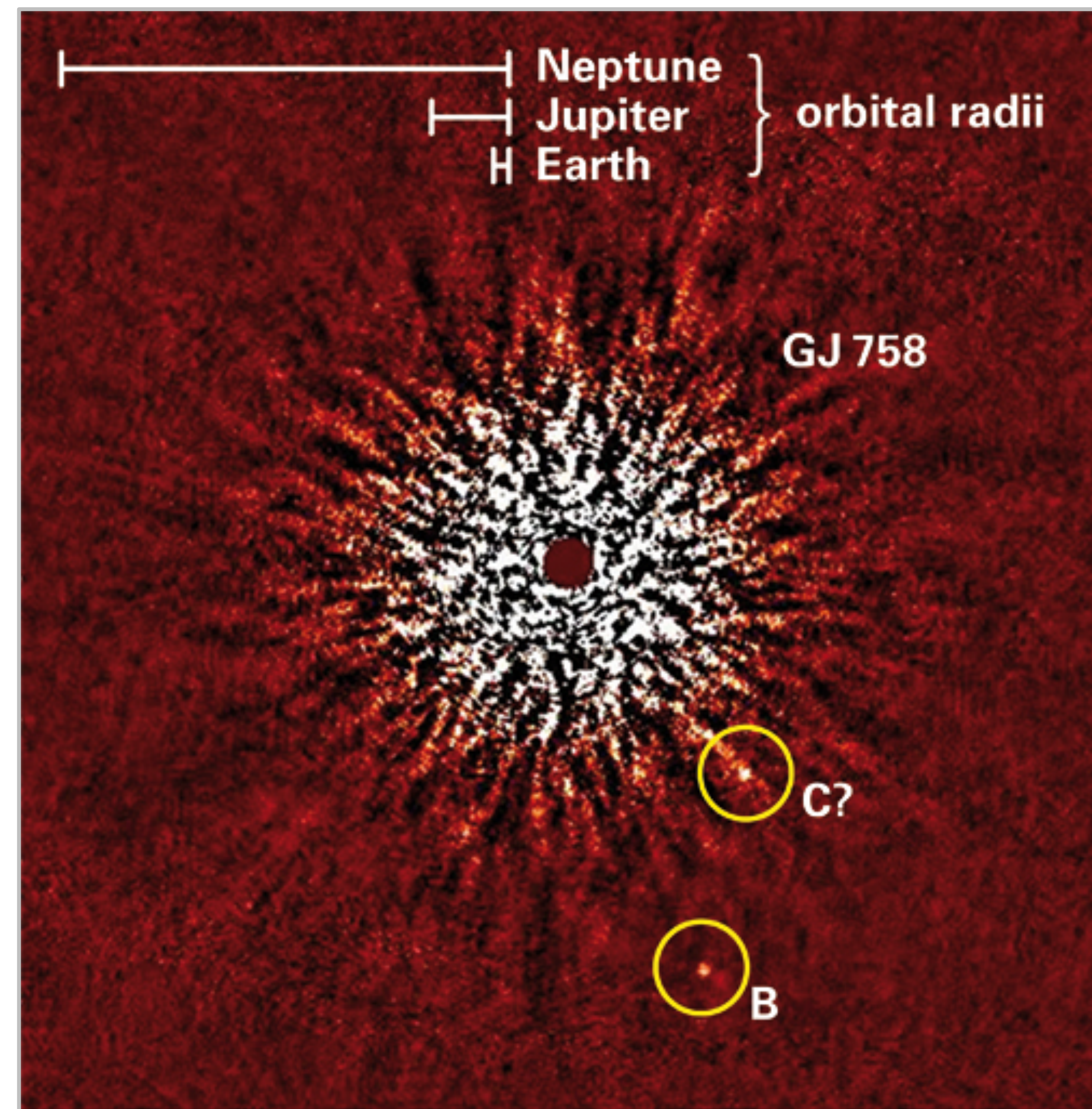


Whiteboard

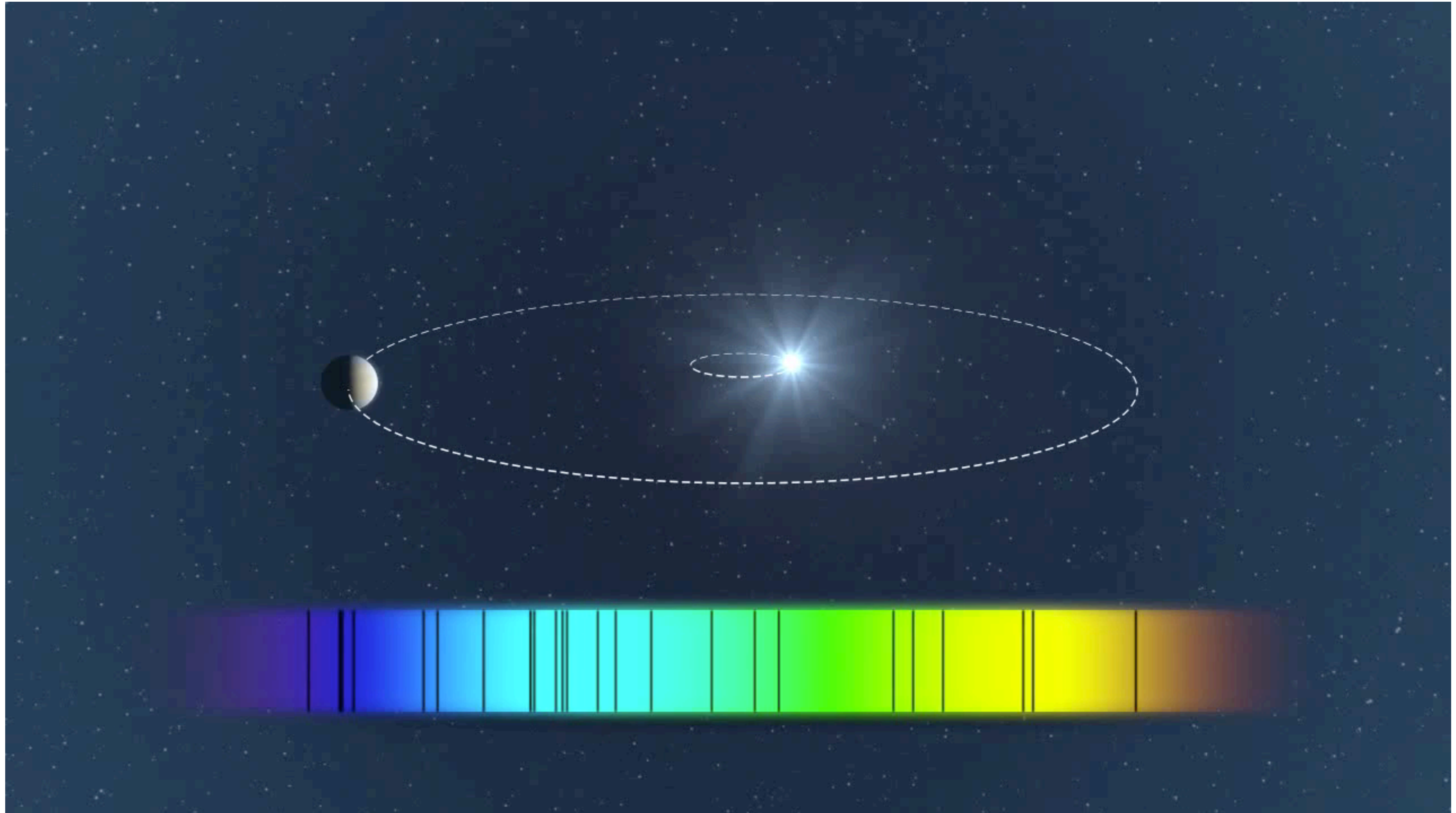


Direct Imaging

