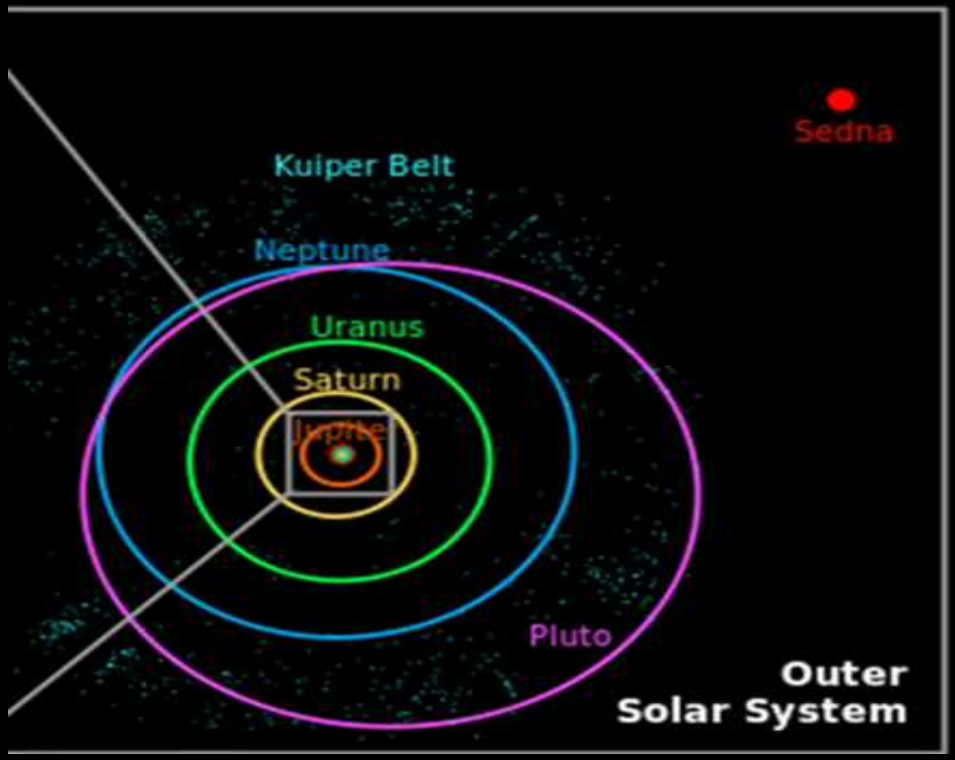
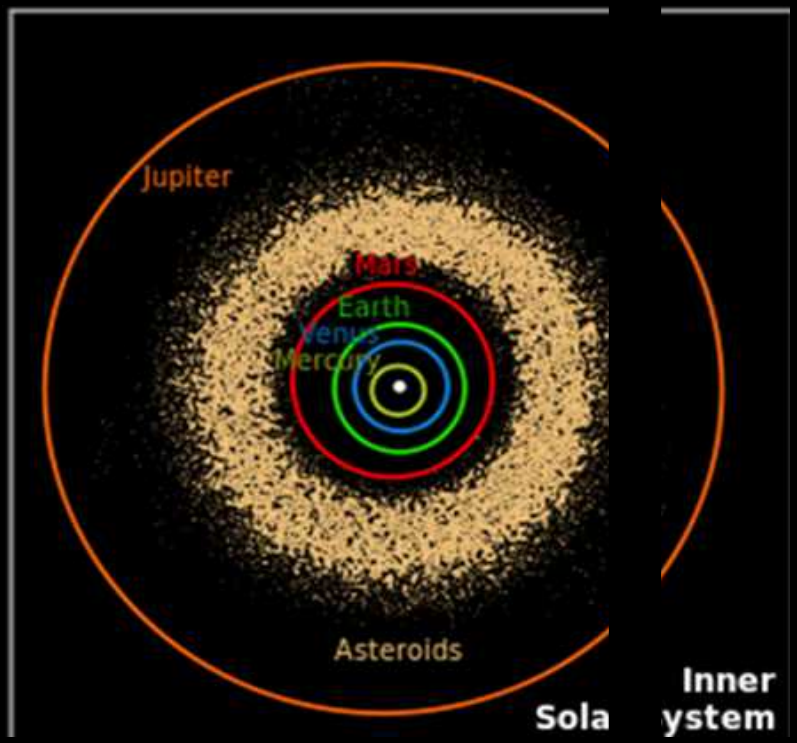
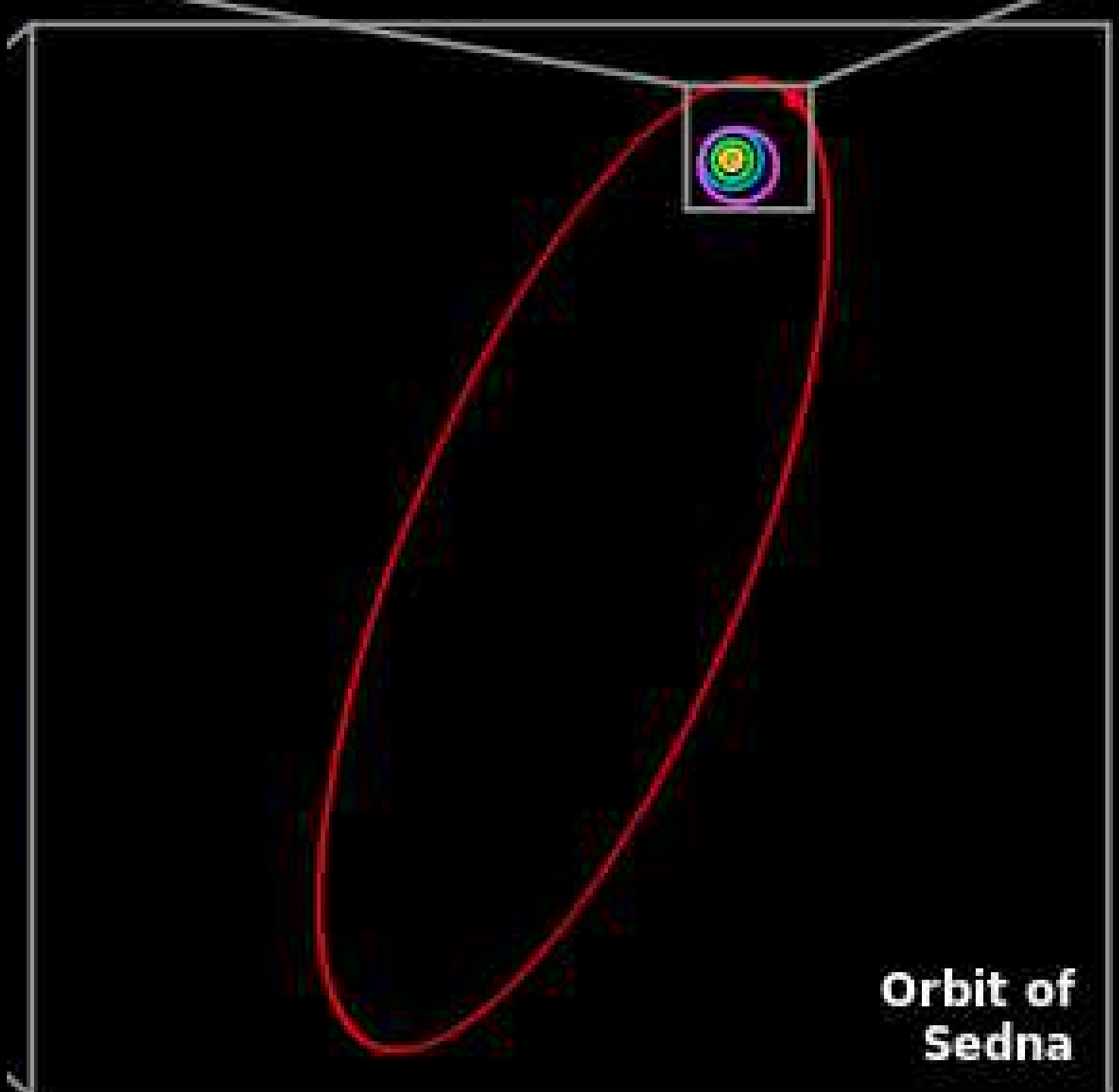
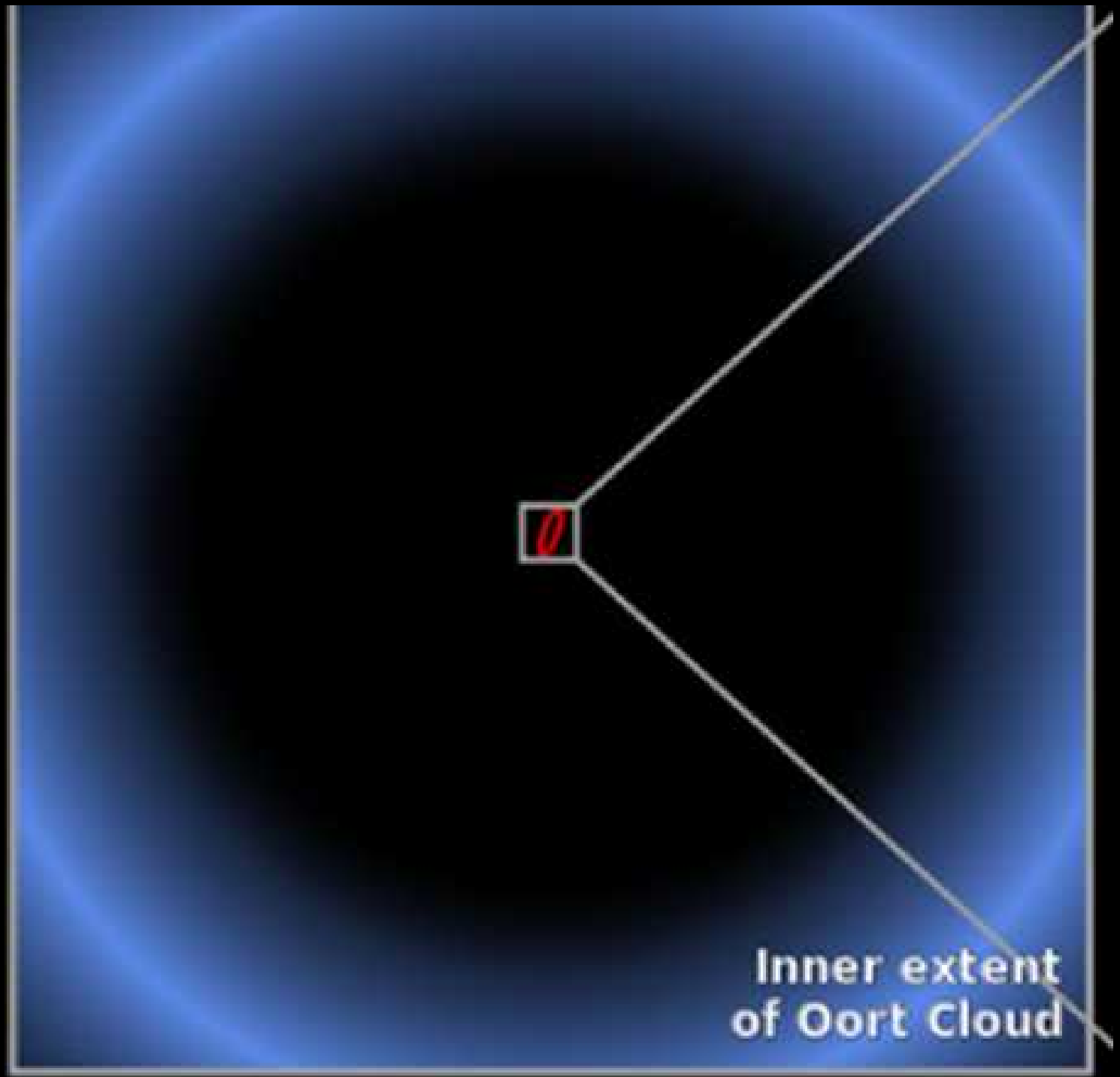

