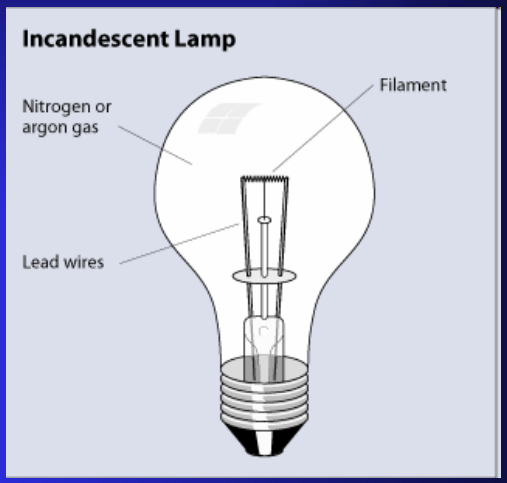
The Sun

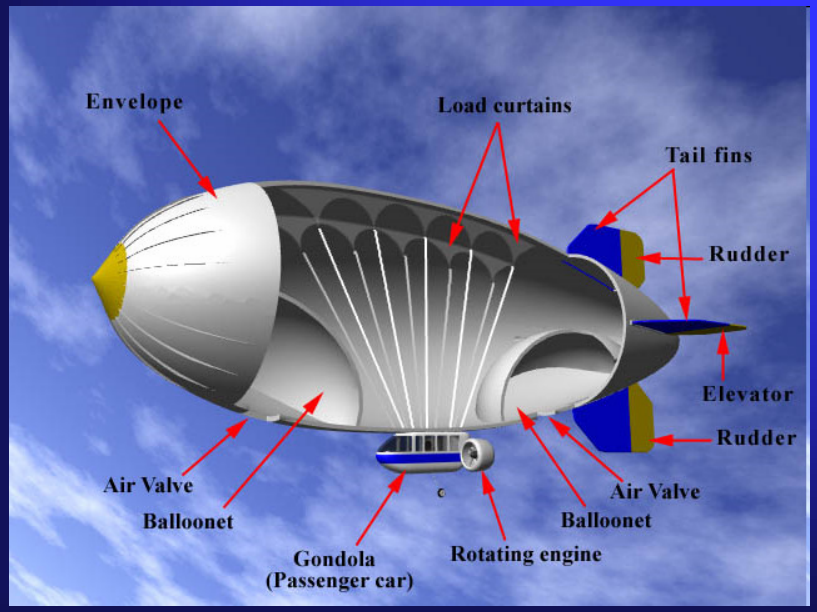
Overview

1. What is the composition of the Sun?
2. Why does the Sun shine?
3. How do we know its temperature?
4. Why is the Sun hot? (what's it's energy source)
5. Why can't it be chemical?
6. Why can't it be gravitational?
7. How does gravitational heating work?
8. What IS fusion, and why does it release energy?
9. How do we know the Sun's composition?
10. What is the structure of the Sun?

What IS the Sun?

A mass of incandescent gas



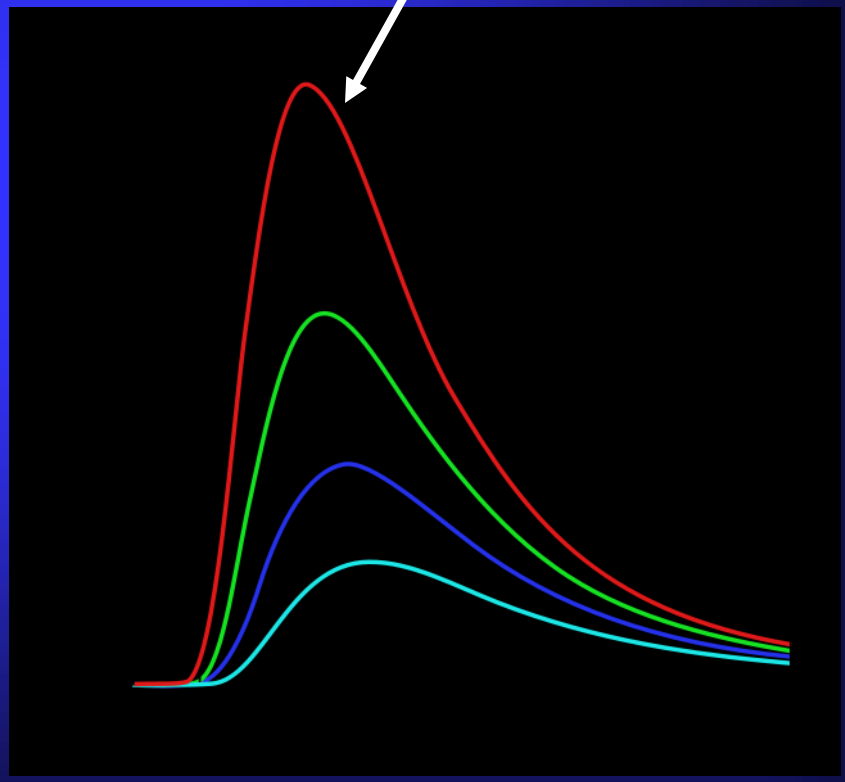


Primarily Hyrdogen

Why Does the Sun Shine?