Planet millions of times fainter
Need to mask the starlight

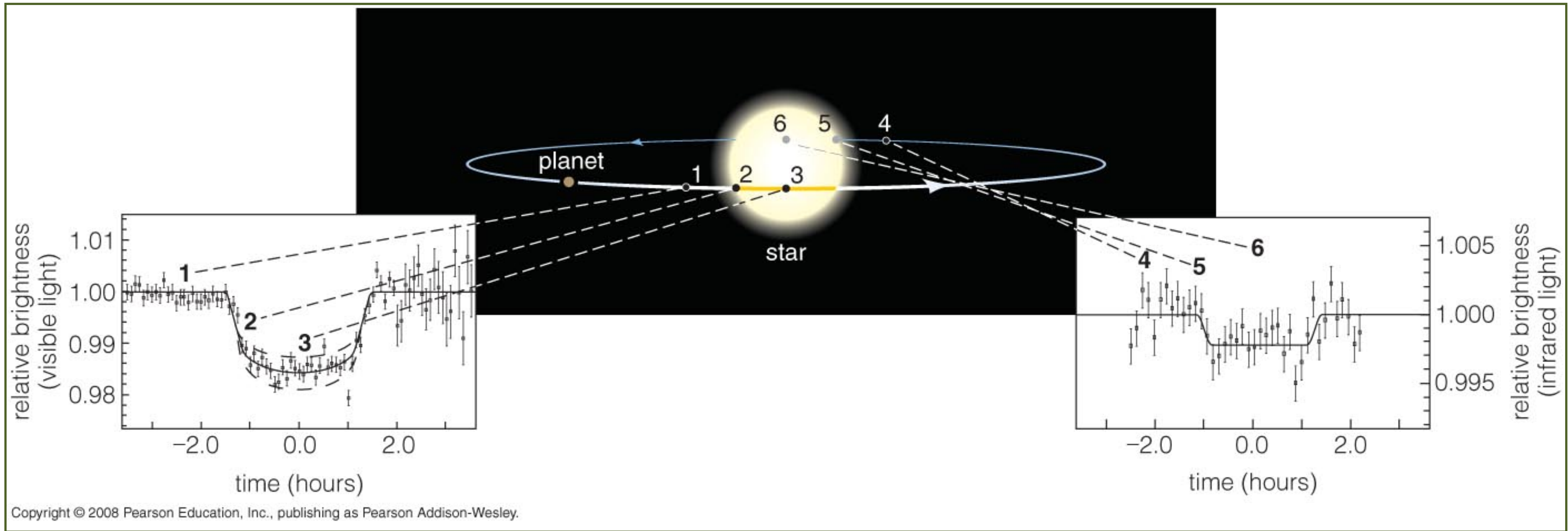