Sedna
Kuiper Belt
Neptune
Uranus
Saturn
Jupiter
Pluto
Outer
Solar System


Jupiter
Mars
Earth
Venus
Mercury
Asteroids
Sola
Inner
ystem


Orbit of
Sedna


0
Inner extent
of Oort Cloud

The Titius-Bode Law:

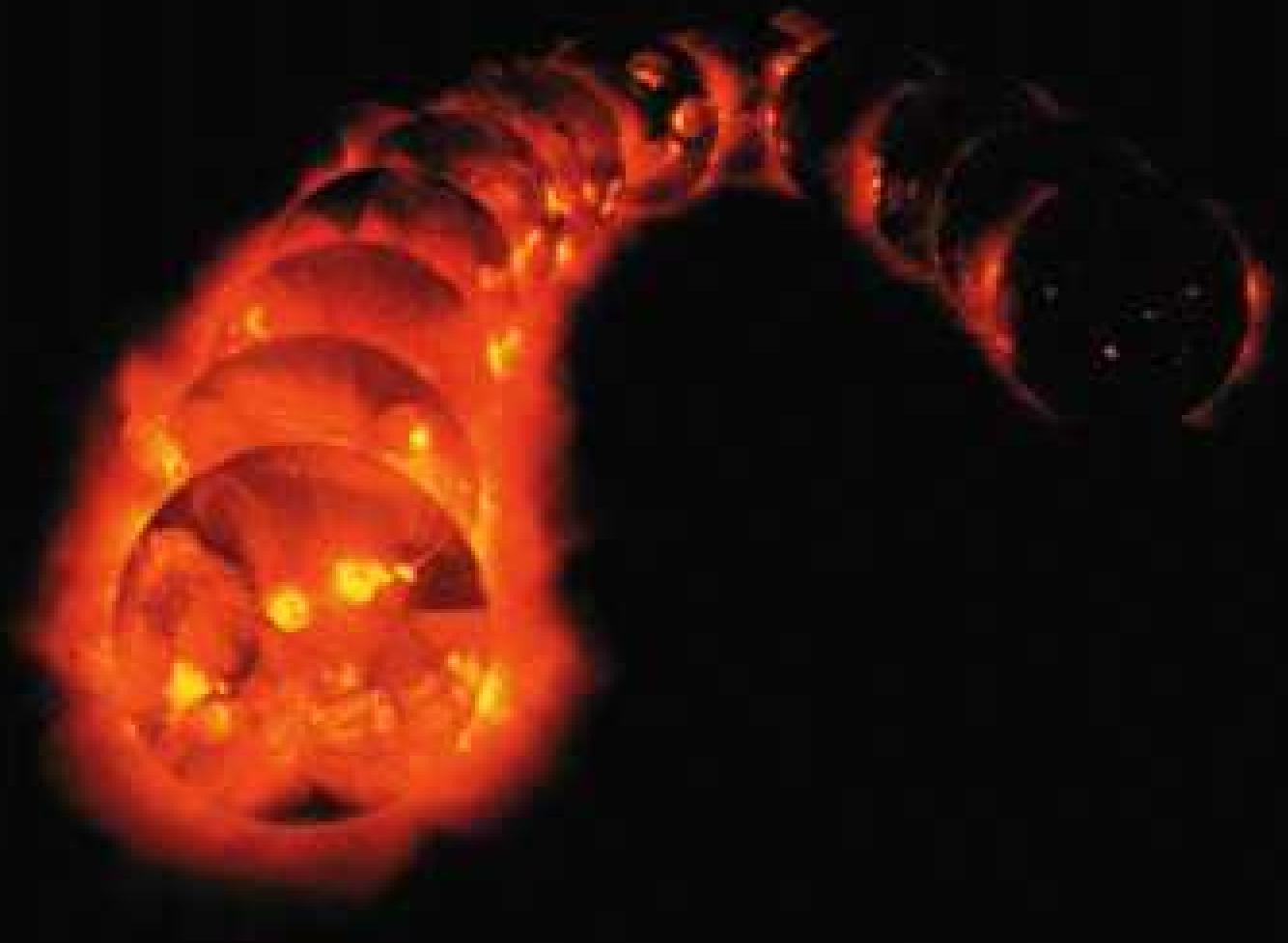
A series of numbers	add 4	divide by ten	measured value	Planet….
0	4	0.4	0.39	Mercury
3	7	0.7	0.72	Venus
6	10	1.0	1.0	Earth
12	16	1.6	1.52	Mars
24	28	2.8	2.8	Ceres
48	52	5.2	5.2	Jupiter
97	100	10.0	9.54	Saturn
192	196	19.6	19.19	Uranus
384	388	38.8	39.44	Pluto

Neptune???