Because it's HOT!

5800 degrees



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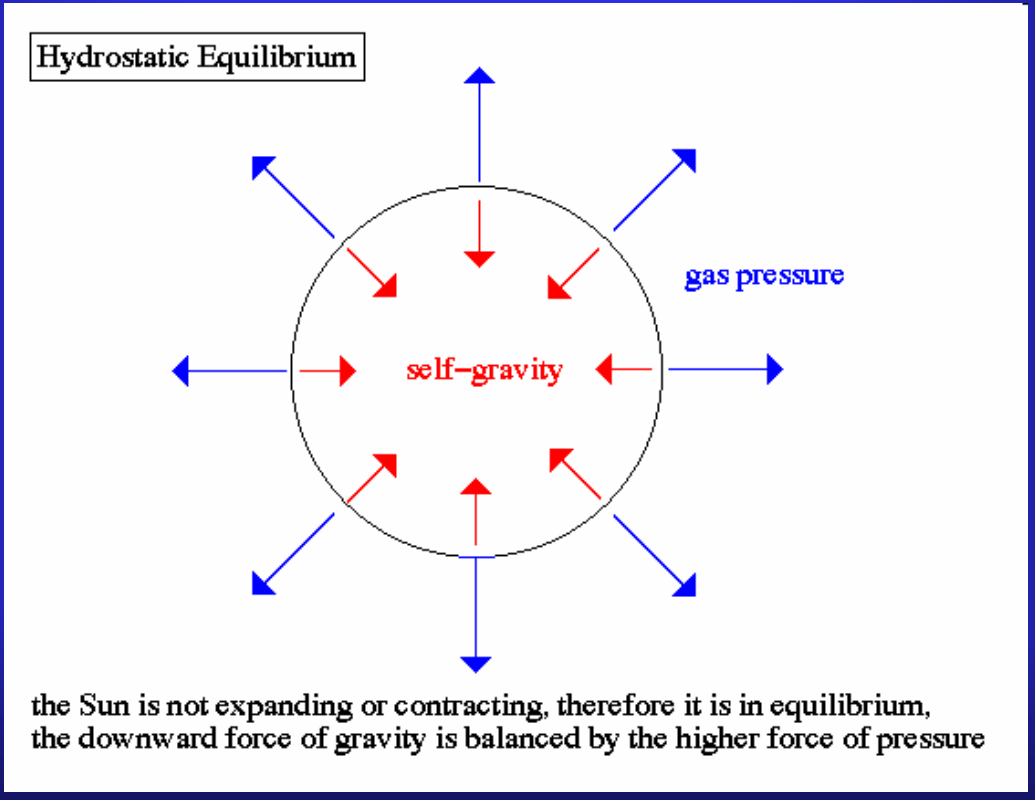
Question

Objects A and B emit like blackbodies.
The λ_{max} is the same for both objects.
A is twice as bright as B.

A. A is hotter that B
B. A is colder than B
C. A and B are at the same temperature
D. A is smaller than B

Keeping the Sun Inflated

Why doesn't the Sun continue to collapse?



What's the energy source?