Can't see the planet, but can see the star

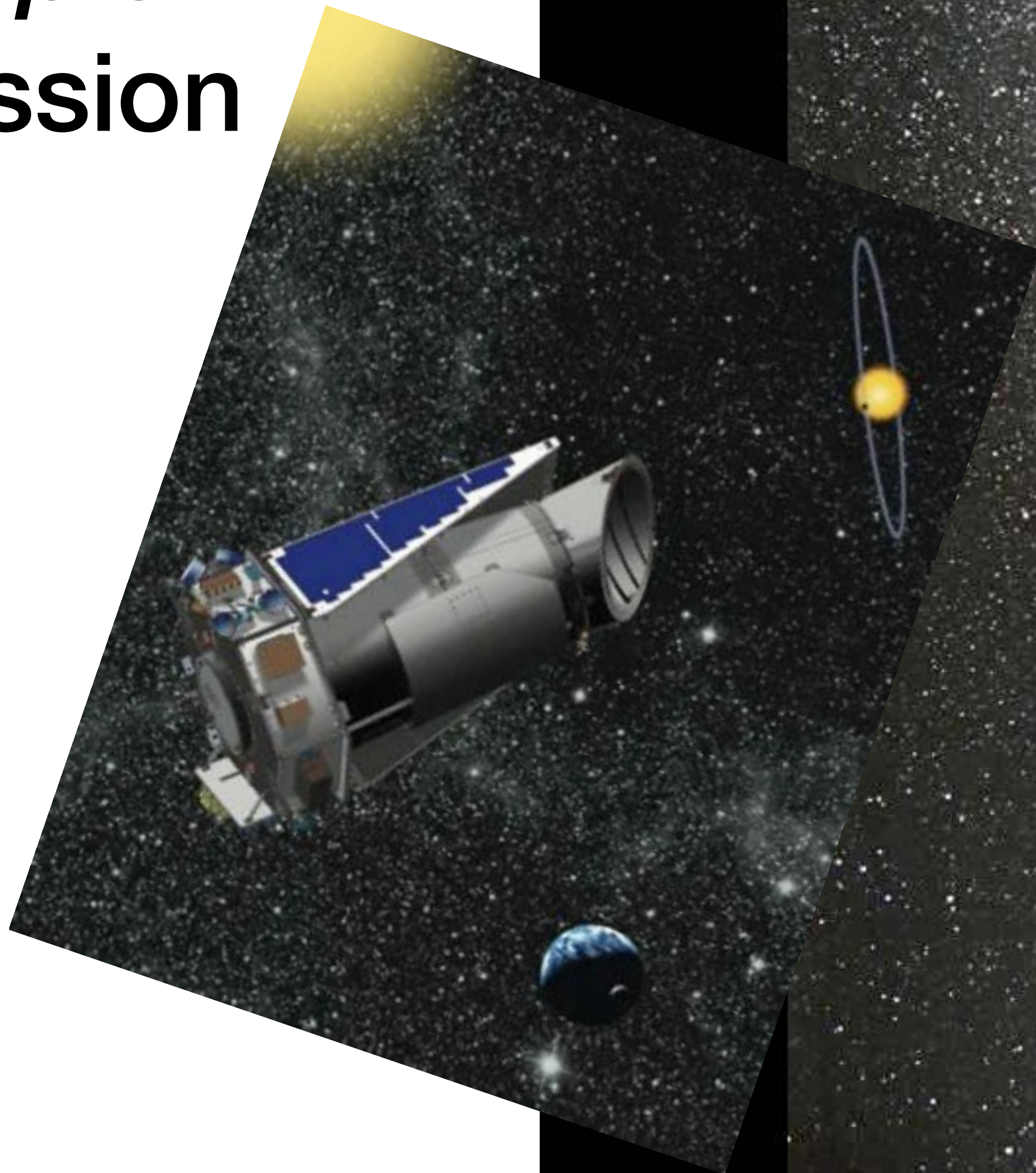


Transit Method