I million kilometers

Largest known trans-Neptunian objects (TNOs)

Our Sun:



Basic Properties of the Sun

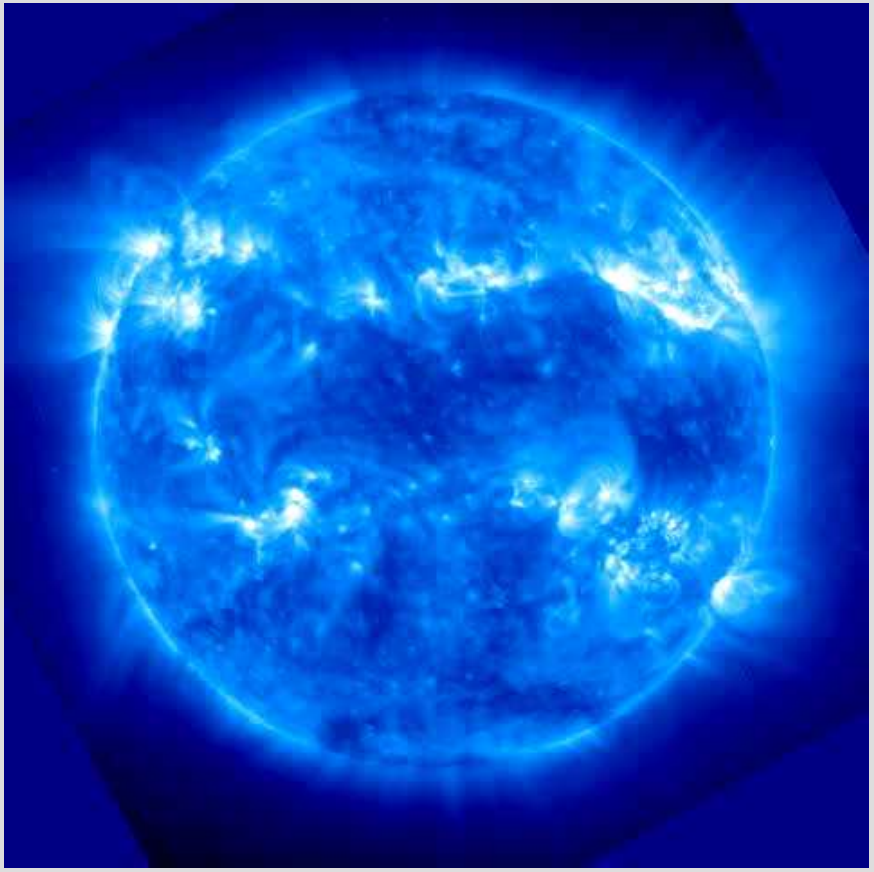
Distance: 1.48 x 108 km
= 1 A.U.

