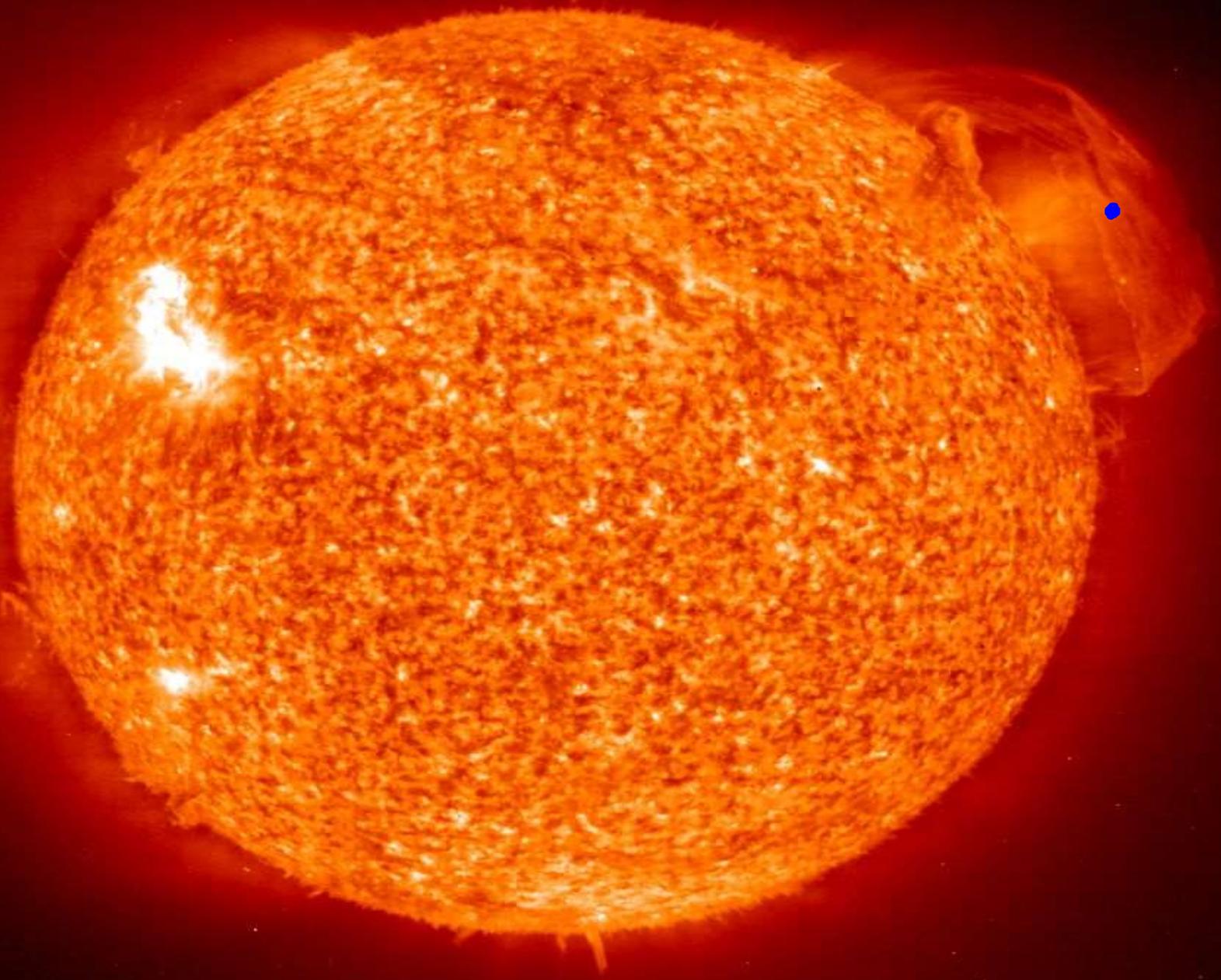
