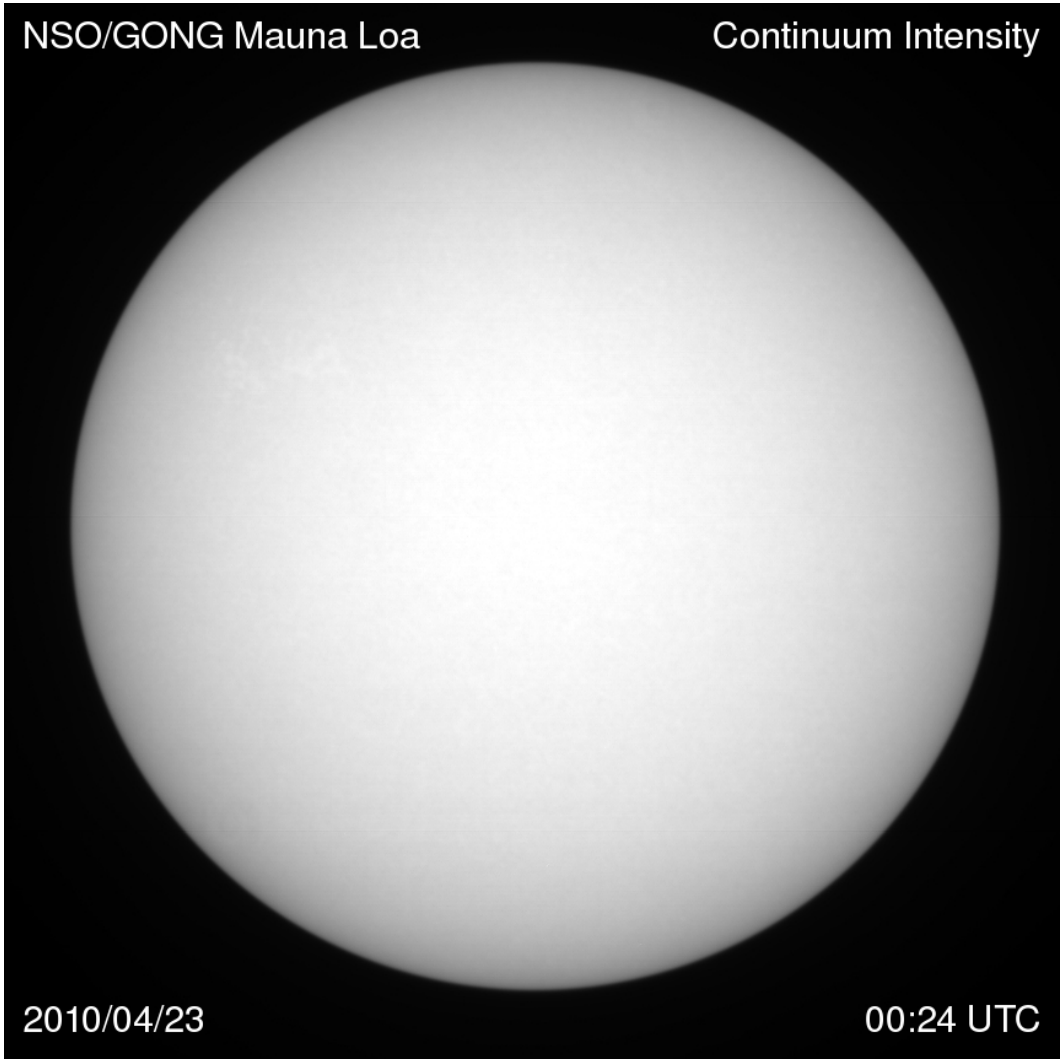
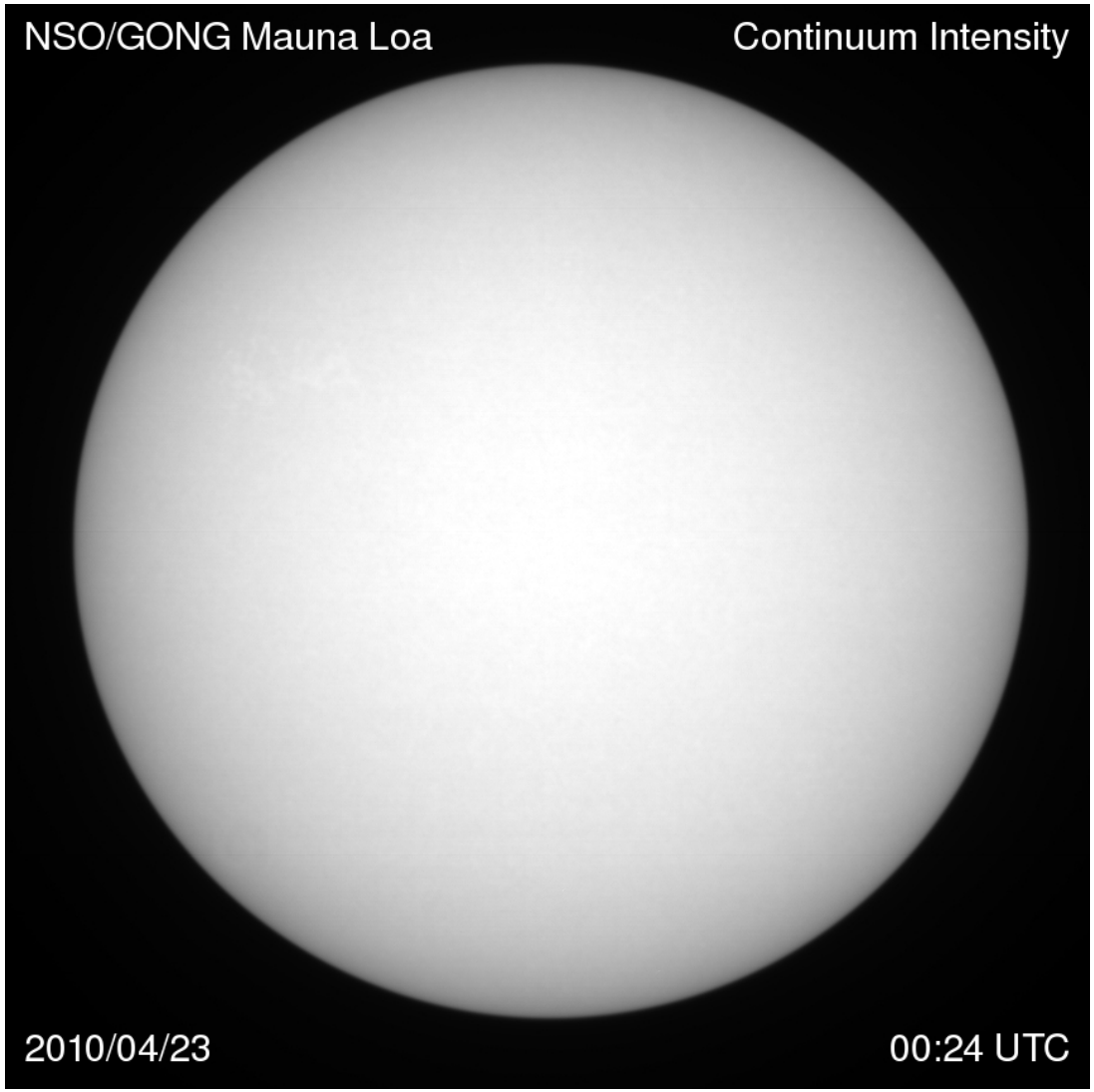
The Sun….center of the solar system

Before discussing other objects in the **solar system** let's discuss the Sun



Let's think through how we determine some of the basic properties of the Sun



How far away is the Sun?

By this time in the semester,
you had better know!

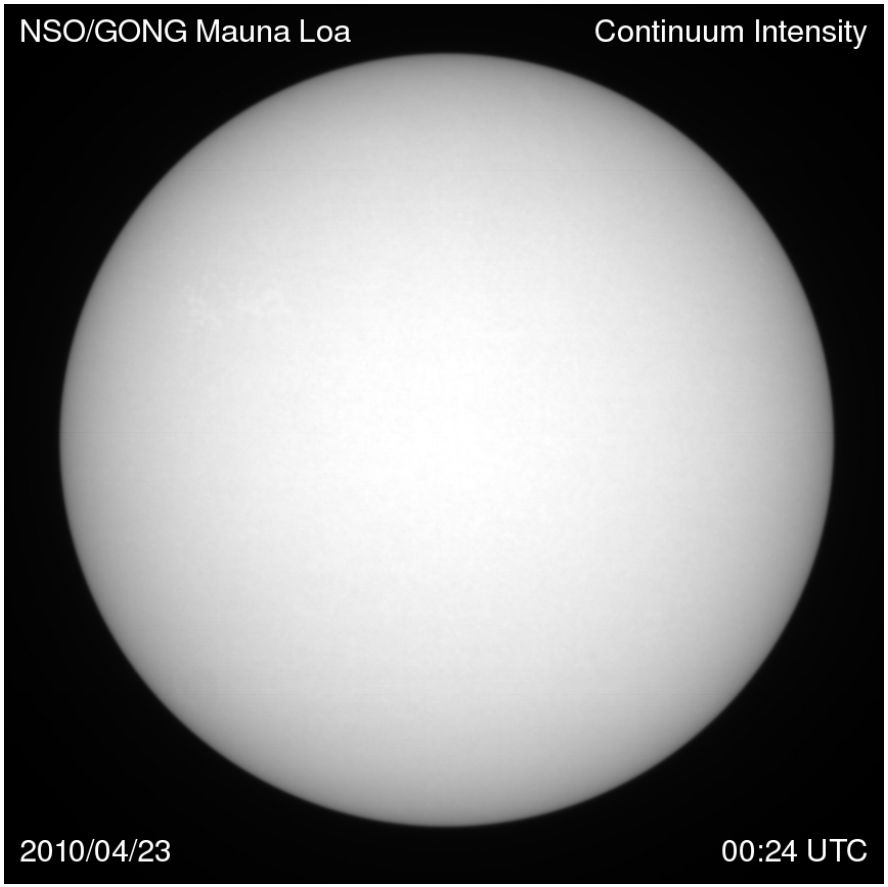
A threat!