Mass: 1.99 x 1030 kg

Radius: 6.96 x 105 km

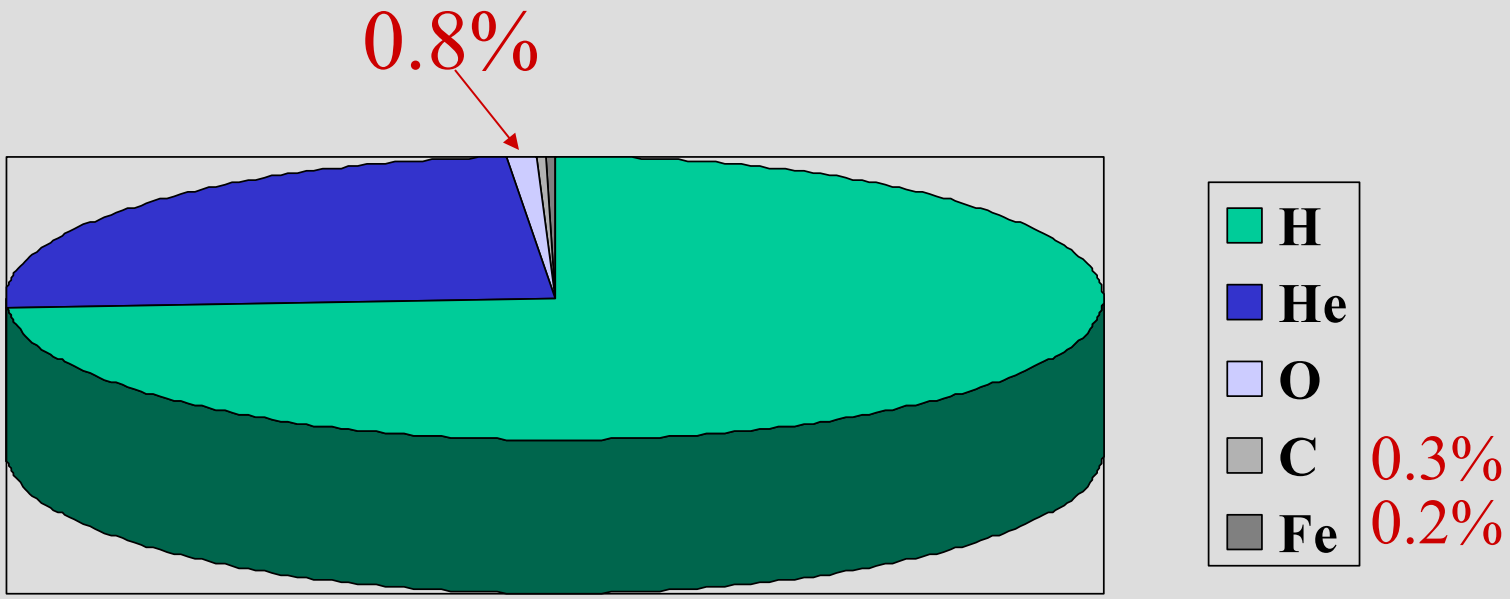
Density: 1410 kg/m3

Equator's Rotational
Period: ~25 days



Luminosity: 3.8 x 1026 Watts

Composition of the Sun

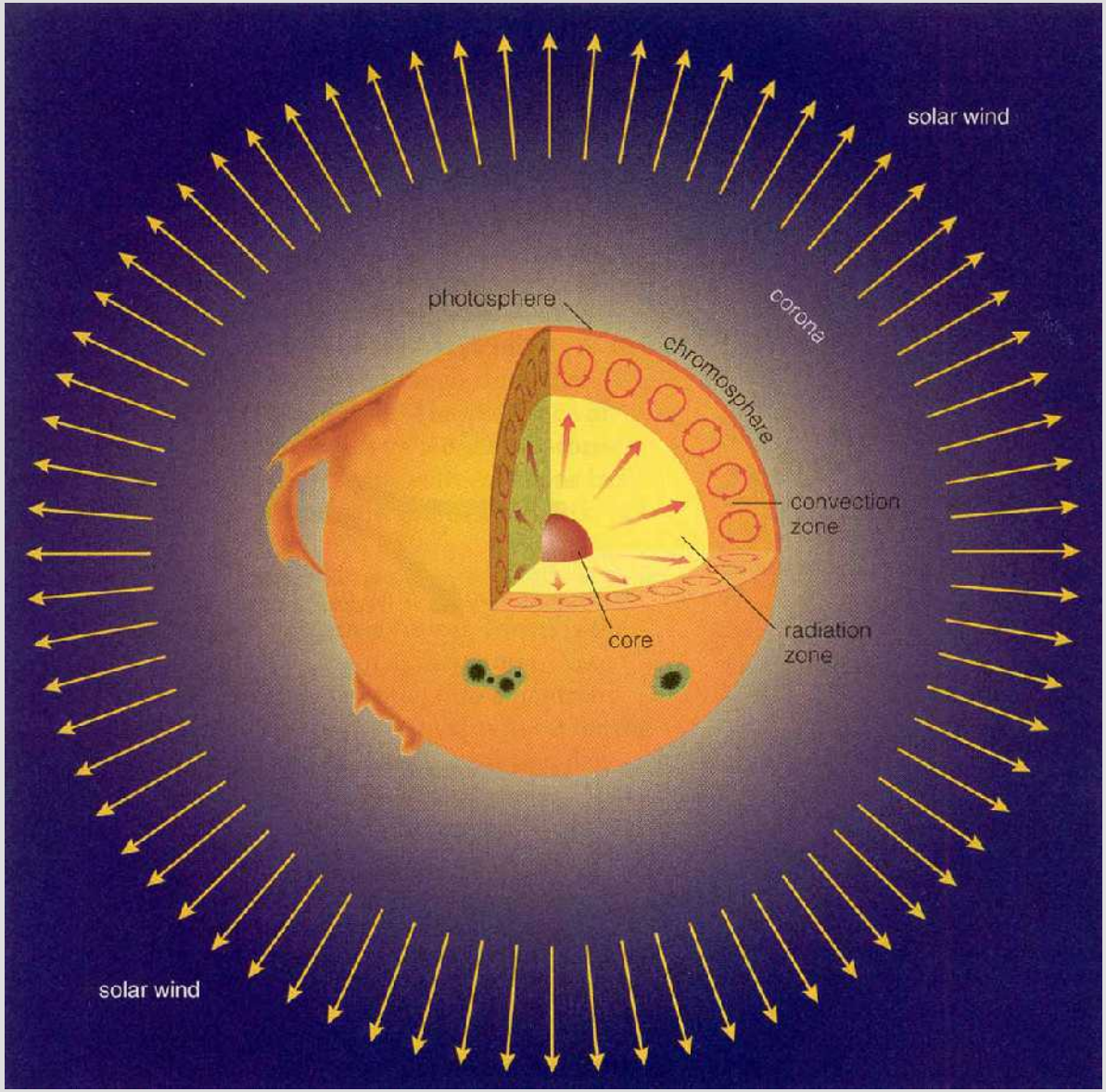


Composition of the Sun

We know this by identifying the **absorption lines** in the Sun's spectrum.

These lines are formed in the photosphere.

Layers of the Sun

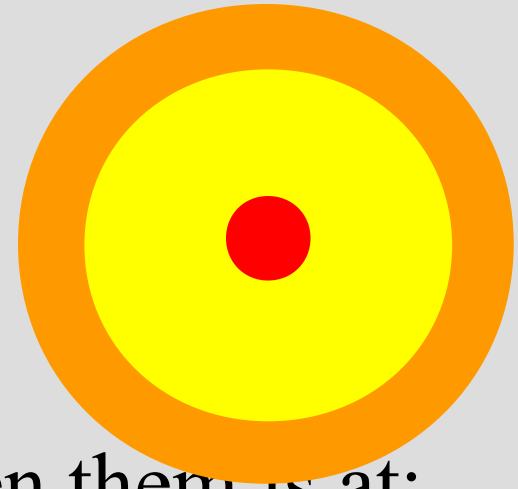


Core

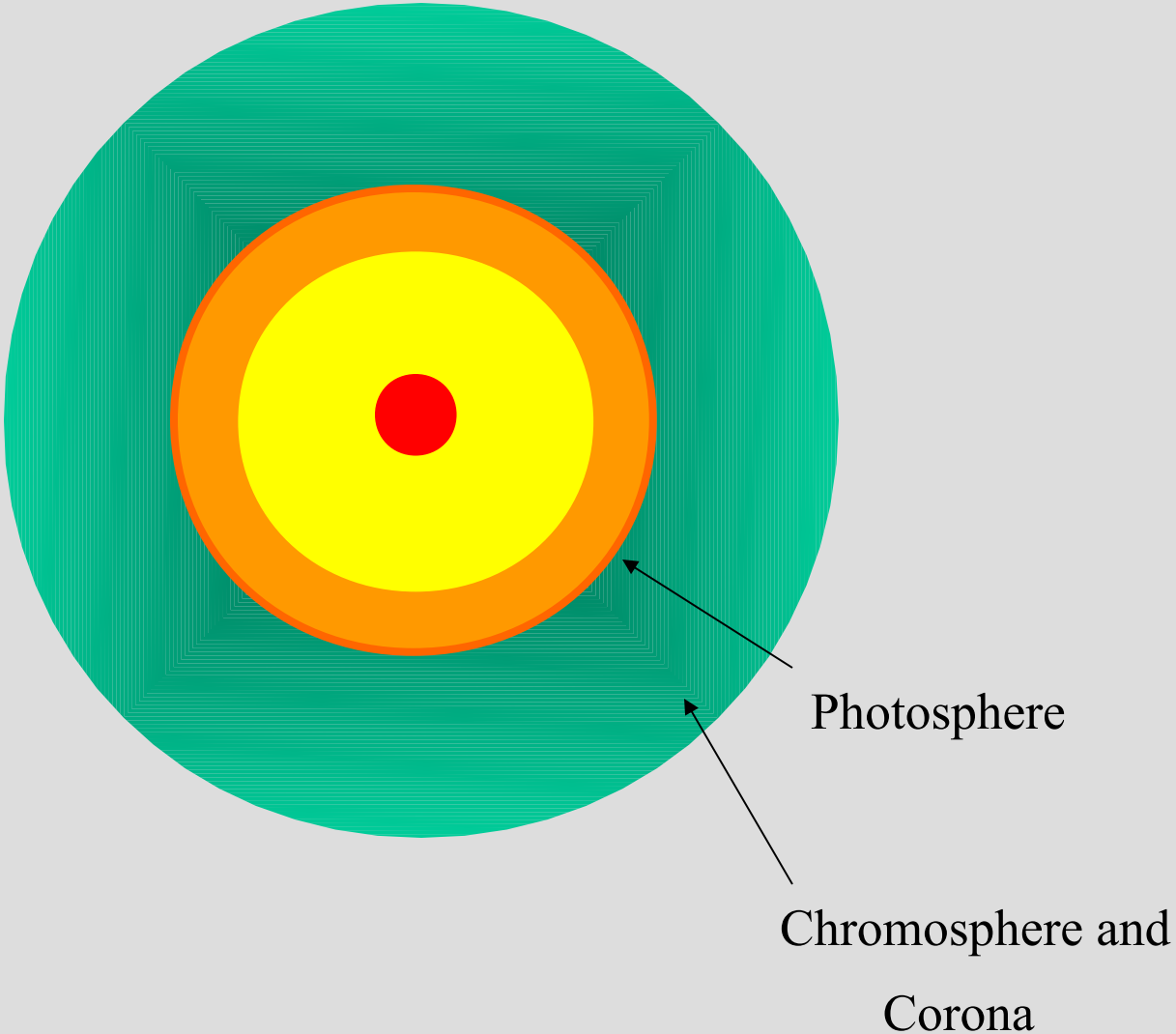
- T = 1.5 x 107 K; depth = 0 – 0.25 R⊙
- This is where the Sun's energy is generated.