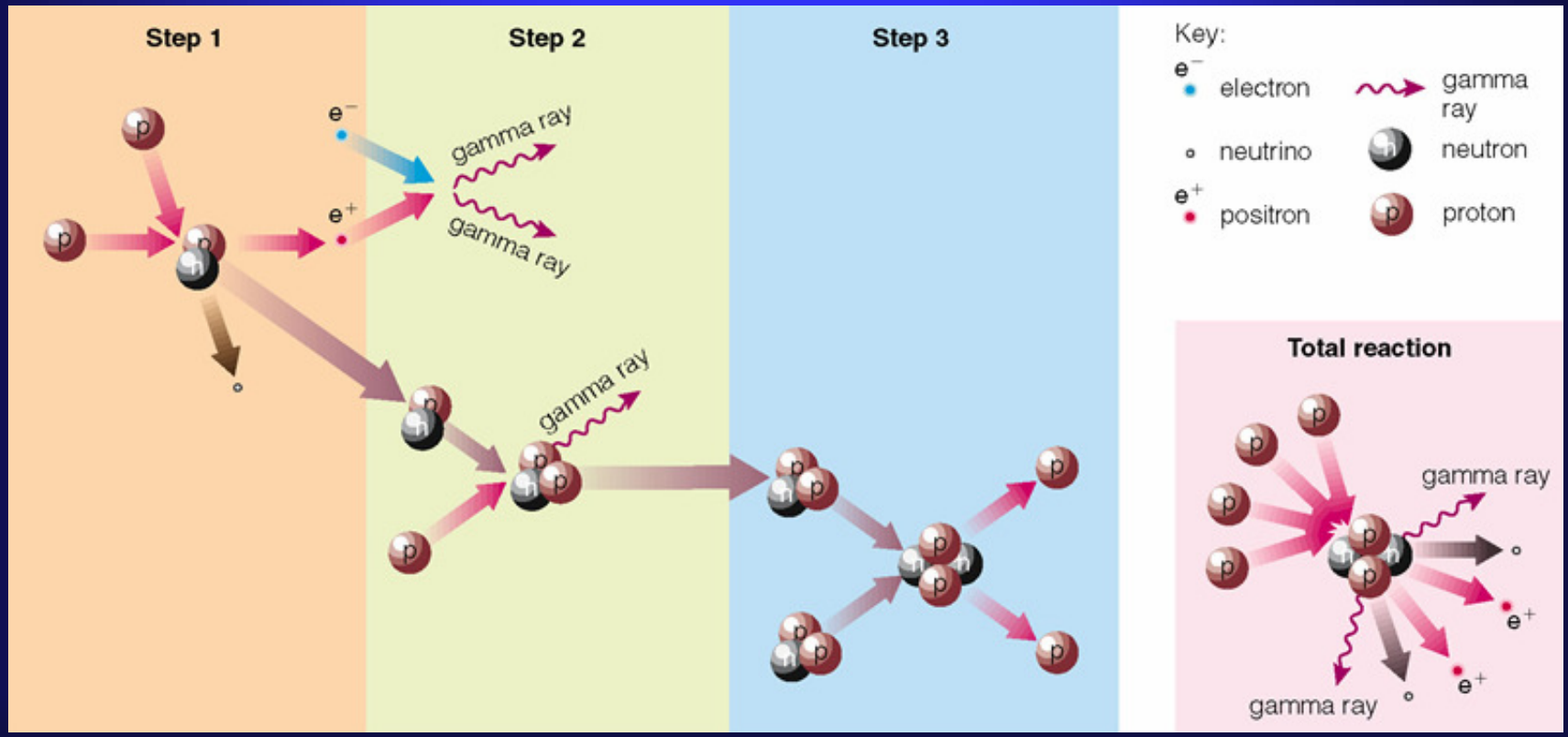
Burning?
It would only last a few thousand years

What's the energy source?

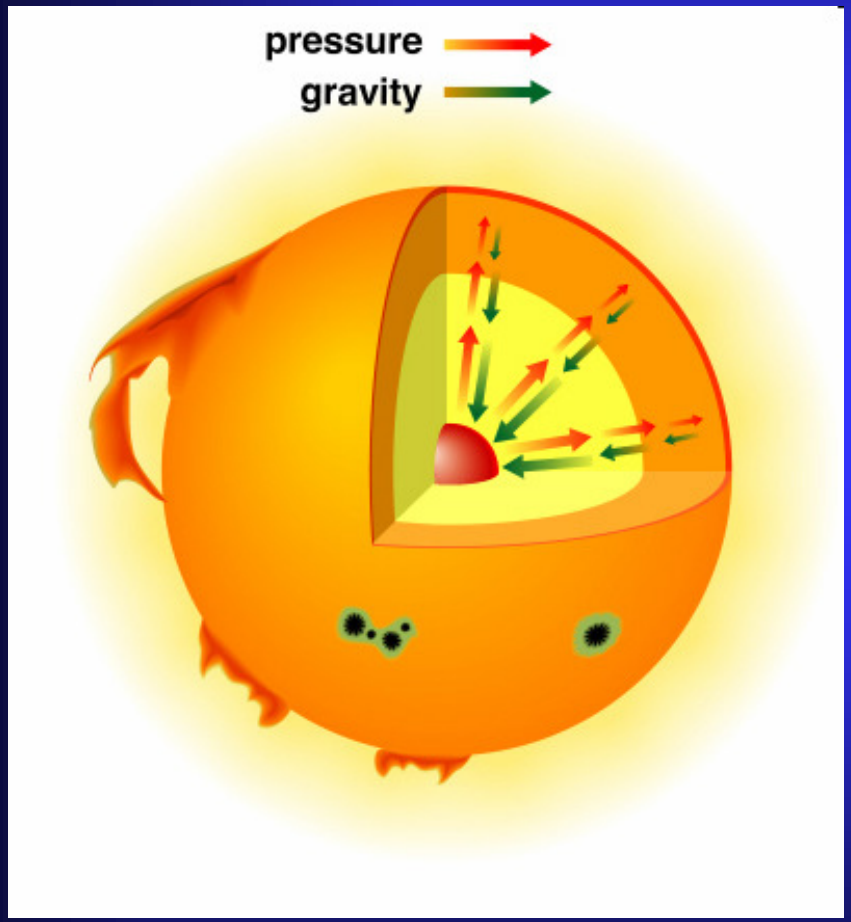
Gravitational Time Scale
A few tens of millions of years