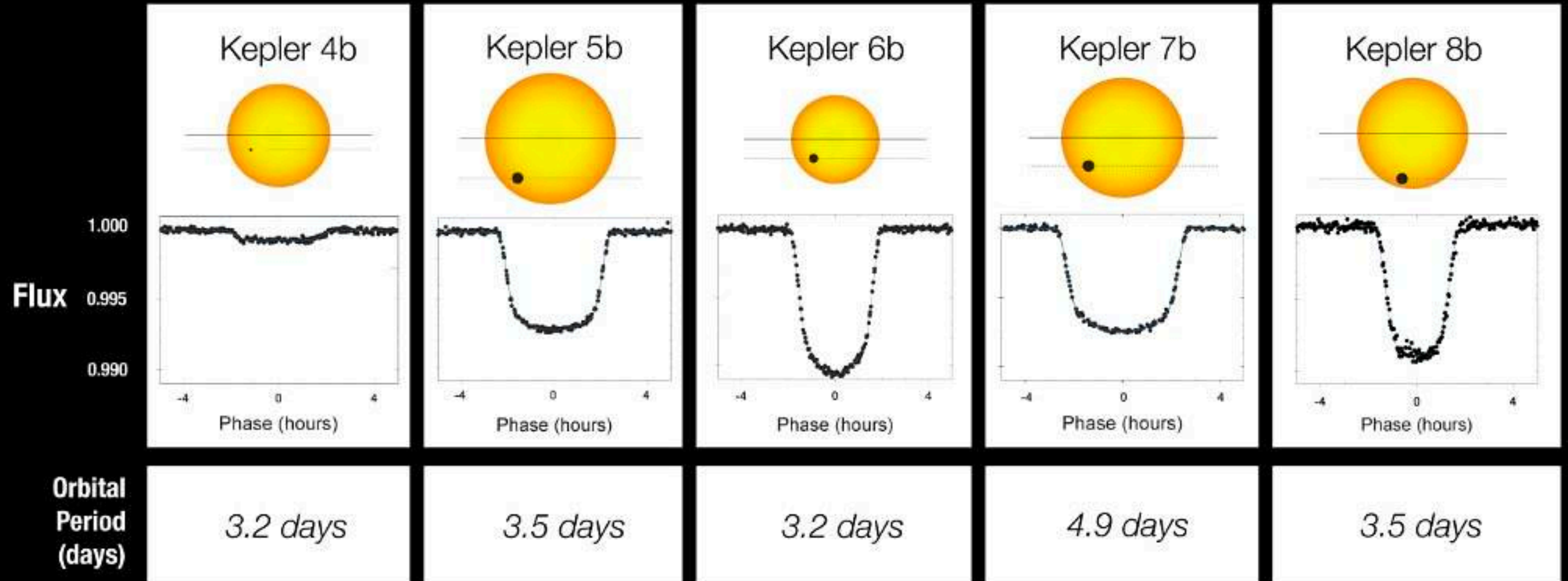
Starlight is blocked by the planet, reducing the amount of light detected from the star