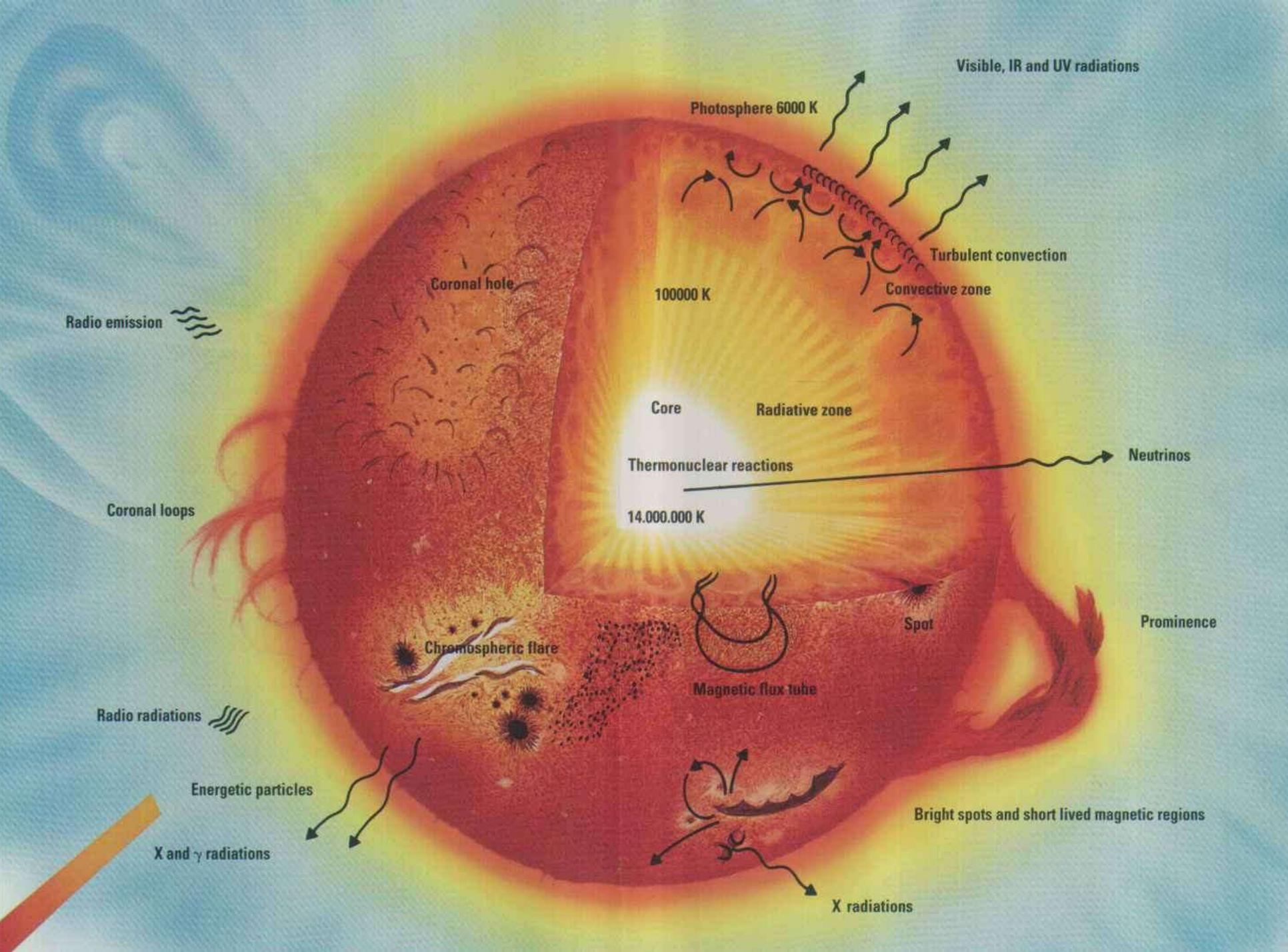