Fusion

The Sun **fuses** hydrogen into helium releasing energy



Solar Thermostat



Fusion Reaction Rate depends on Temperature

As temp. decreases, pressure decreases

As gravitational potential is released, temperature increases

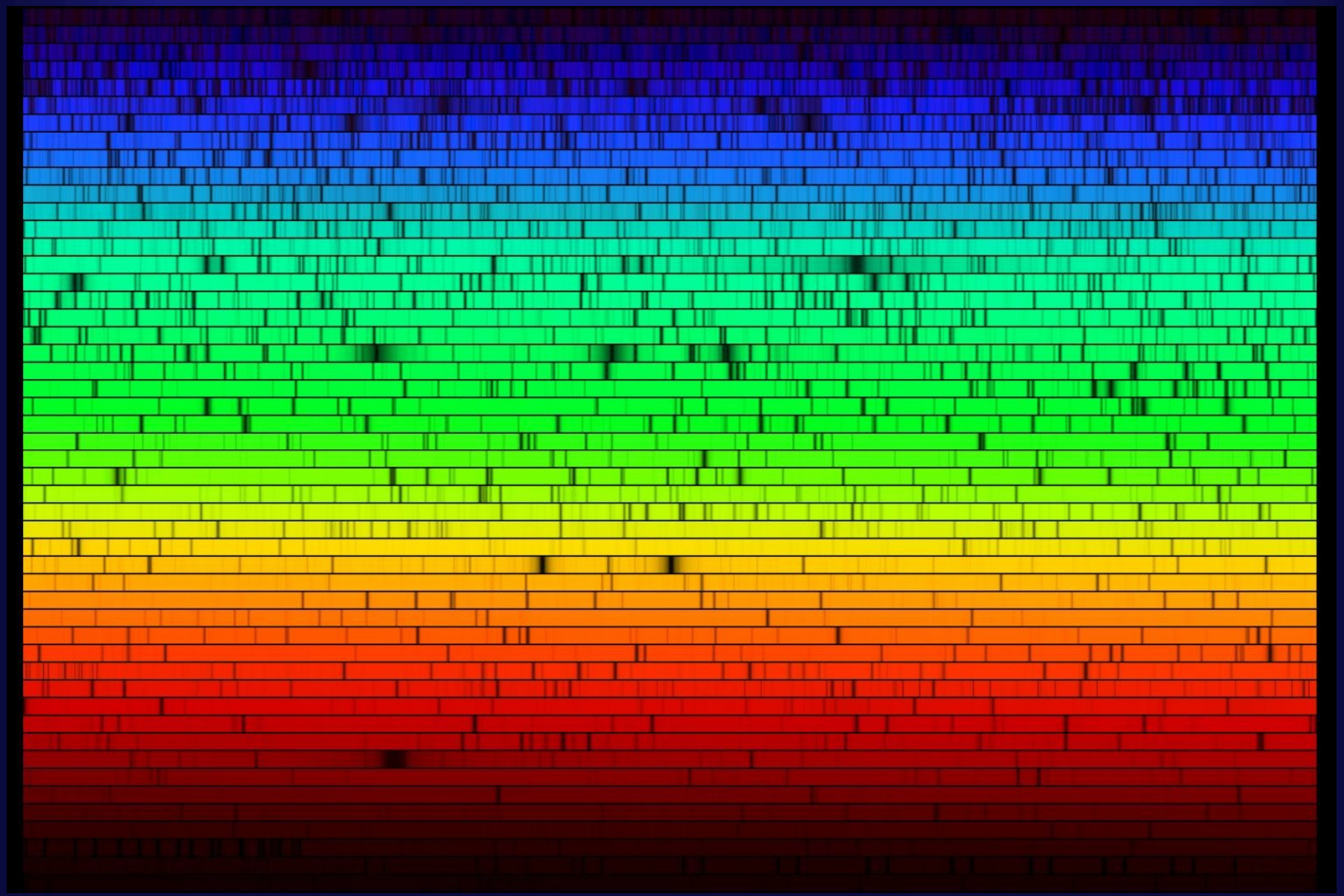
As helium contaminates the core, fusion reaction rates slow