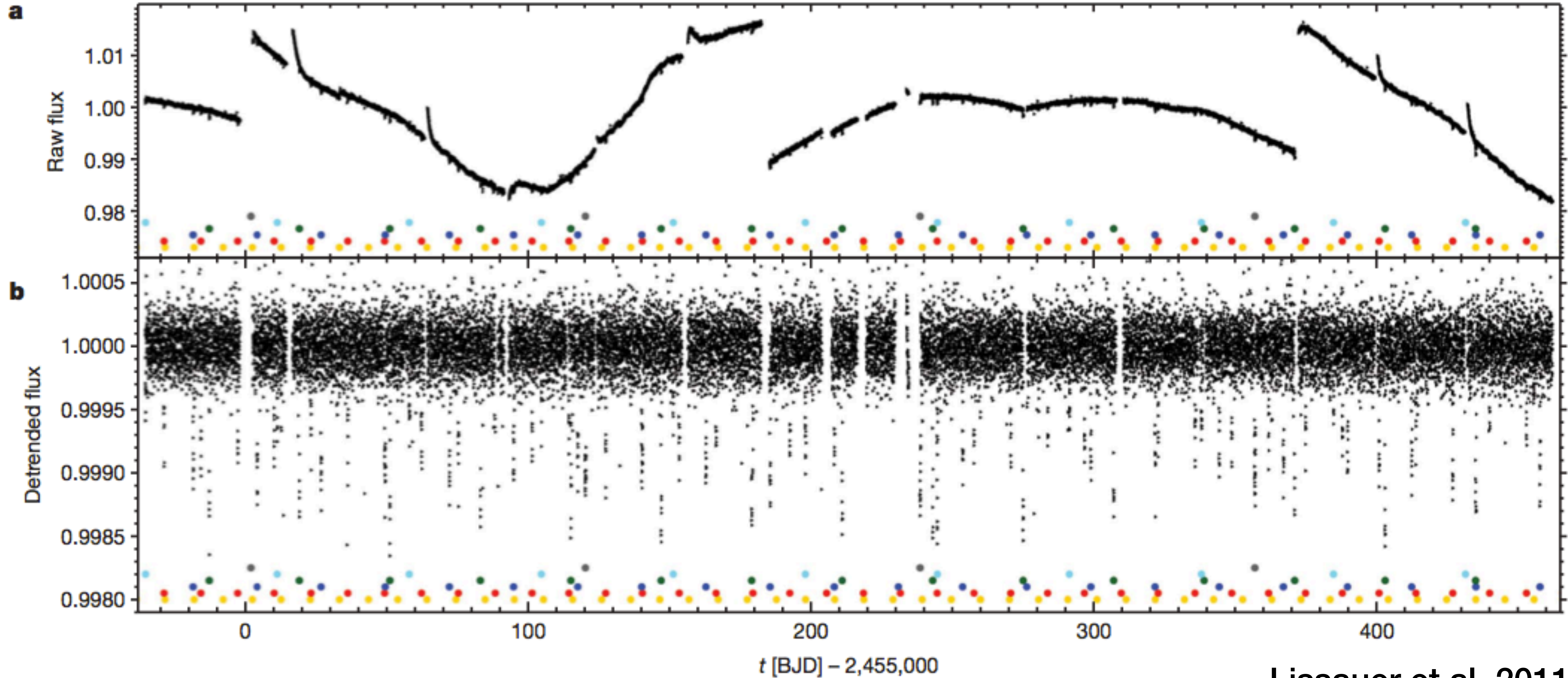
Kepler Mission



Transit Light Curves



Kepler-11 System (6 planets)