Interior Zones

- T < 8 x 106 K; depth = 0.25 – 0.86 R⊙
- Energy is transported through the interior.
- The interior is divided into two zones:
  - Radiation Zone
  - Convection Zone

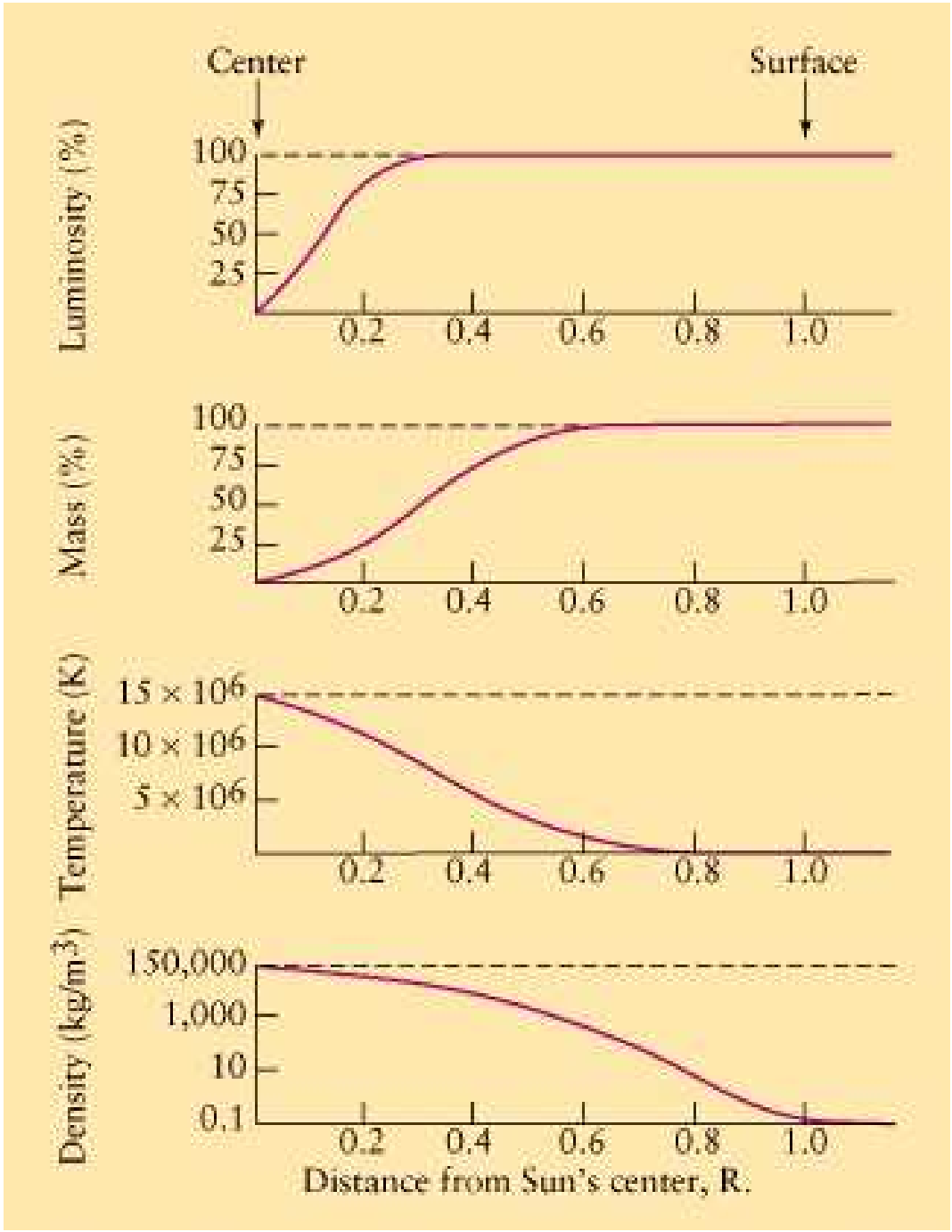


- Boundary between them is at:
  - T = 2 x 106 K; depth = 0.70 R⊙


Photosphere
Chromosphere and
Corona

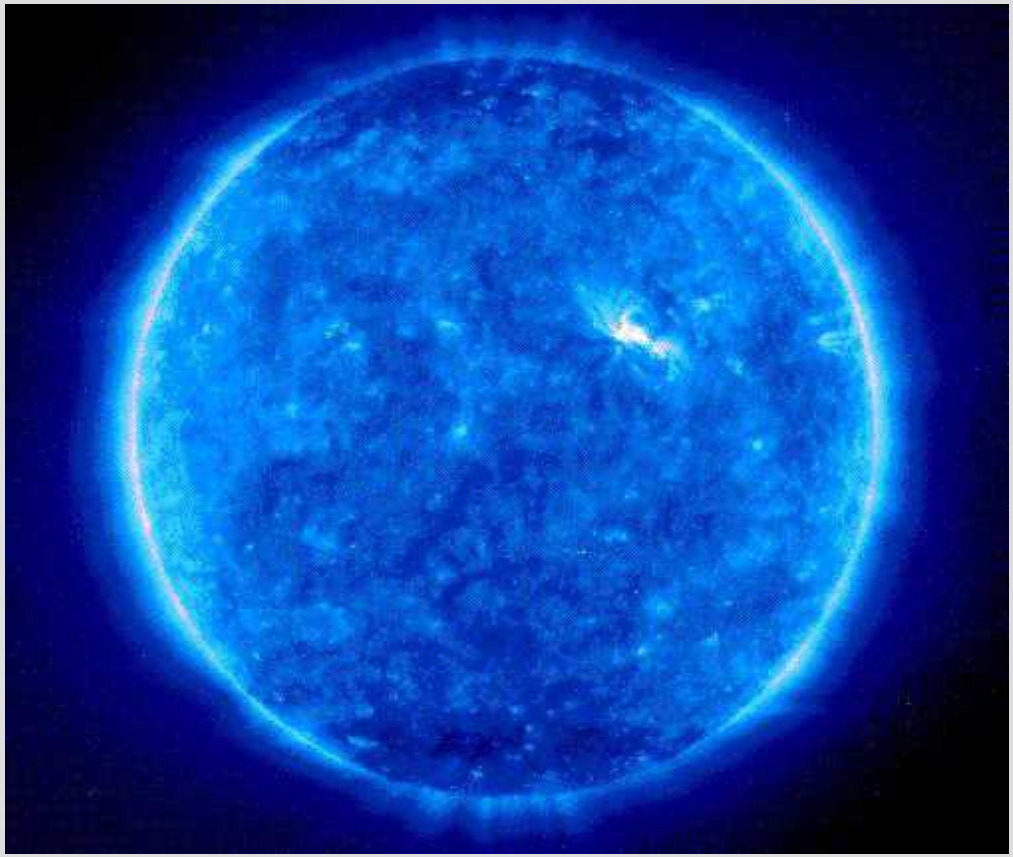
Layers of the Sun

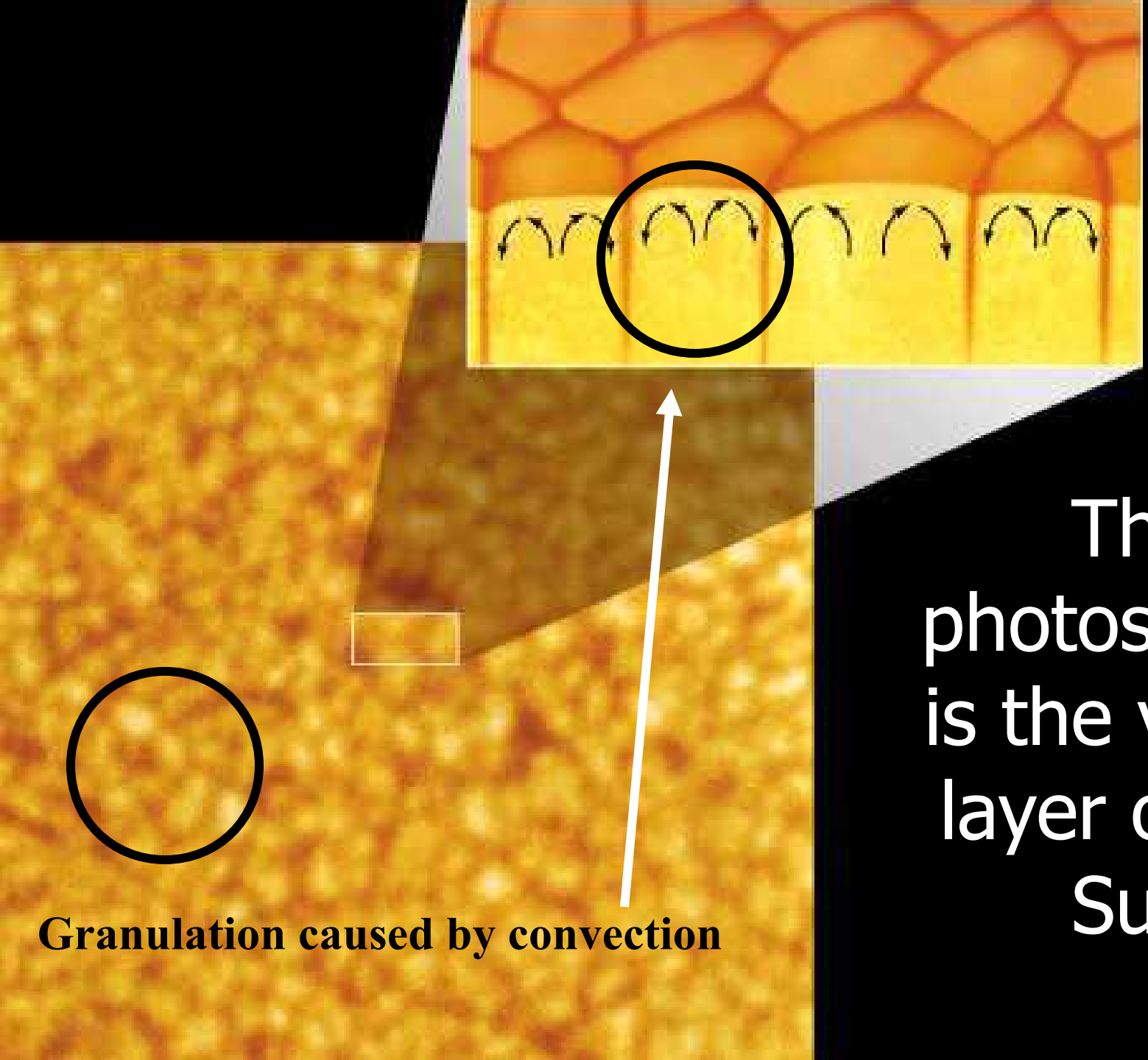
	Temperature	Radial Extent
· Core	1.5 x 107 K	0.25 R⊙
· Radiation Zone	> 2 x 106 K	0.70 R⊙
· Convection Zone	< 2 x 106 K	0.85 R⊙
· Photosphere	5.8 x 103 K	R⊙ – 400 km thick
· Chromosphere	1– 5 x 104 K	R⊙ + 2,500 km thick
· Corona	2 x 106 K	R⊙ + 600,000 km thick
· Solar Wind	> 106 K	beyond the orbit of Pluto