Question

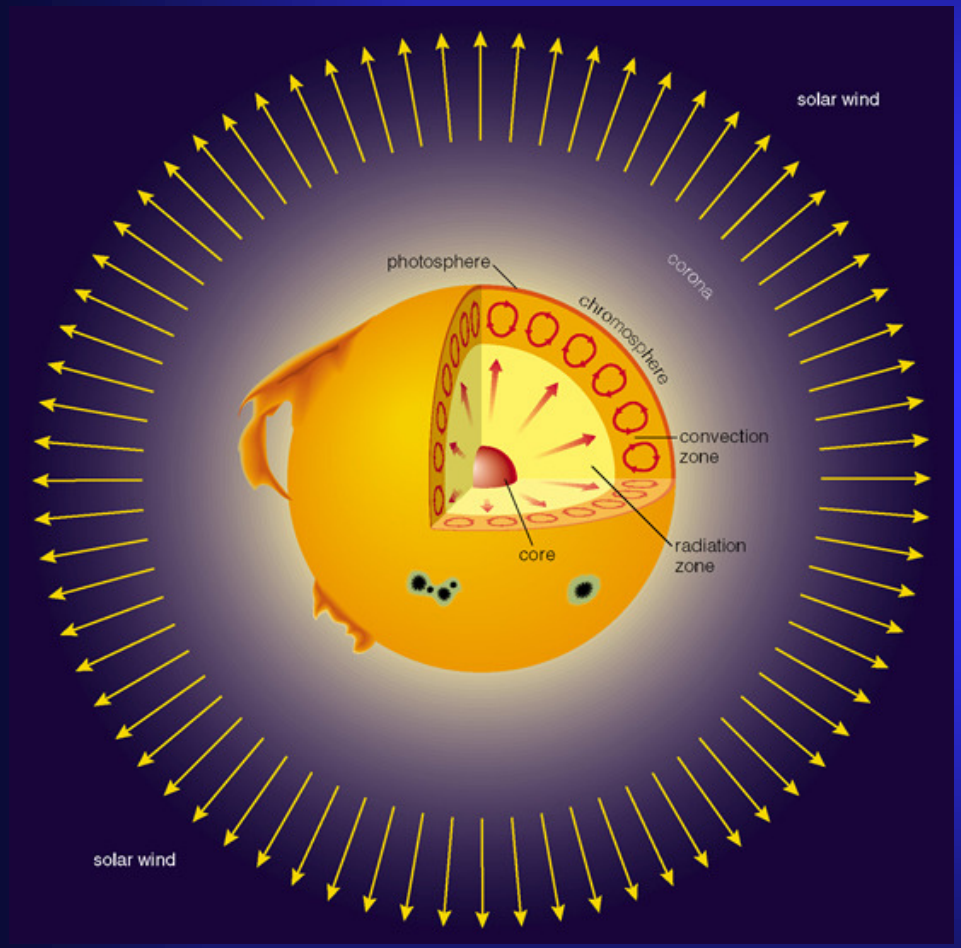
How is the Sun's composition different than it was 1 billion years ago?

A. It has more mass
B. It has less helium
C. It has more hydrogen
D. It has less hydrogen

Absorption



Structure



Hot Dense Core
Fusion happens here

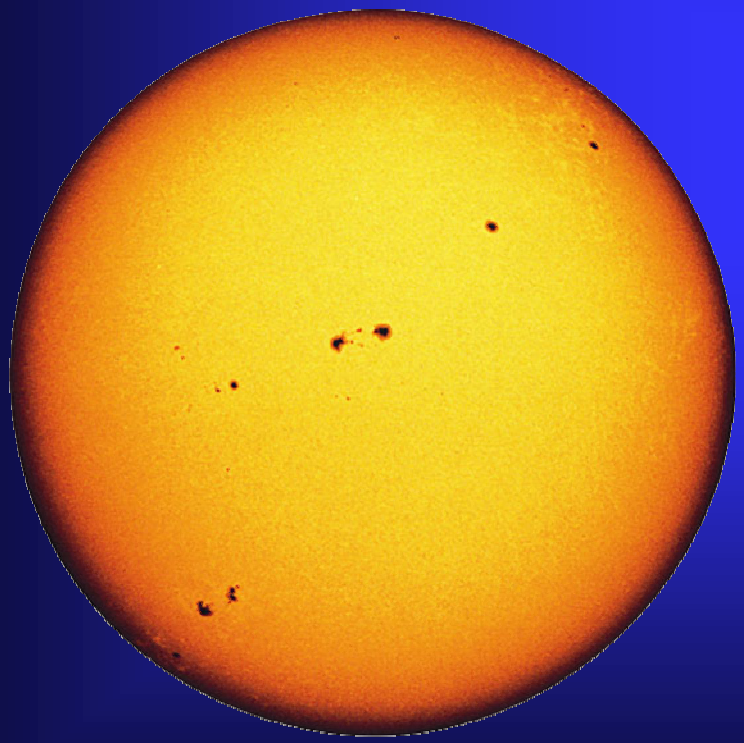
Radiative Zone
Energy carried by photons