How could we figure out the radius/ diameter of the Sun?

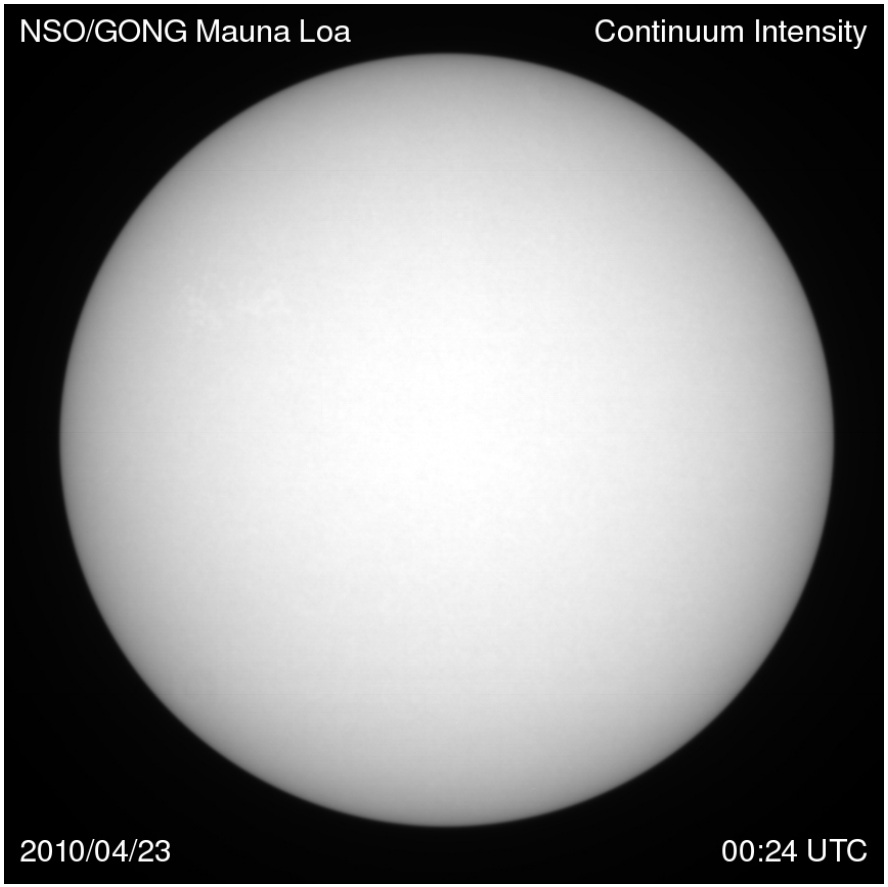
How could we figure out the radius/ diameter of the Sun?

Answer: 696,000 km

How could we determine the mass of the Sun?



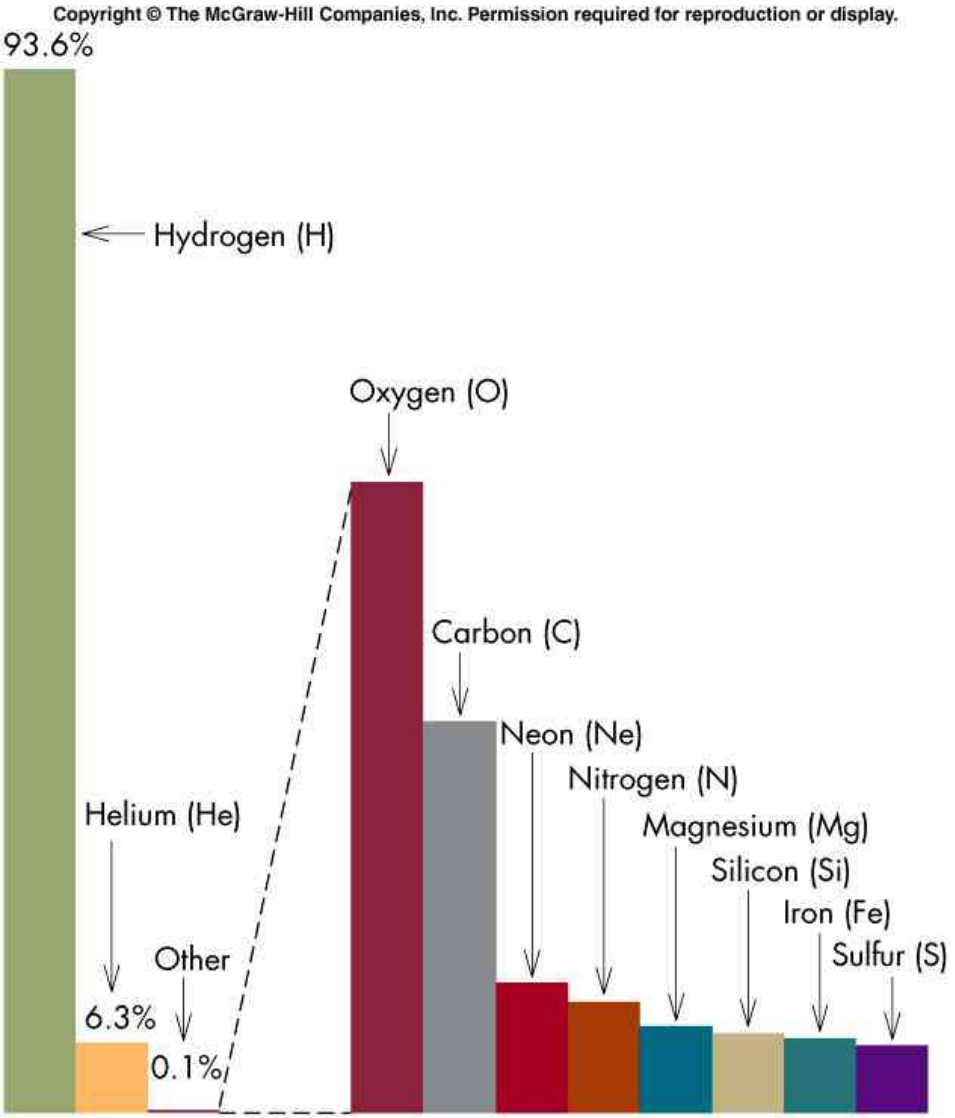
How could we determine the mass of the Sun?



Answer: 1.989E30 kg

What is the Sun made of?