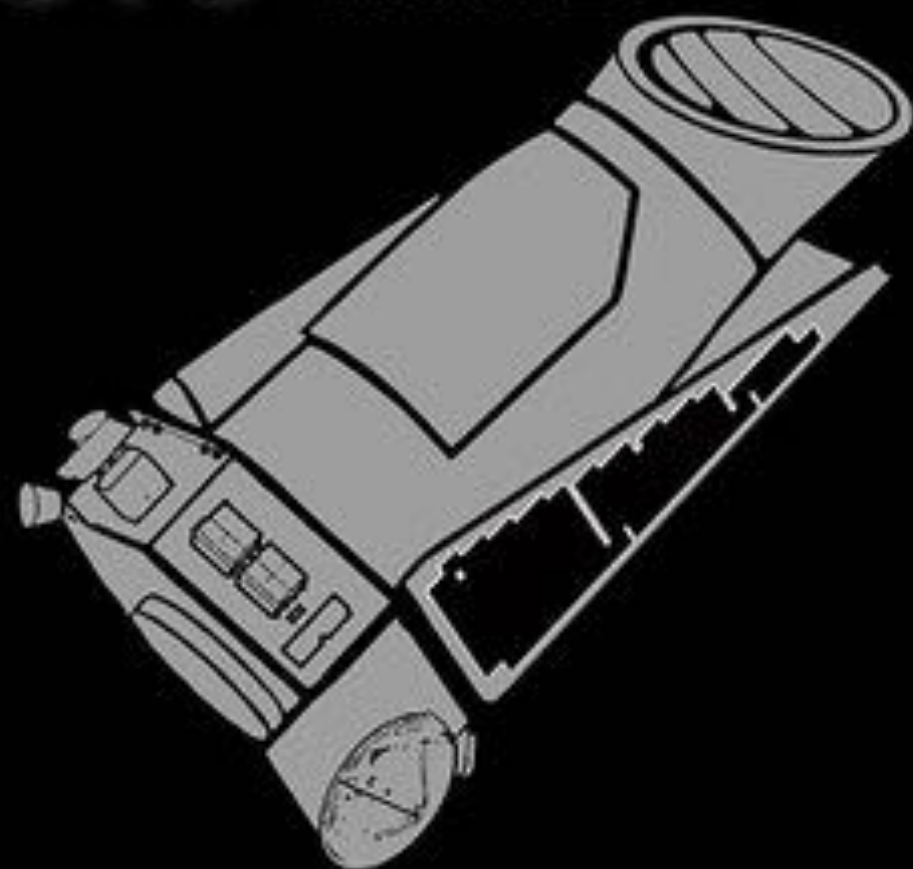
Lissauer et al. 2011

Kepler

BY THE NUMBERS



9.6 YEARS IN SPACE



530,506
STARS OBSERVED

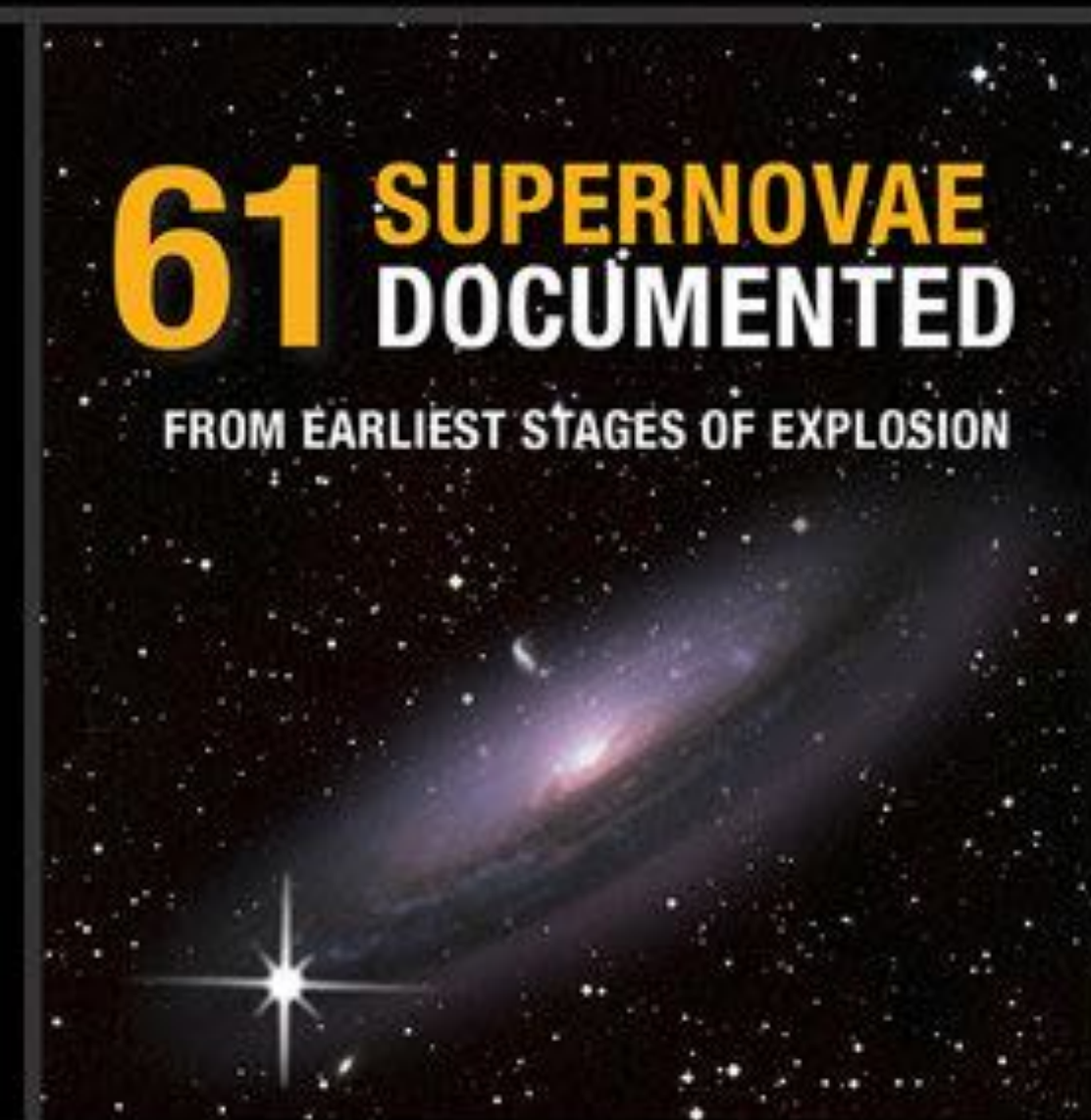


2,662
PLANETS CONFIRMED



61 SUPERNOVAE DOCUMENTED

FROM EARLIEST STAGES OF EXPLOSION



2 MISSIONS COMPLETED

678  SCIENCE DATA COLLECTED