Center
Surface
Luminosity (%)
100
75
50
25
0.2
0.4
0.6
0.8
1.0
Mass (%)
100
75
50
25
0.2
0.4
0.6
0.8
1.0
Temperature (K)
15 × 10⁶
10 × 10⁶
5 × 10⁶
0.2
0.4
0.6
0.8
1.0
Density (kg/m³)
150,000
1,000
10
0.1
0.2
0.4
0.6
0.8
1.0
Distance from Sun's center, R.

Photosphere

- T = 5,800 K; depth = 400 km
- This is the “yellow surface” that we see.





Granulation caused by convection

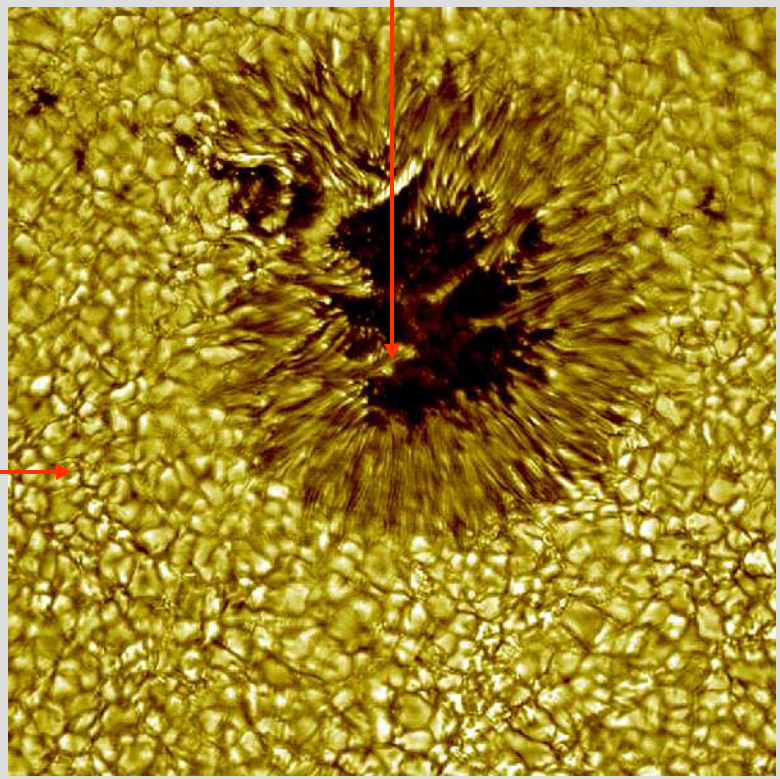
The photosphere is the visible layer of the Sun


Sunspots are the most well known feature on the photosphere

Photospheric Features

Sunspots: dark spots on the surface where the temperature is cooler.

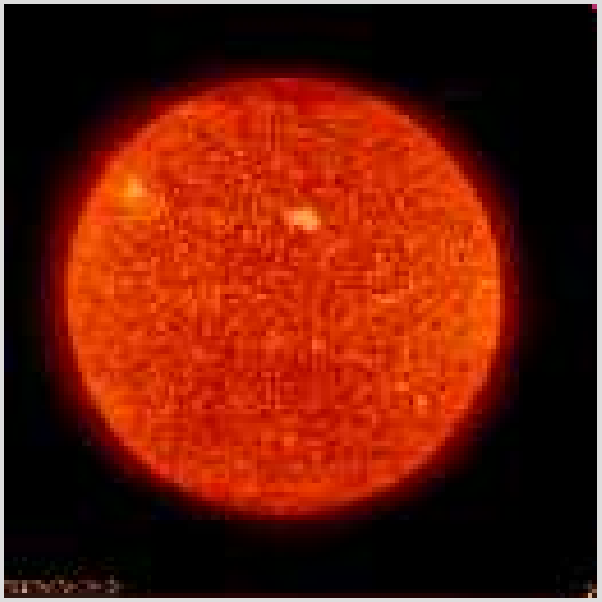
Granulation: the tops of convection cells seen "bubbling" on the Solar surface