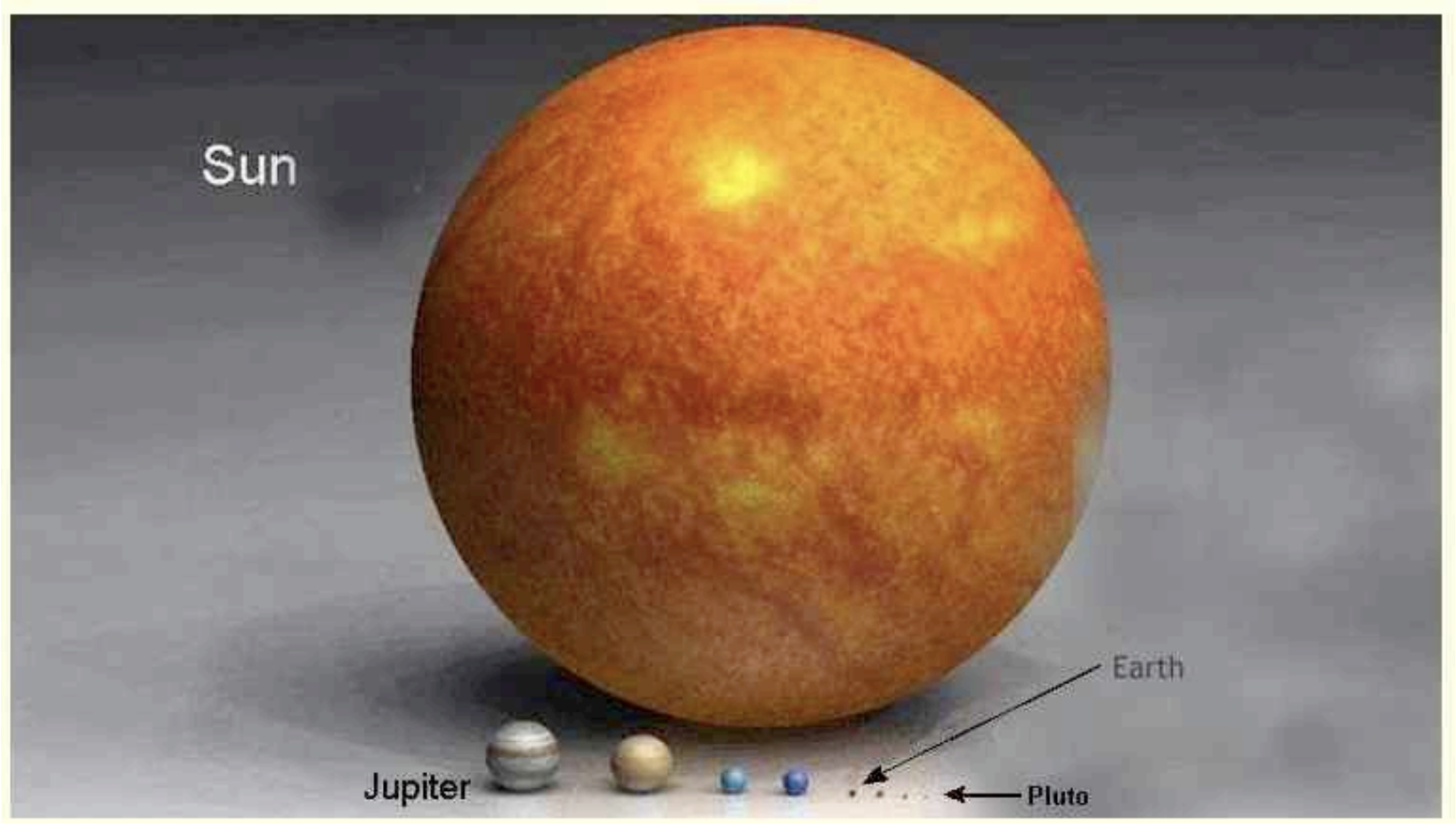
The stuff of the universe



Let's see how the Sun "stacks up" against some of the objects we have talked about

Object	Radius (km)	Mass (kg)
Earth	6378	5.97E24
Moon	1738	7.35E22
Mars	3394	6.39E23
Jupiter	71490	1.90E27
Sun	696,000	1.99E30

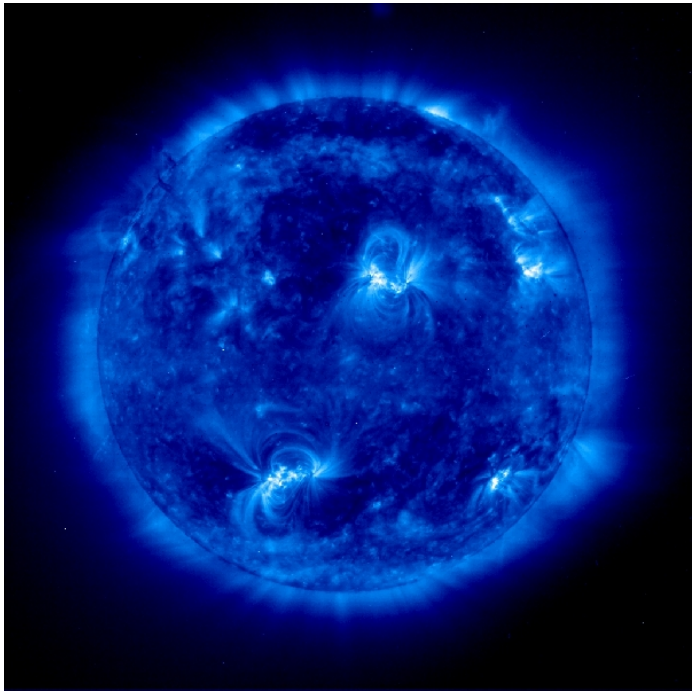
The Sun is in an entirely different class of objects than the planets…it is a star



One emphasizes (somewhat) different aspects of the Sun in a solar system astronomy class

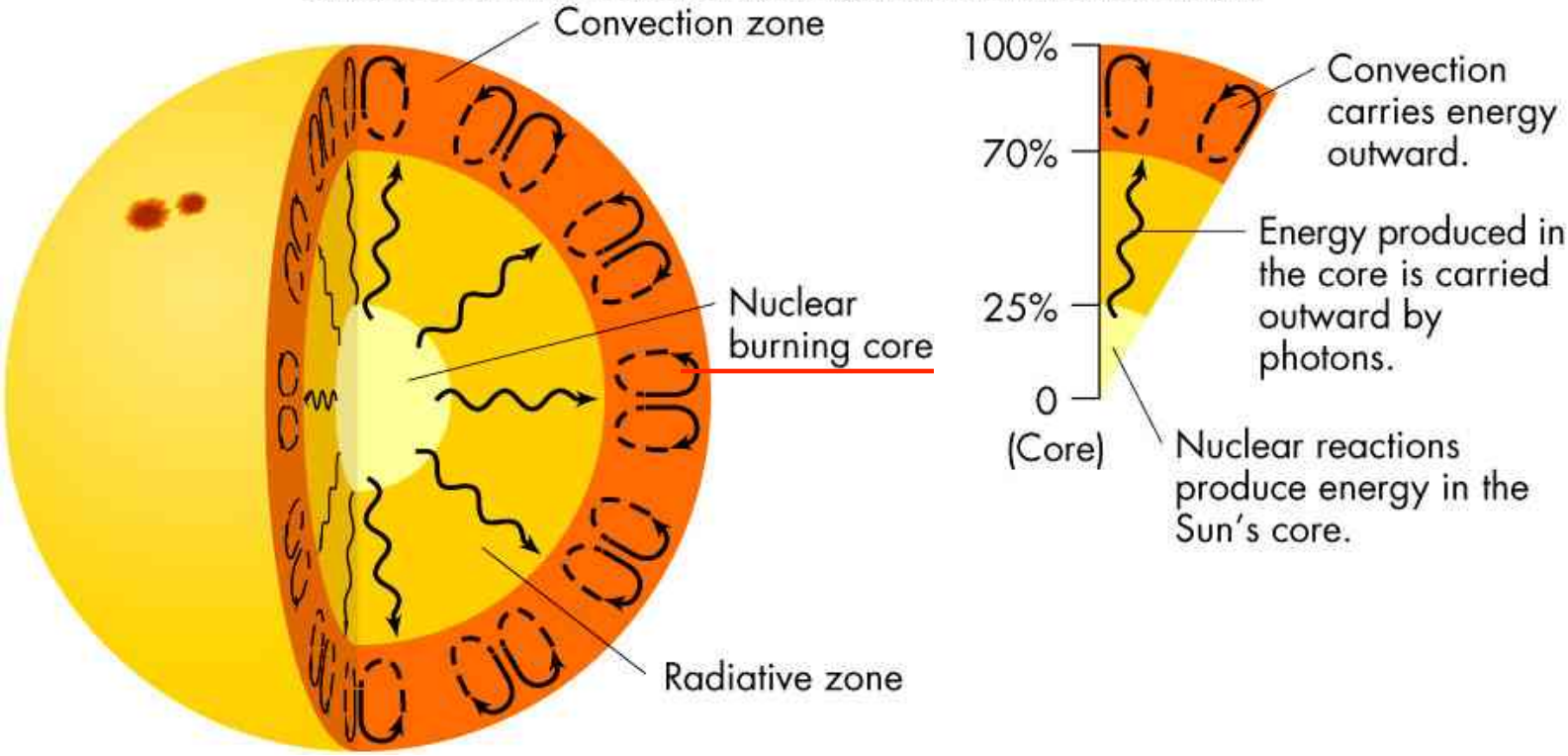
Reign of Akhenaten and Nefertiti (~1350 BCE)

Point to make: when observed in the light of ultraviolet lines, the Sun is not a constant, static object



SOHO watches the ultraviolet Sun rotate

Why does the Sun shine?