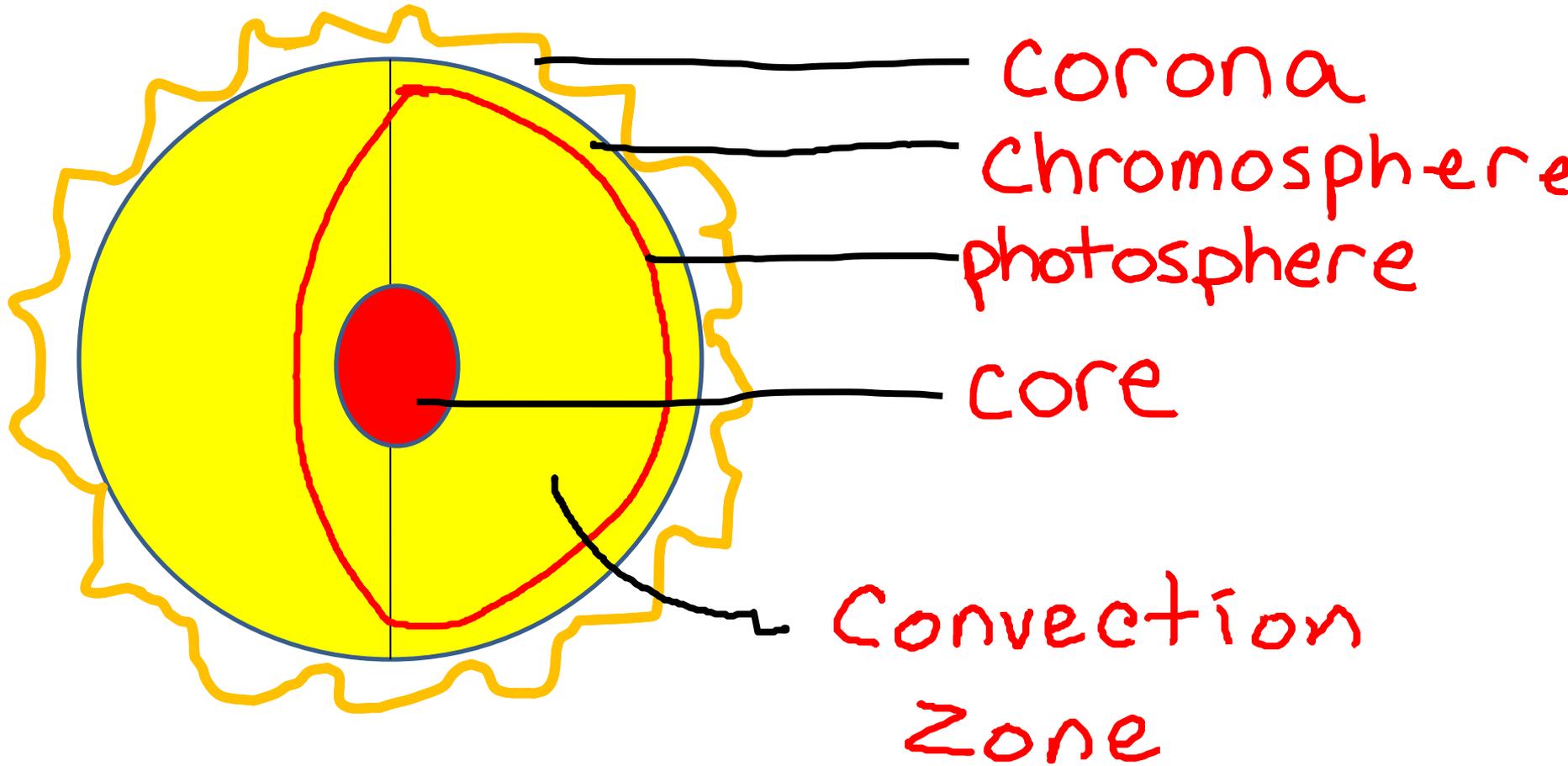
# Sun

Mr. Skirbst

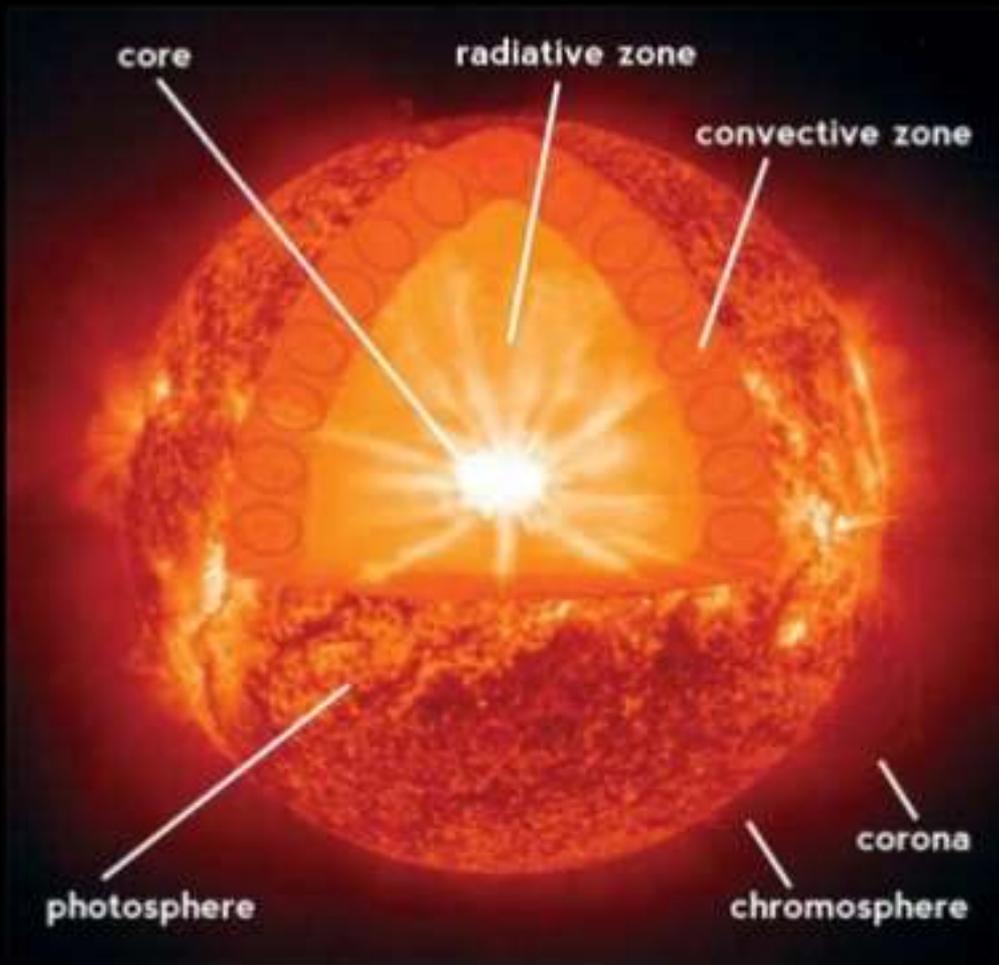




# Sun's Structure



# Sun's Atmosphere



## Three layers

- **Photosphere**
  - Most of sun's light comes from this layer
  - 400 km thick
  - 5,527°C
- **Chromosphere**
  - More helium, redish
  - 2,500km thick
  - 29,727°C
- **Corona**
  - Visible during eclipse
  - Several million km thick