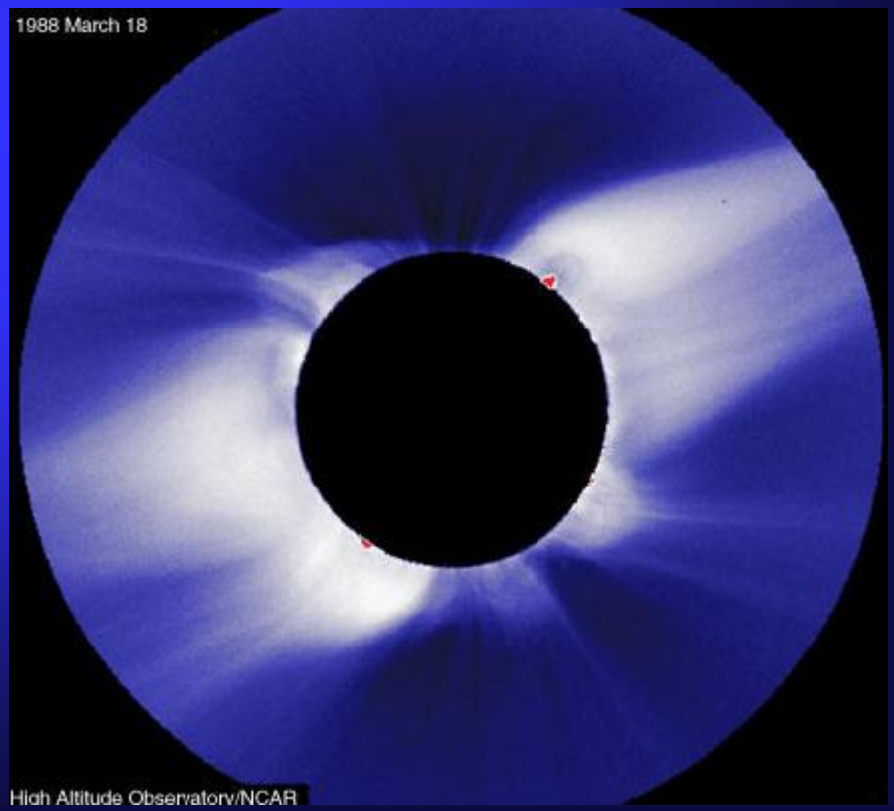
Convective Zone
Energy carried by convection