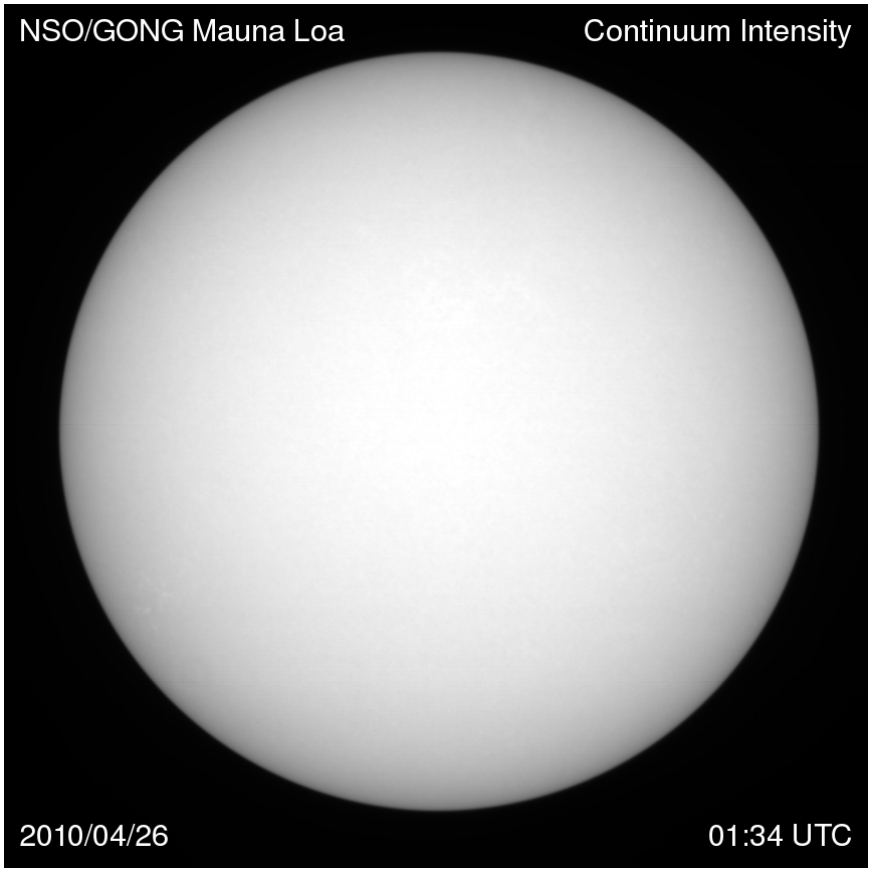


Luminosity (or power output) of 3.85E26 Watts

Because the Sun is the type of star it is…

- It produces the “right luminosity” for us (3.85E26 Watts)
- This luminosity is believed to have been stable for the last several billion years
- It shines at this luminosity long enough for us to arrive on the scene and enjoy it

Let's begin exploring the Sun as a solar system object

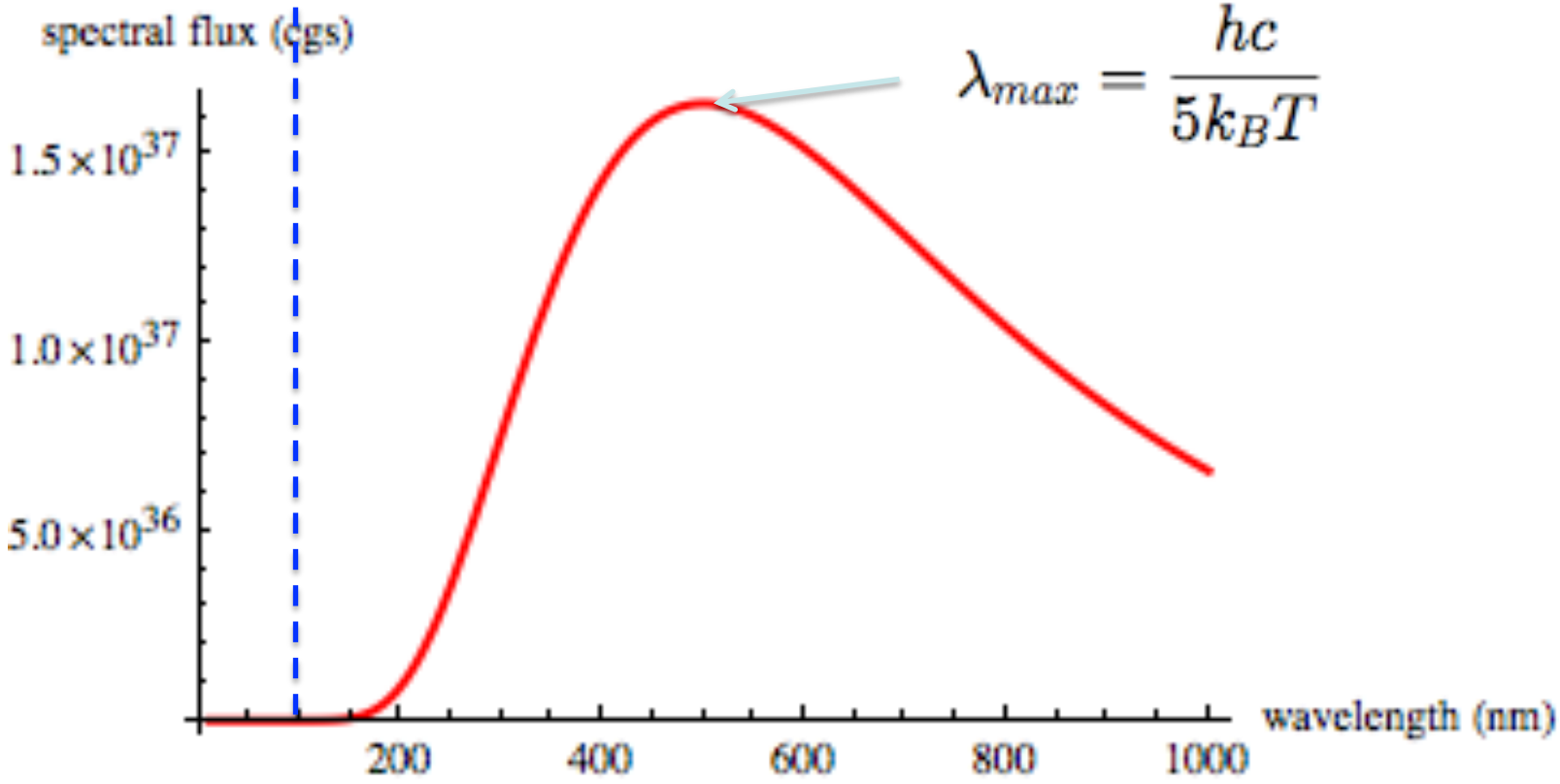


What we see as the disk of the Sun is a layer in its atmosphere called the **photosphere**

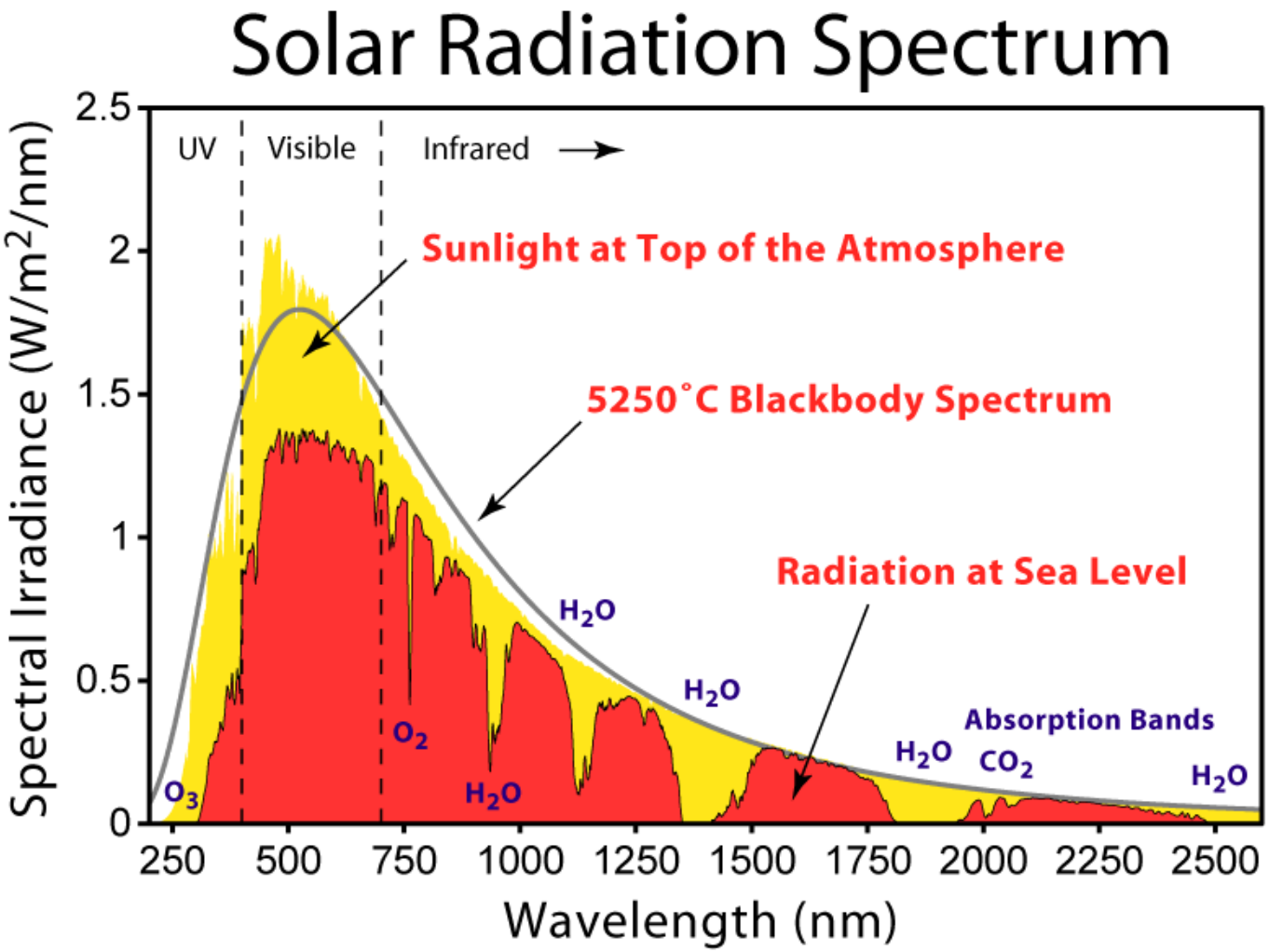
The Sun is a beautiful illustration of Wien's Law