  - 1-2 million degrees C

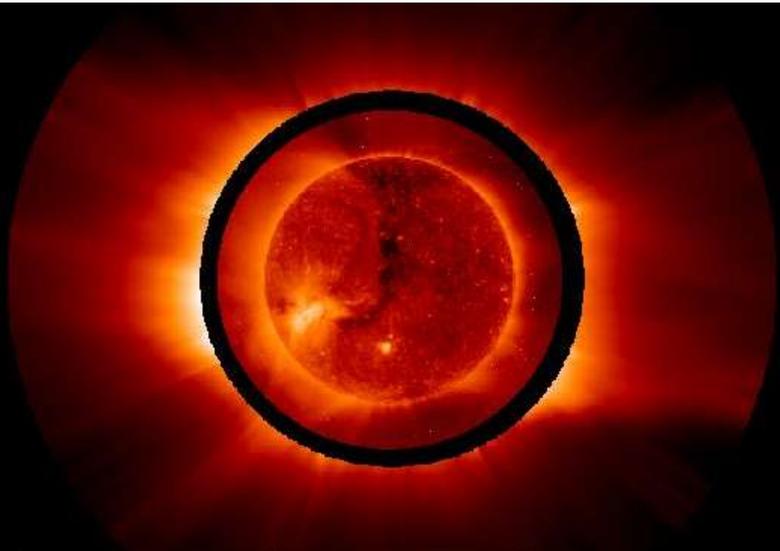
# Corona

**outermost layer of sun's  
atmosphere – means “crown”**

## The Corona

The uppermost layer of the Sun is called the corona, a name meaning “crown”.

You can see why from the picture above: irregular, turbulent blasts of radiation and hot gas (the “solar wind”) constantly boil into space - which make total solar eclipses so spectacular.