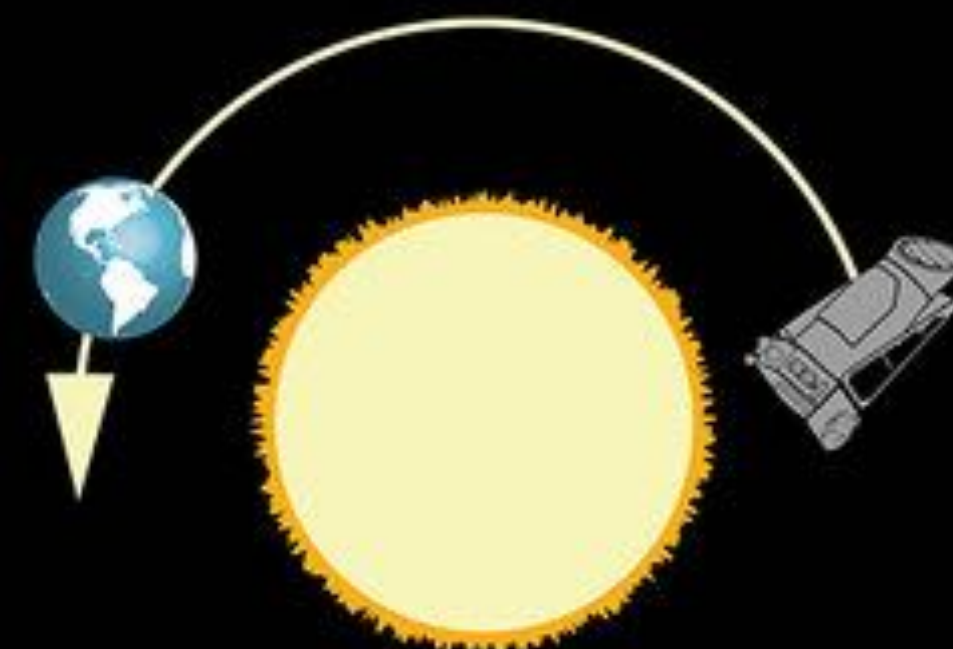
2,946 SCIENTIFIC PAPERS PUBLISHED

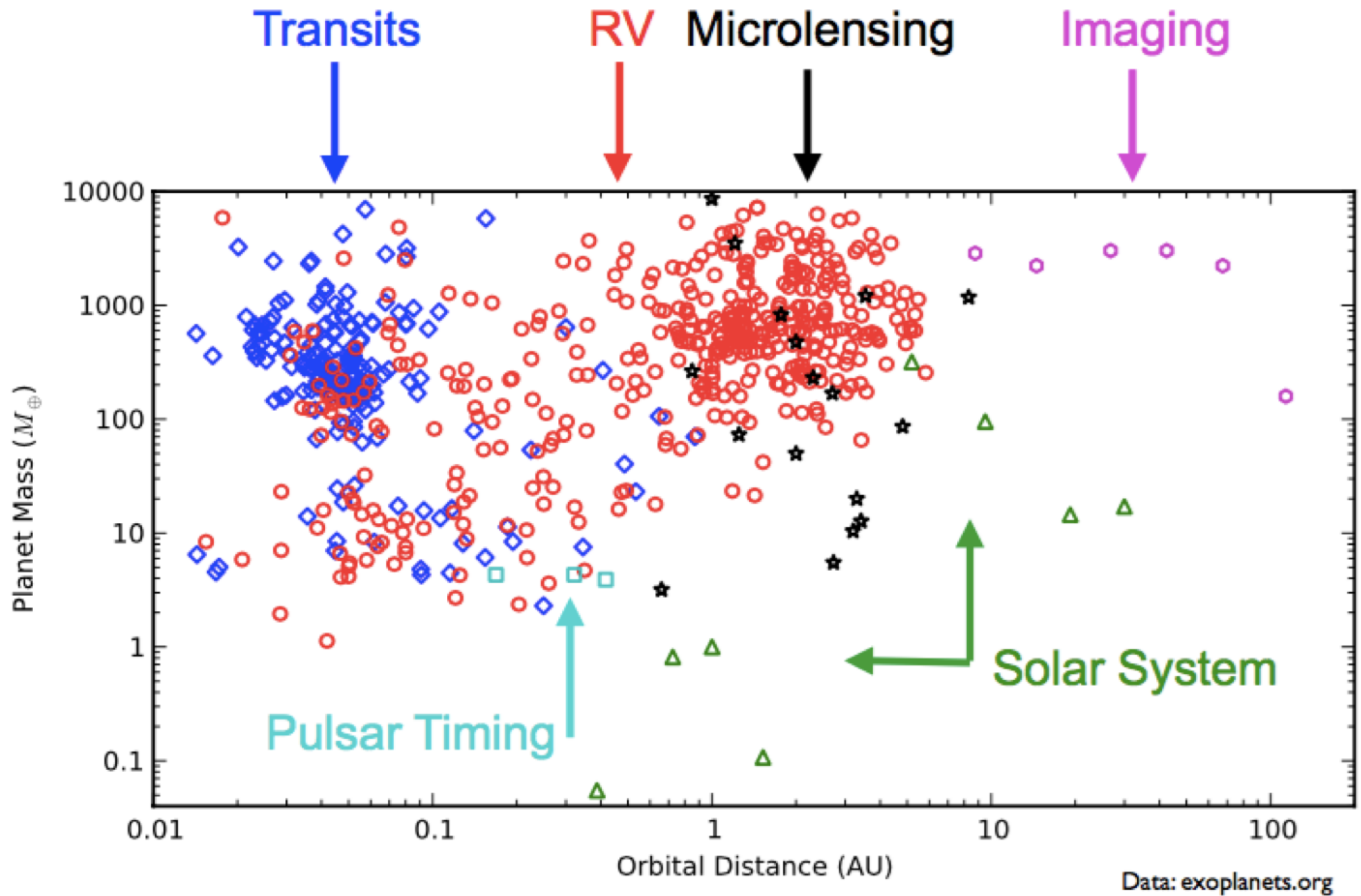
94 MILLION MILES AWAY

3.12 GALLONS FUEL USED



732,128
COMMANDS EXECUTED





What do we know about planets in general?

- Planets are more numerous in the Galaxy than stars!
- Smaller, rocky planets are common (20-50% of stars should have at least 1)
- Solar system is a little weird
 - Most common planet is b/t Earth and Neptune in mass
 - Many systems are more compact than the solar system
- 4277 confirmed planets (as of Saturday)
 - 72% by Transit method
 - 19% by RV method
 - 2% by microlensing
 - 1% by direct imaging

exoplanets.nasa.gov