The solar spectrum is a good match (although not perfect) to a blackbody spectrum

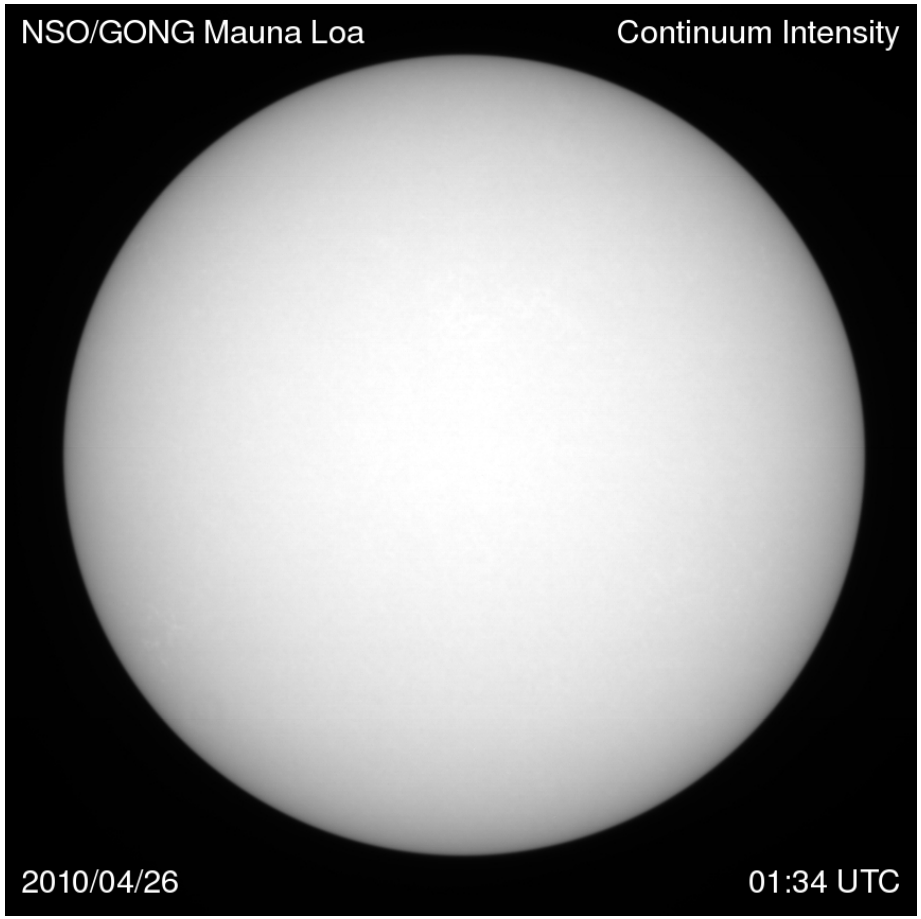
What are the conditions in the solar atmosphere? Compare solar spectrum with Planck function



What are the conditions in the solar atmosphere?



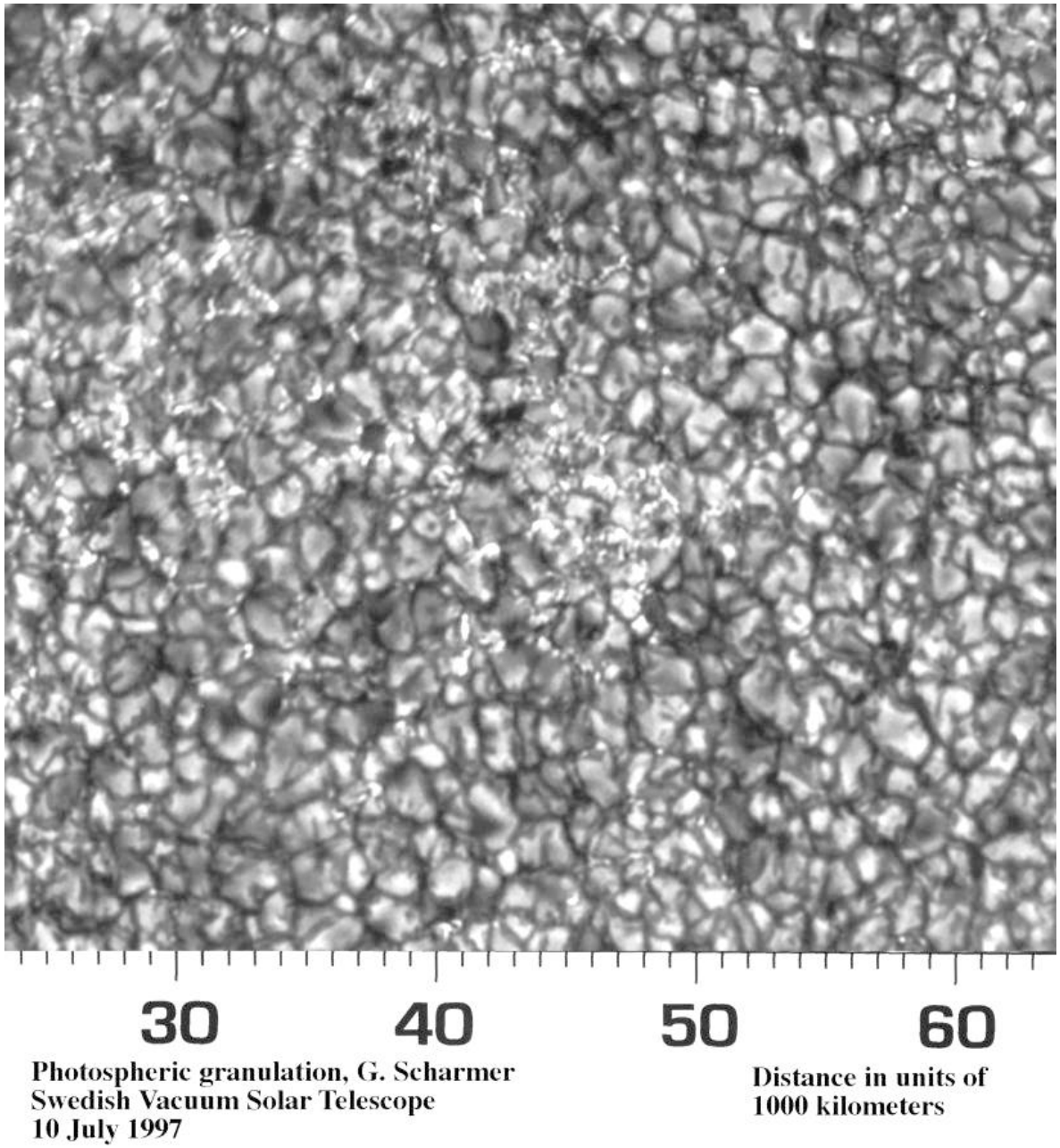
Let's take a closer look at the solar photosphere…it isn't as featureless as it seems



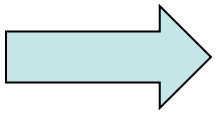
It is particularly interesting if you look in the light of the hydrogen alpha line (656 nanometers)

Granules in the Solar Atmosphere

Granules are convection cells; the outer layer of the Sun is carrying heat by "boiling"