# Chromosphere

**middle atmosphere –  
“chromo” means color**

## The Sun's Atmosphere: Chromosphere

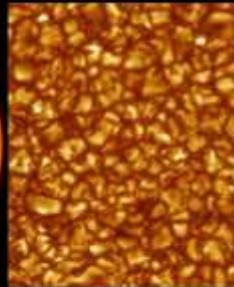
- Middle layer of sun's atmosphere
- Reddish glow that appears during total solar eclipse when moon blocks photosphere
- Hotter than photosphere
- *Chroma* is Greek for color



# Photosphere

“surface” of the sun –  
“photo” means light

## The Sun's Atmosphere: Photosphere



- The inner layer of the sun's atmosphere—the sun's surface layer
- Thick enough to be visible
- Gives off visible light: *photos* is Greek for “light”
- Layer from which the light we actually see (with the human eye) is emitted

# Sun's Internal Structure

- Core

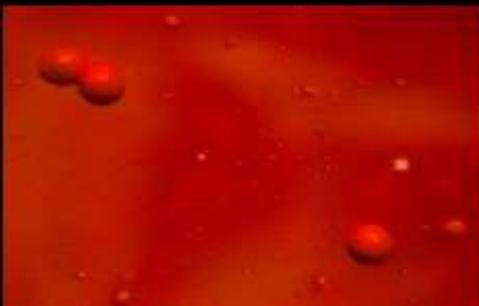
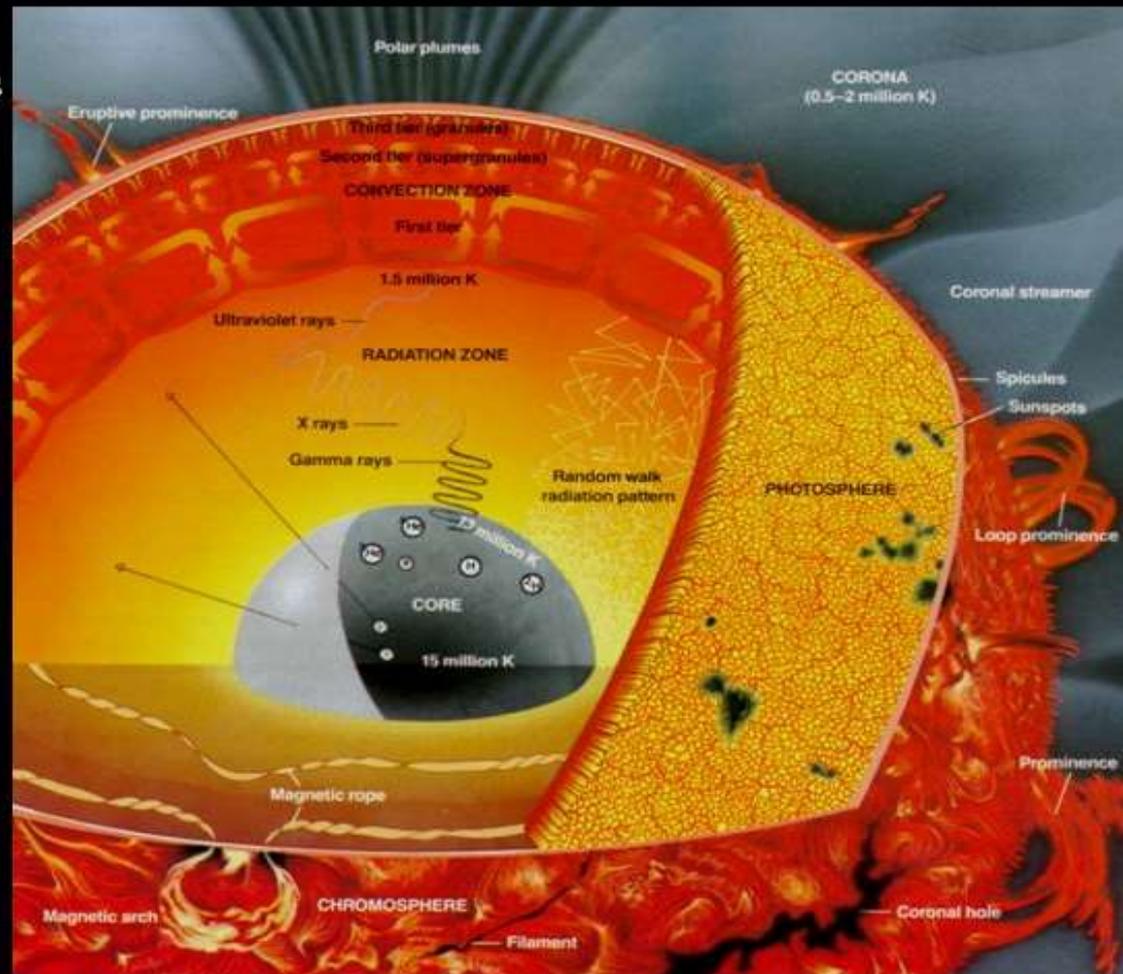
- Where the energy is created.
- Every second, nuclear reactions convert about 700 million tons of hydrogen into helium.