National Solar Observatory/AURA/NSF

Sunspots

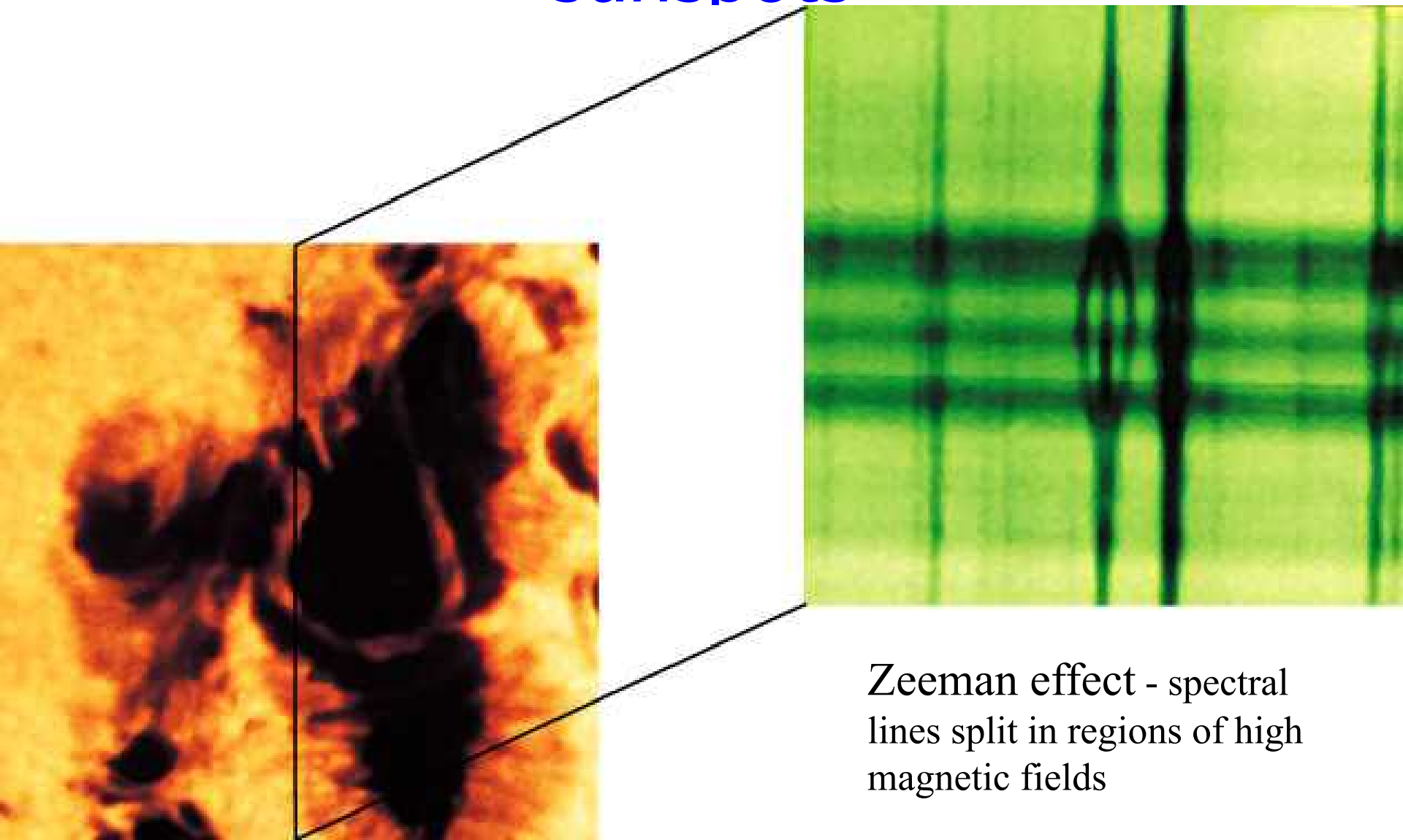
courtesy of SOHO/MDI consortium
SOHO is a project of ESA and NASA



Sunspots occur in pairs; the pairs cluster into groups; and they rotate with the Sun

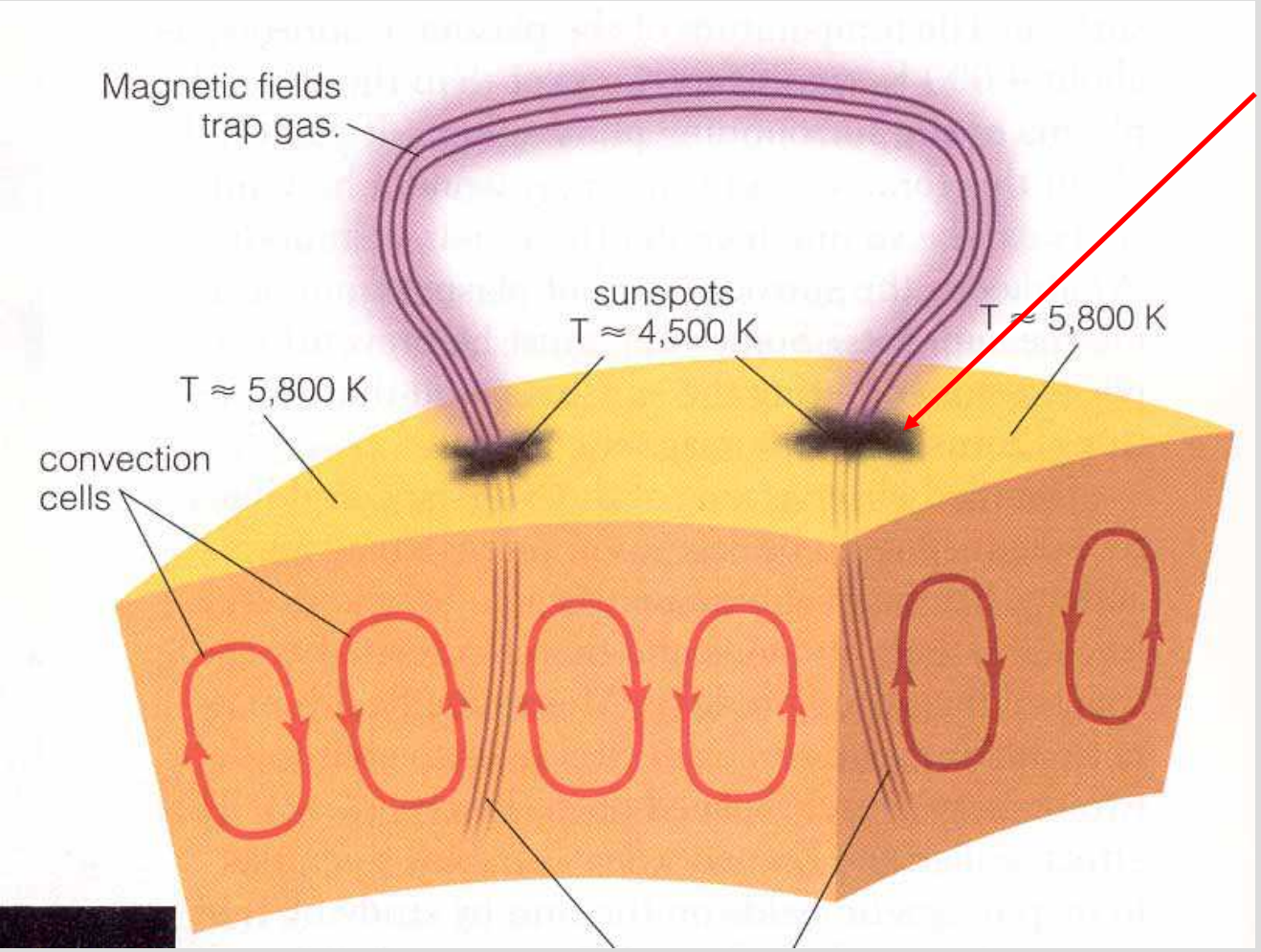
Sunspots come and go over an 11-year cycle.

The Sun's magnetic fields create sunspots



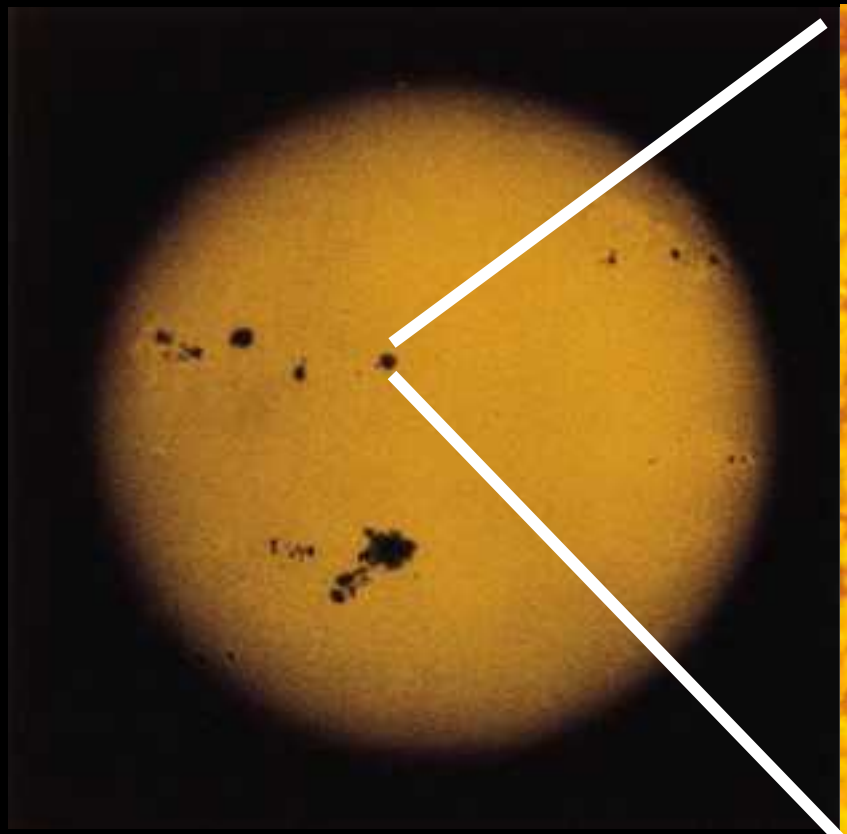
Zeeman effect - spectral lines split in regions of high magnetic fields