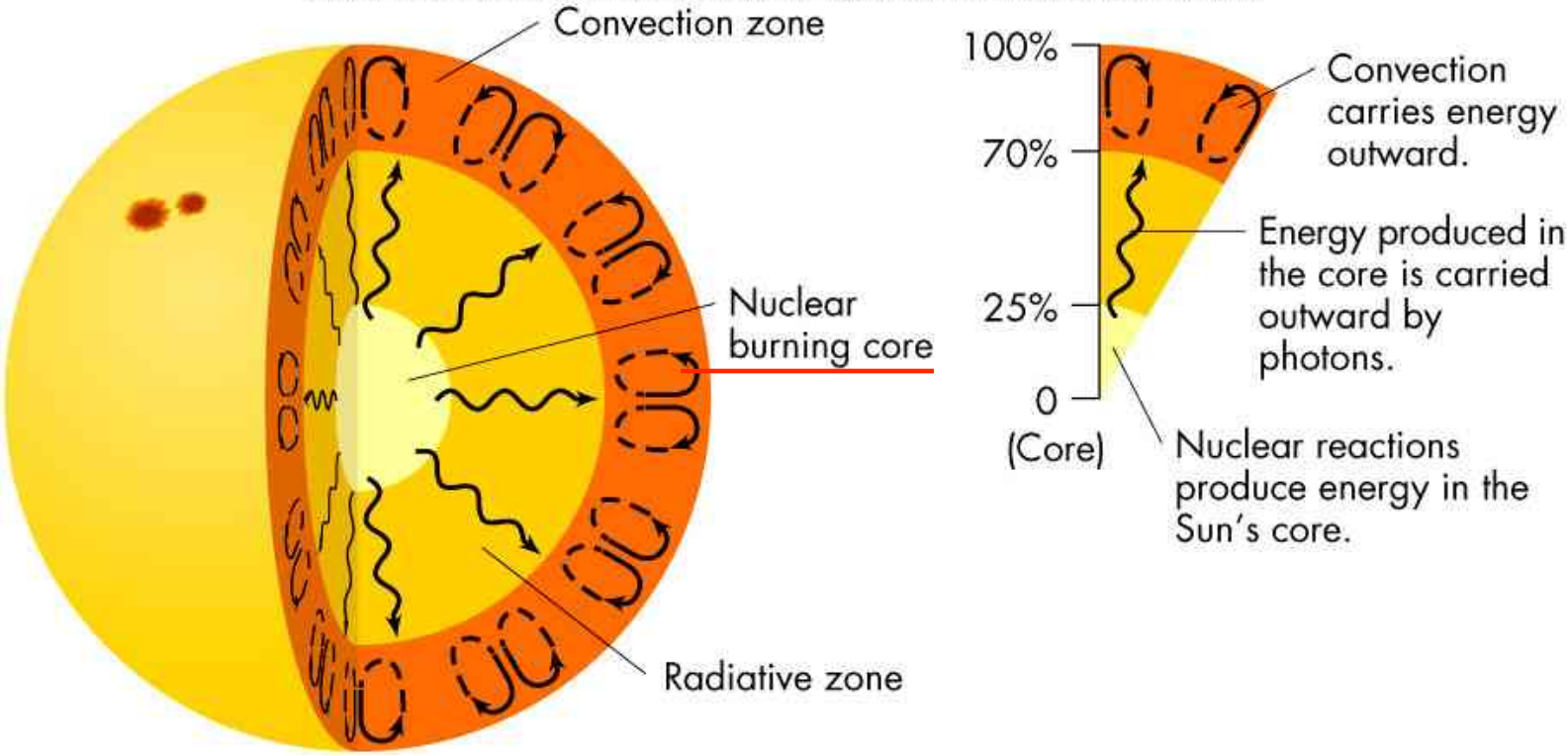


The physics of convection is common in nature as a way of moving heat from one place to another