- Radiation Zone

- Where energy is carried by radiation.

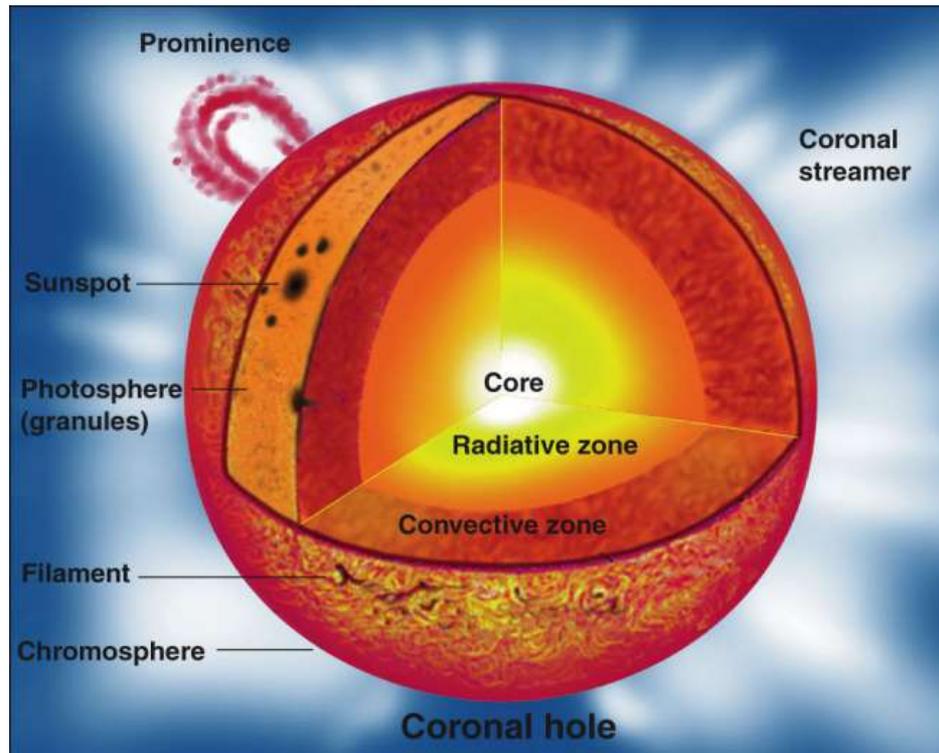
- Convection Zone

- Energy transported by convection (just like boiling soup) where heat is transported to the photosphere.