Photosphere and Corona

The visible surface
Photons escape

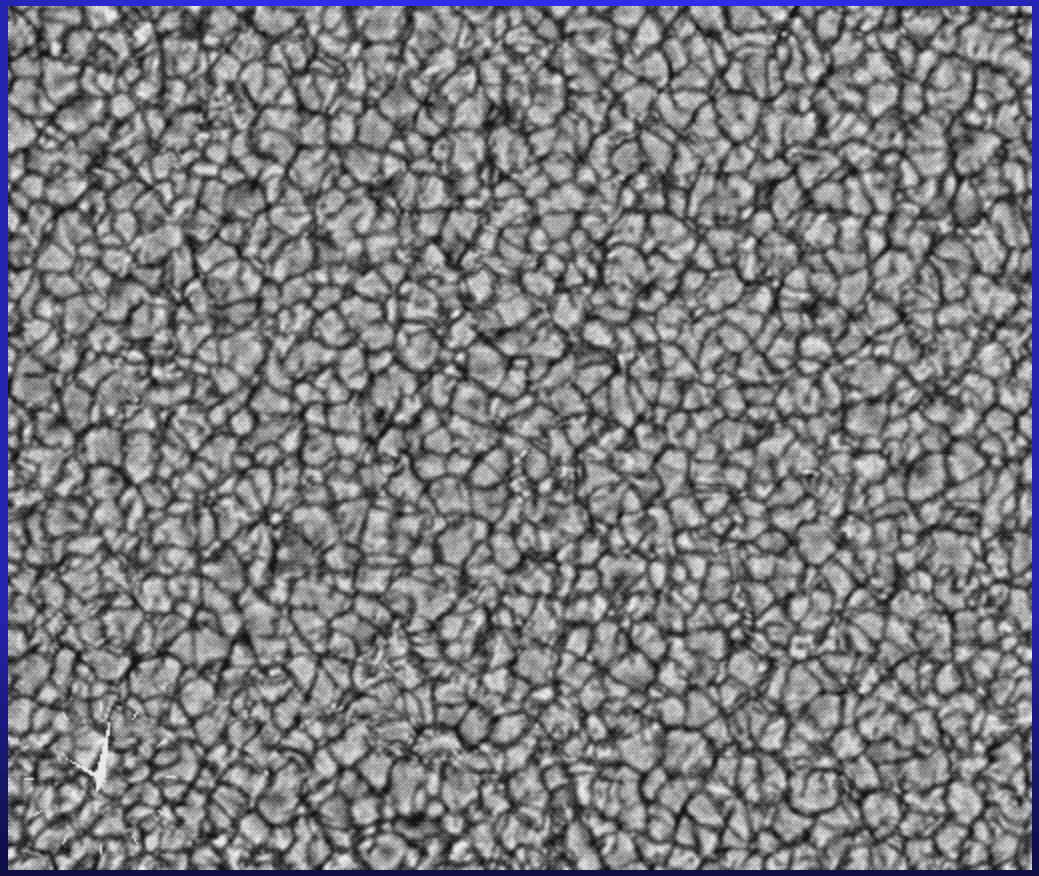
Hot thin
atmosphere





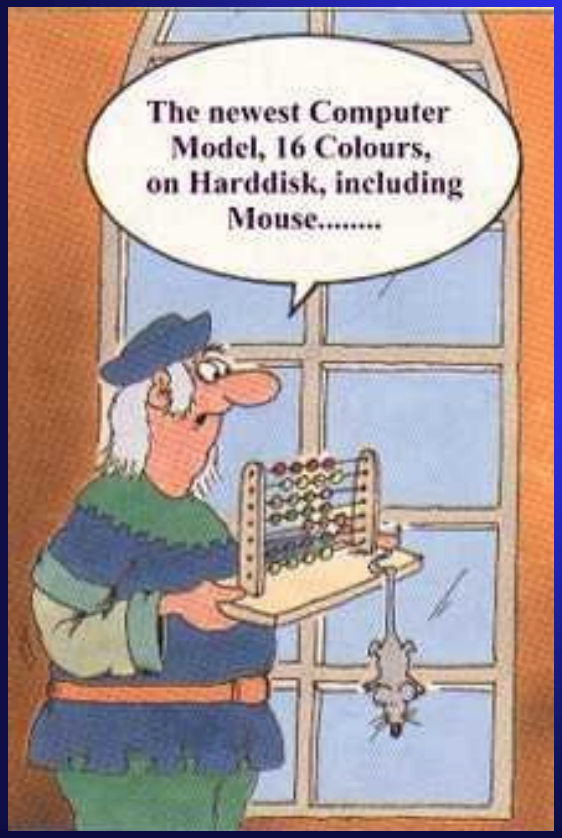
Convection Granules

Evidence of convection is seen on the solar "surface"

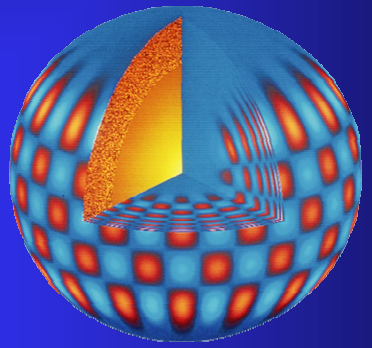


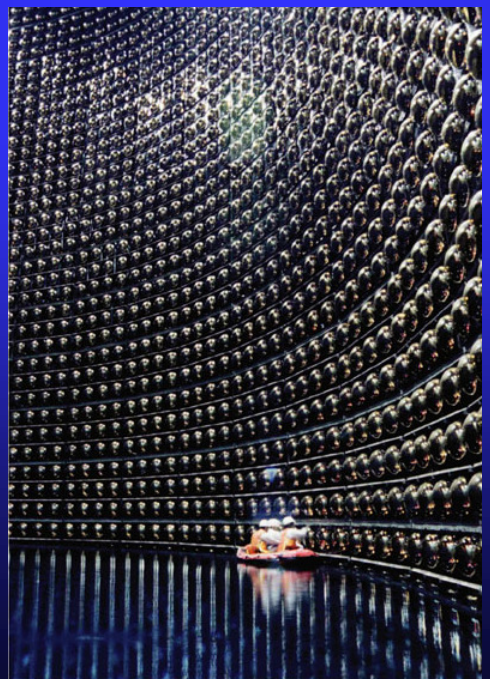
How do We Know?