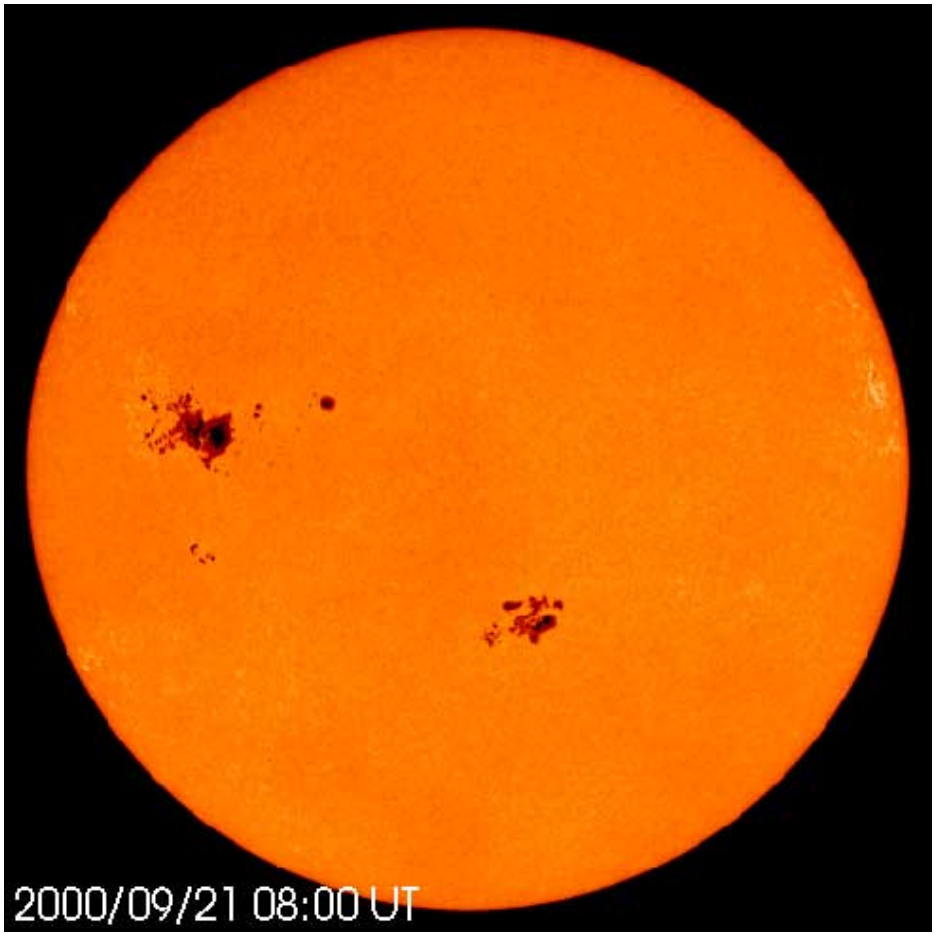
demo

The observation of convection means the Sun gets hotter the deeper you go



Luminosity (or power output) of 3.85E26 Watts

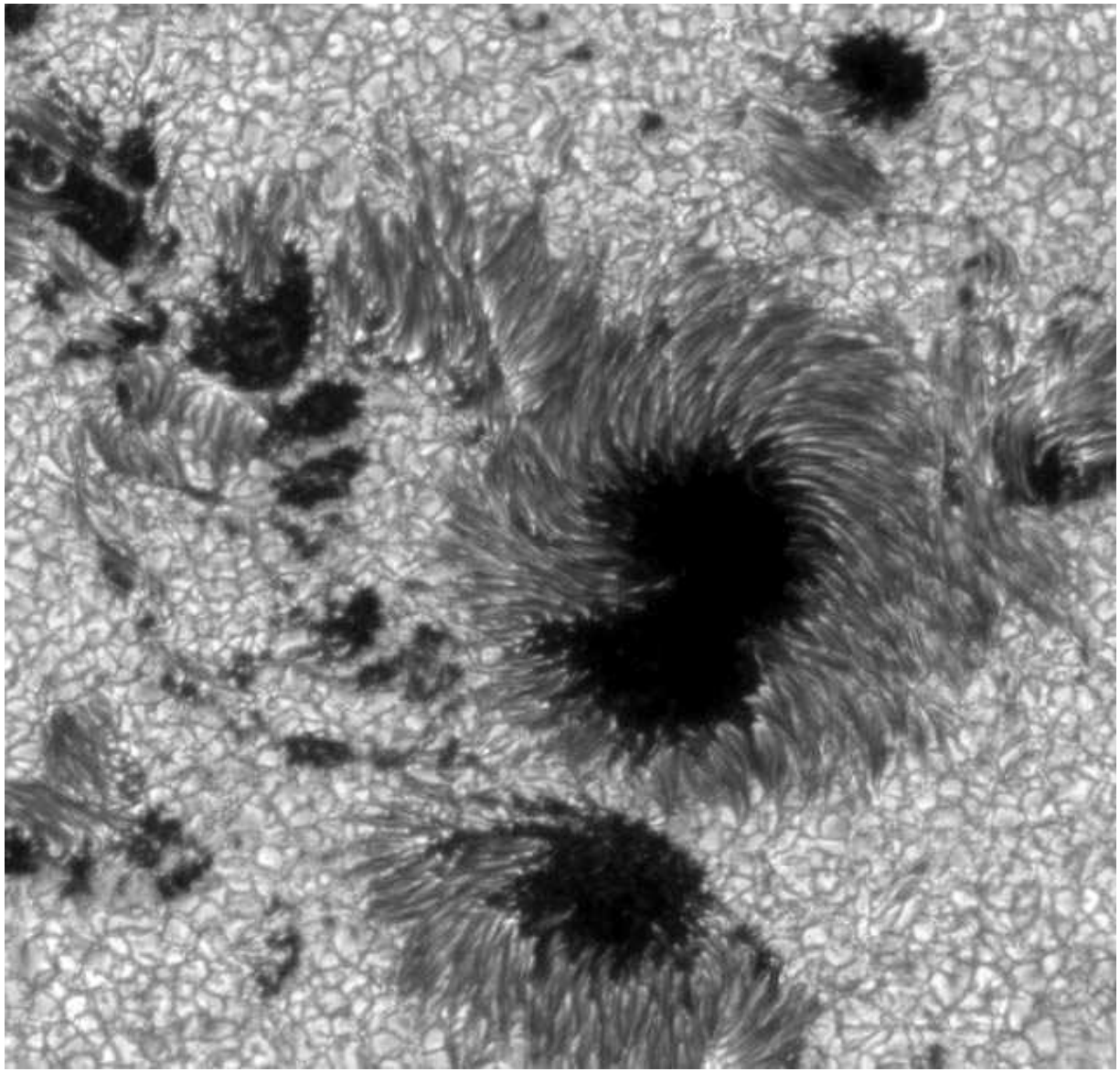
Next topic: solar activity



The appearance of the Sun changes from time to time

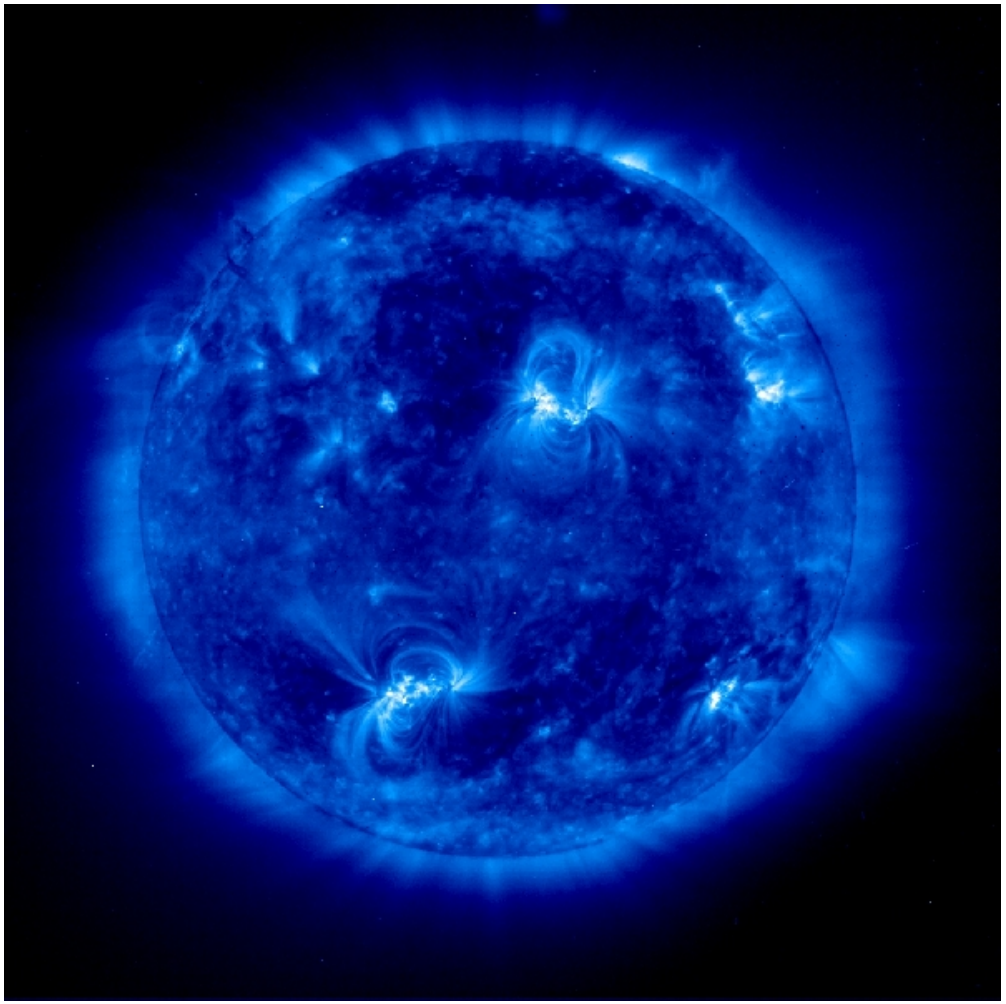
Closeup of a sunspot

Sunspots are regions of strong magnetics fields (0.2 -0.4 Tesla)

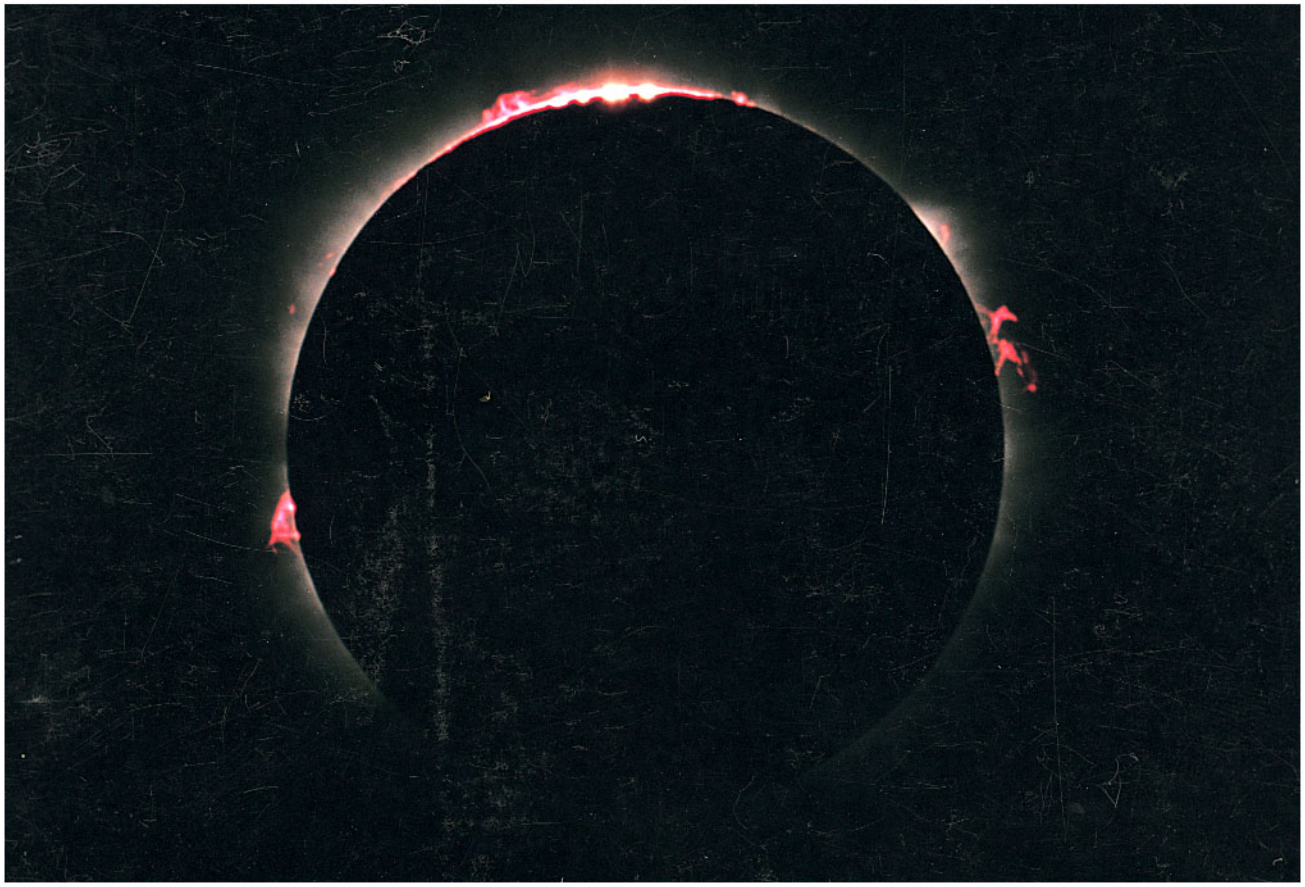


Sunspots and their strong magnetic fields are related to more mysterious aspects of the Sun