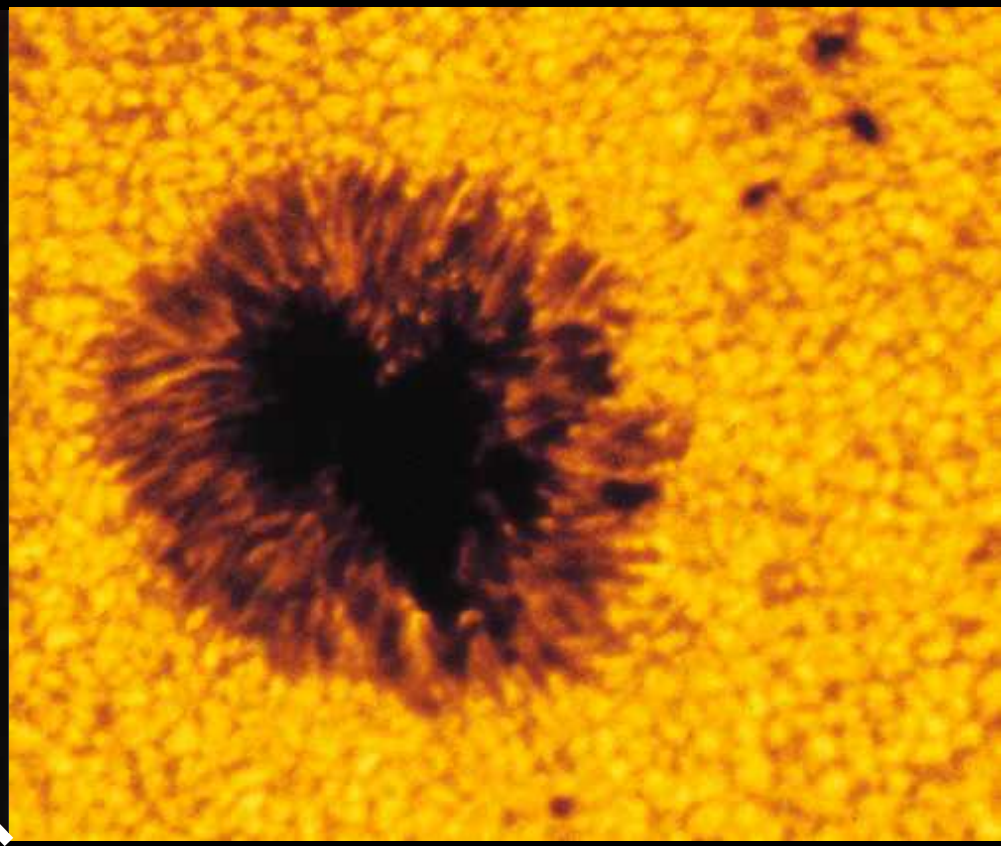
What causes a sunspot?



magnetic field slows down convection;
Less heat is transported to surface;
so that part of photosphere is cooler

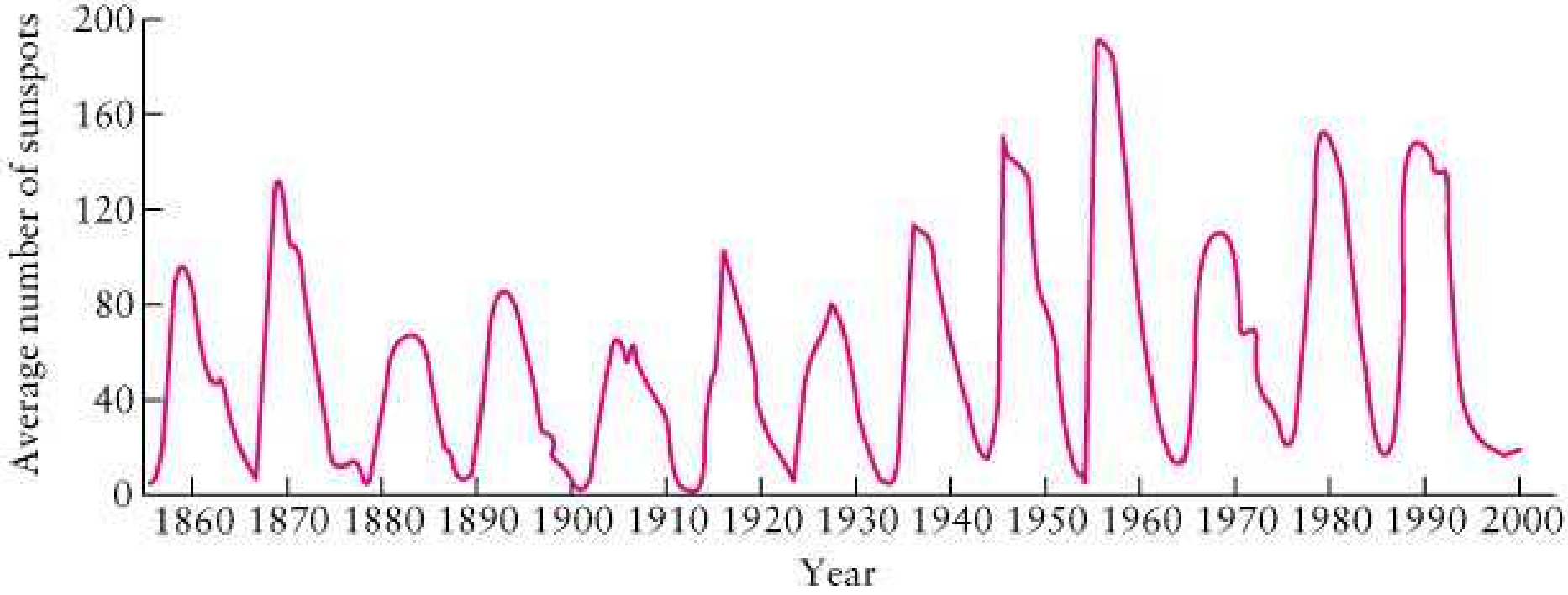
Monitoring sunspots reveals the solar cycle and the Sun's



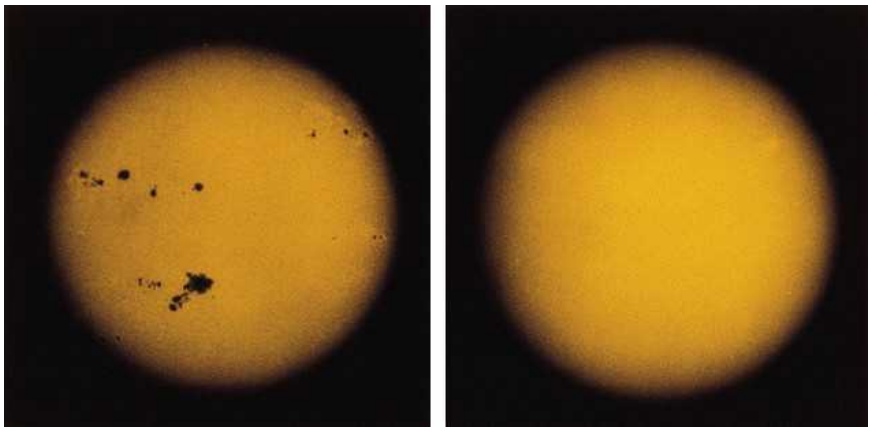


The daily movement of **sunspots** reveals that the Sun's rotation takes about 4 weeks

The annual change in numbers of **sunspots** reveals that the Sun experiences an 11-year solar cycle



Maximum number



Minimum number

What to know:

- Know the properties of the Jovian planets.
- Know what the differences and similarities are between asteroids, comets, and meteors.
- Know the anatomy of a comet.
- Know the different types of asteroids…
- Know the overall picture of our Solar system.
- Know how to use Bode's Rule.
- Know some temperatures associated with the Sun.
- Know the geometry of the asteroid belt.