Mathematical Models



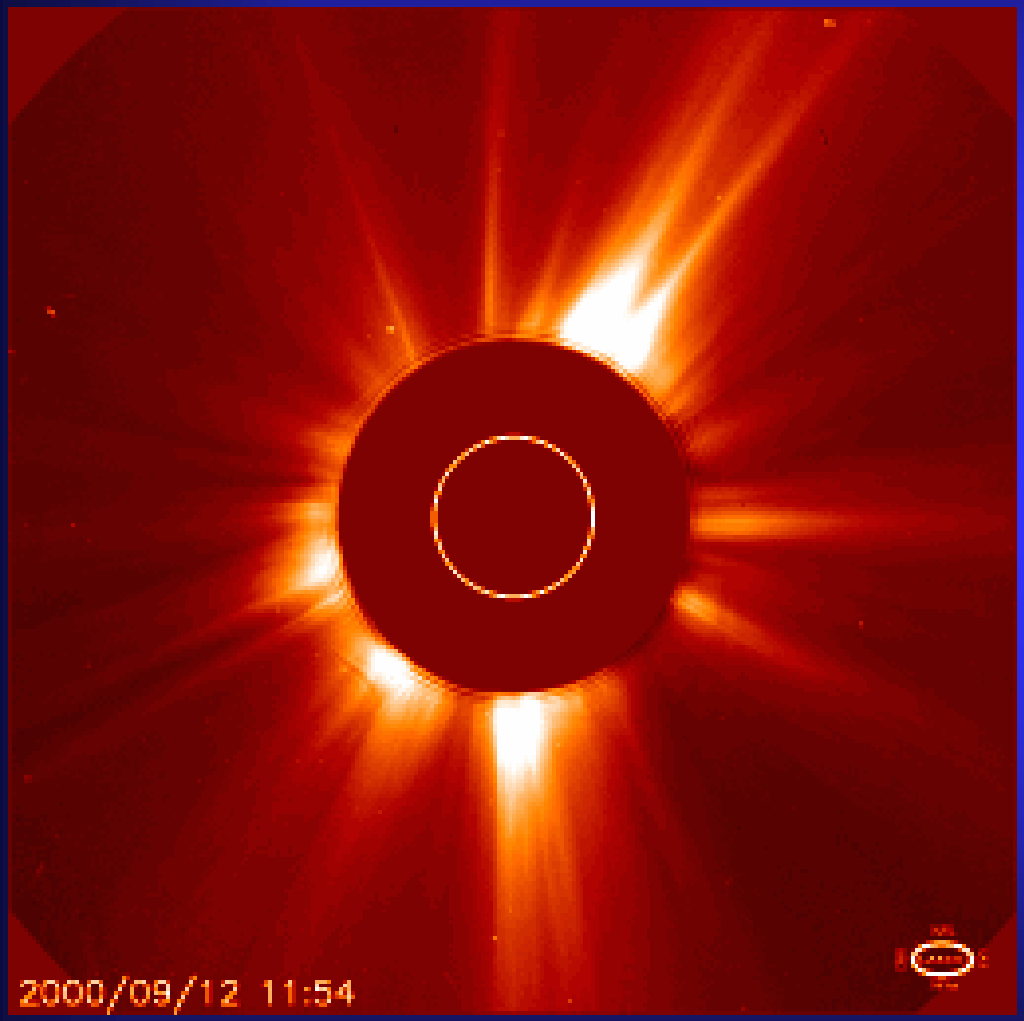
Helioseismology

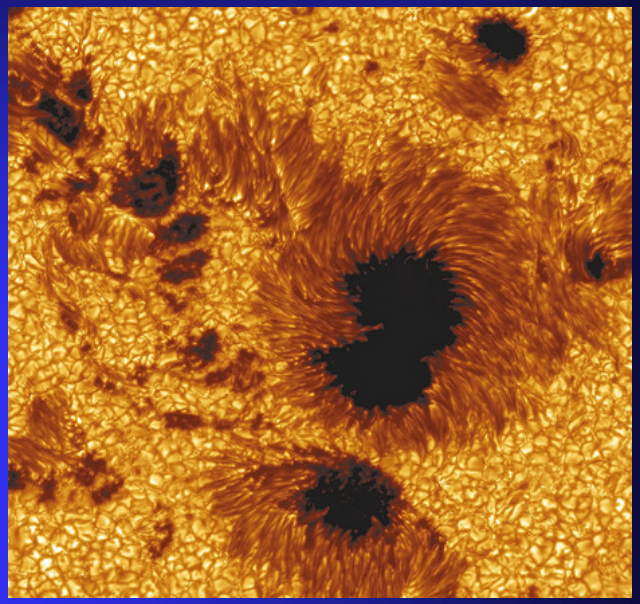




Neutrinos

Solar Weather





Pretty Pictures