Above the photosphere are more rarefied and hotter parts of the solar atmosphere

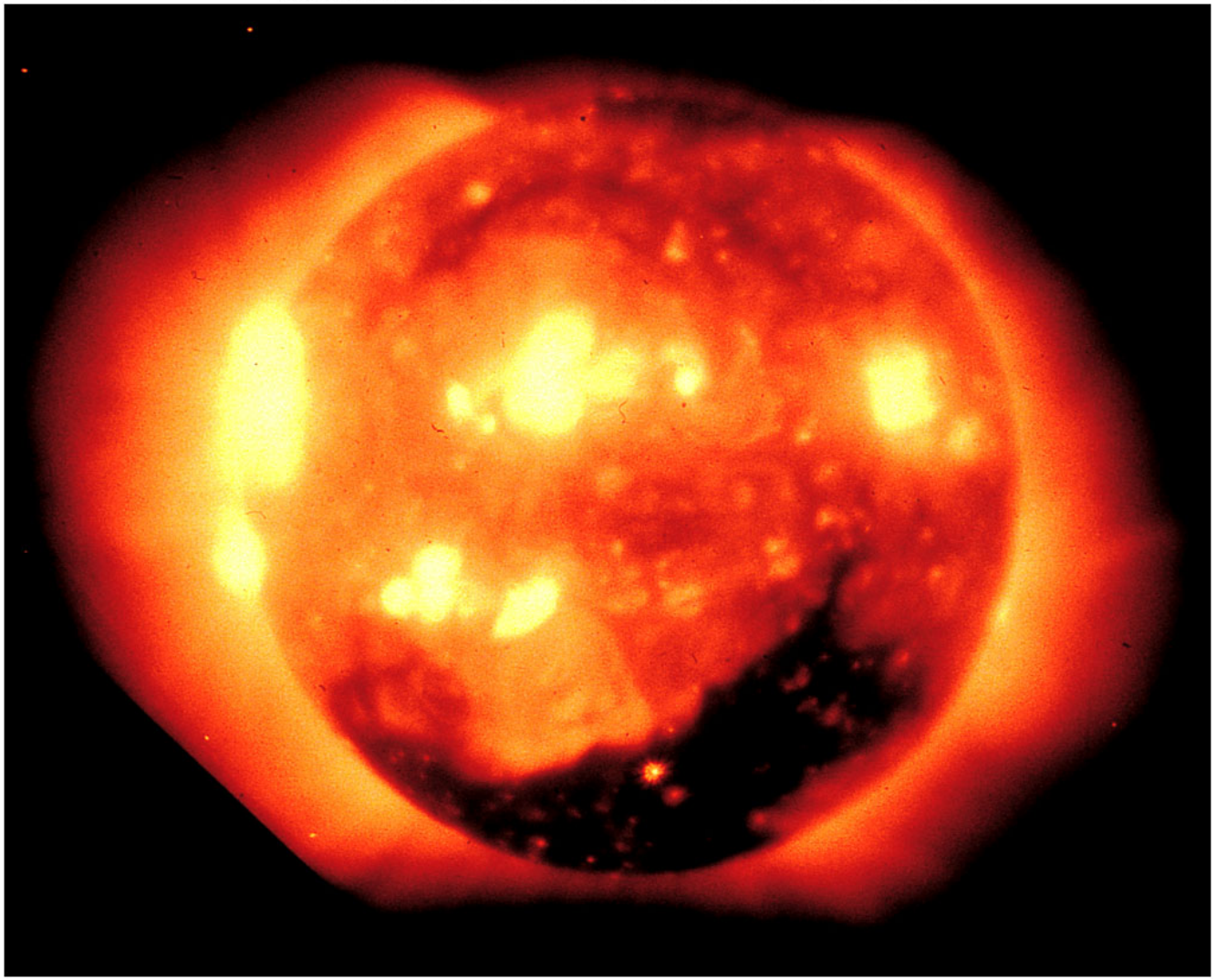


The Chromosphere-region above the photosphere, and substantially hotter

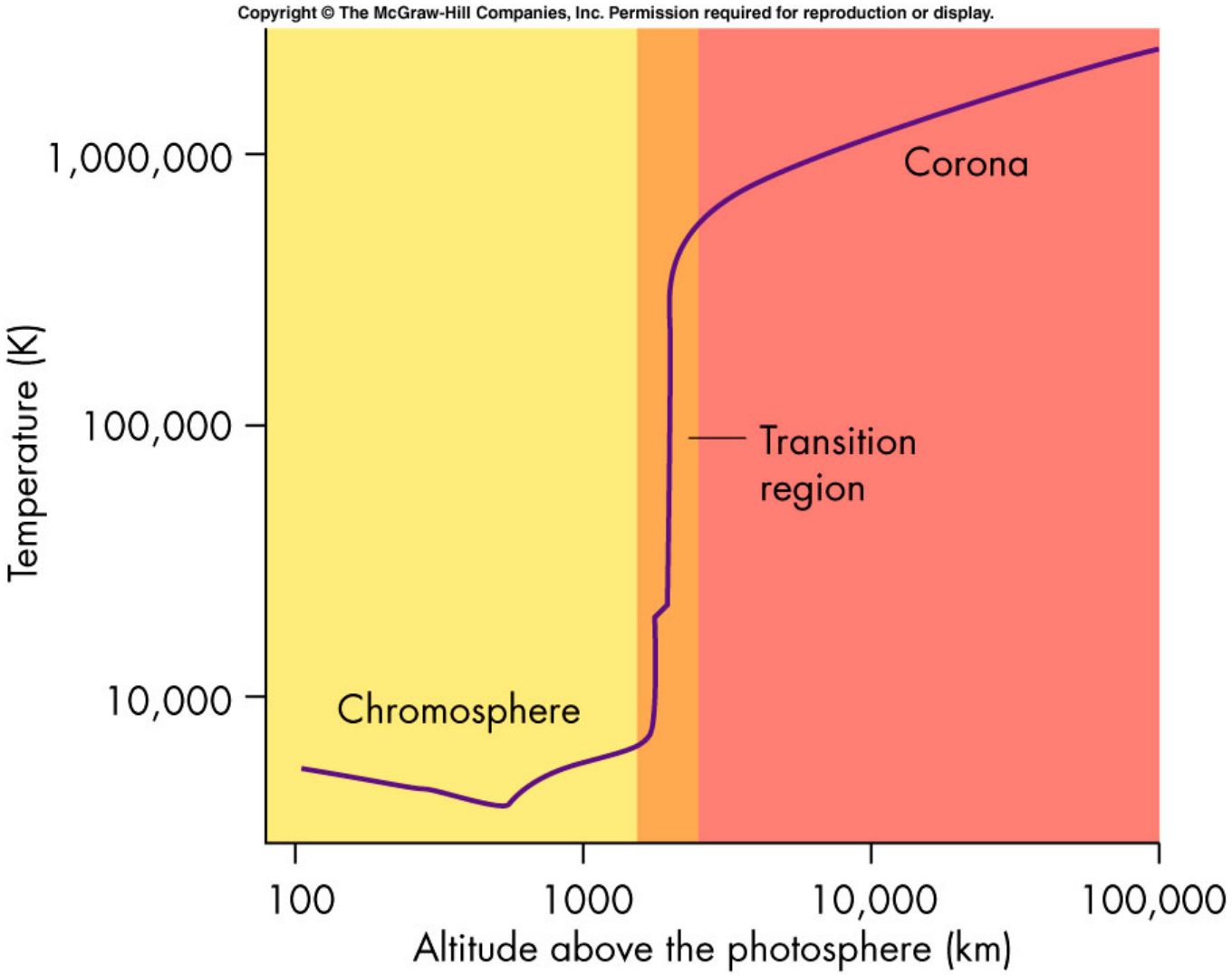


The Solar Corona

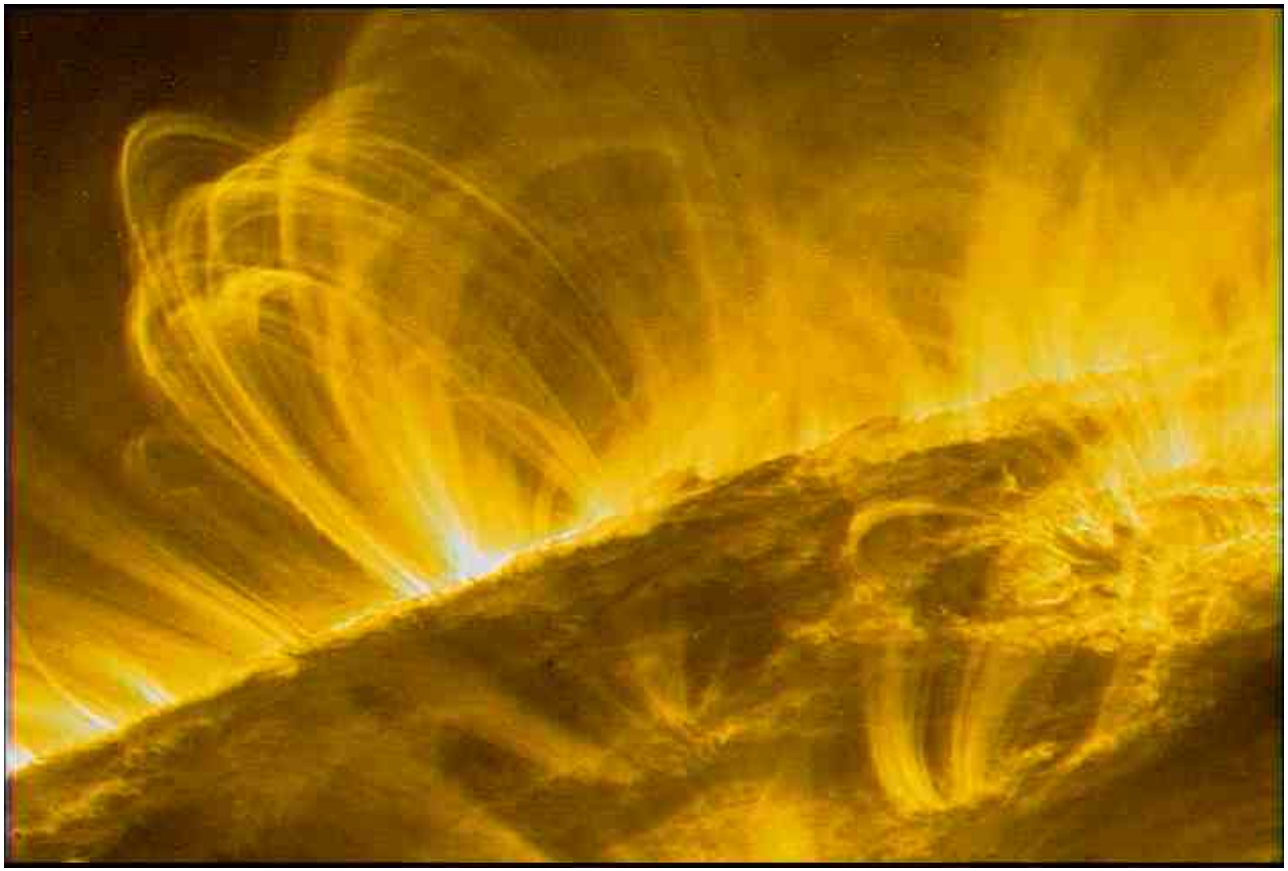
The X-Ray Sun



The Temperature Profile in the Solar Atmosphere



The process or processes responsible for heating the solar corona almost certainly involve the solar magnetic field



We just don’t know how

The hot, rarefield, magnetically-dominated parts of the solar atmosphere show continual activity and energy release

erupting solar prominence...April 21, 2010