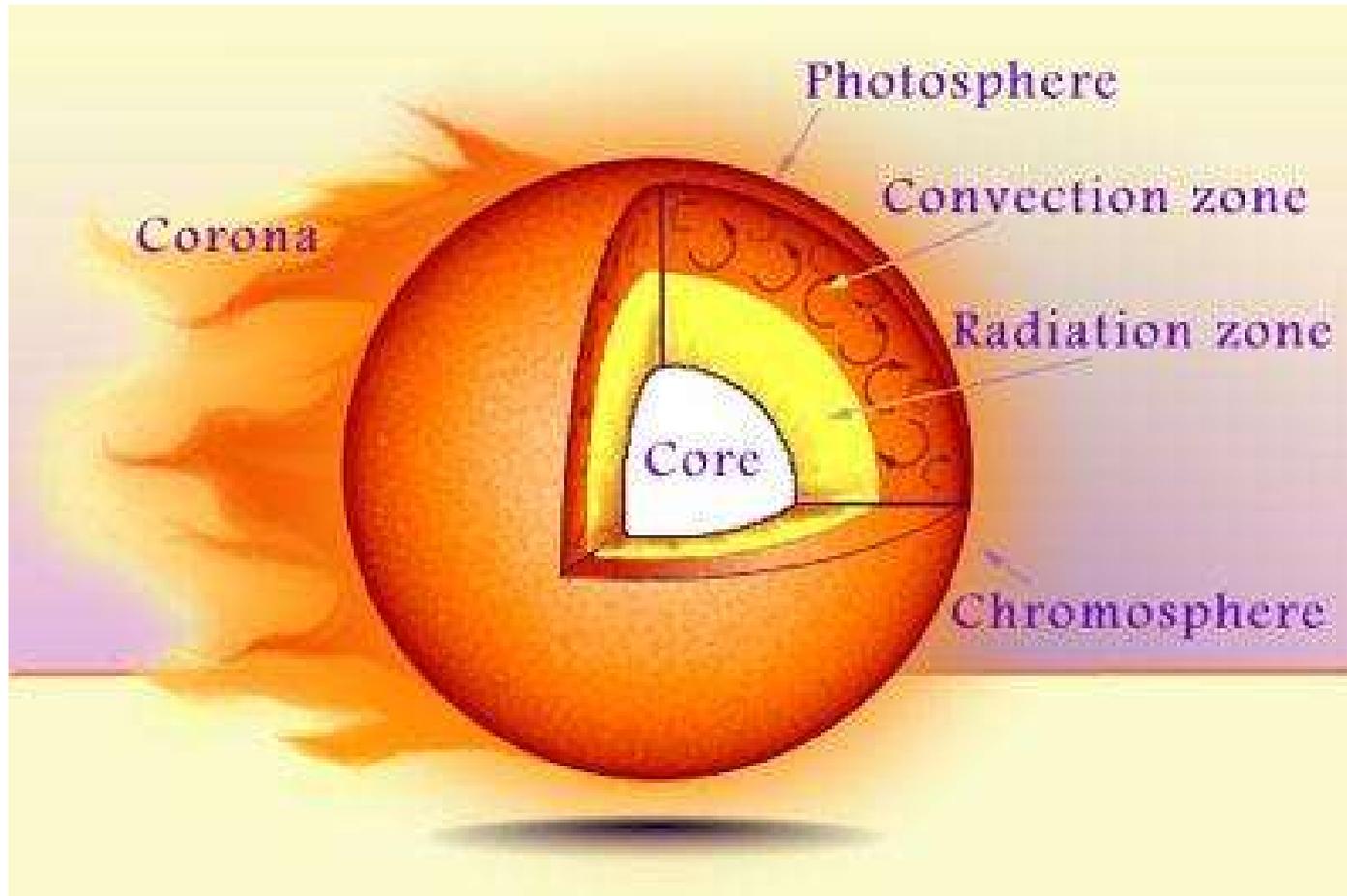
# Convection Zone

energy carried by convection –  
like boiling water



# Radiation Zone

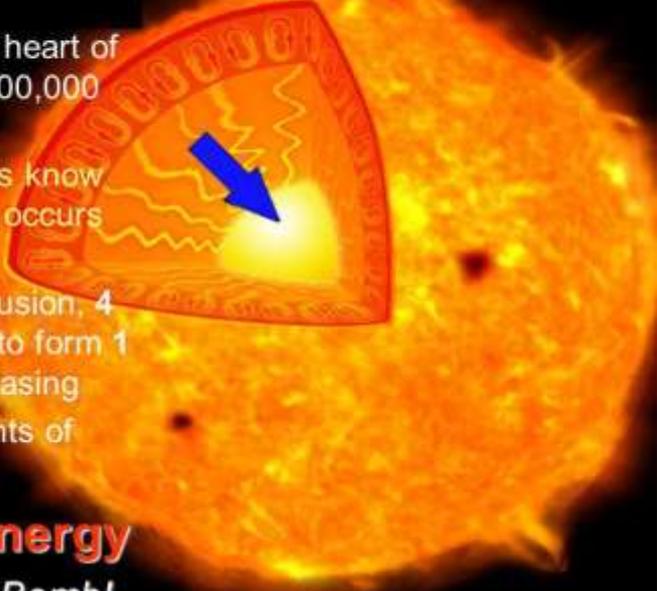
energy carried by radiation



# Core

place of nuclear fusion –

hottest place – hydrogen forms helium



The diagram shows a cross-section of the Sun. The core is the innermost, brightest yellow-white region. A blue arrow points to the core. The surrounding layers are shown in shades of orange and red, with wavy lines representing energy transport. The background is a dark space with stars.

**Core**

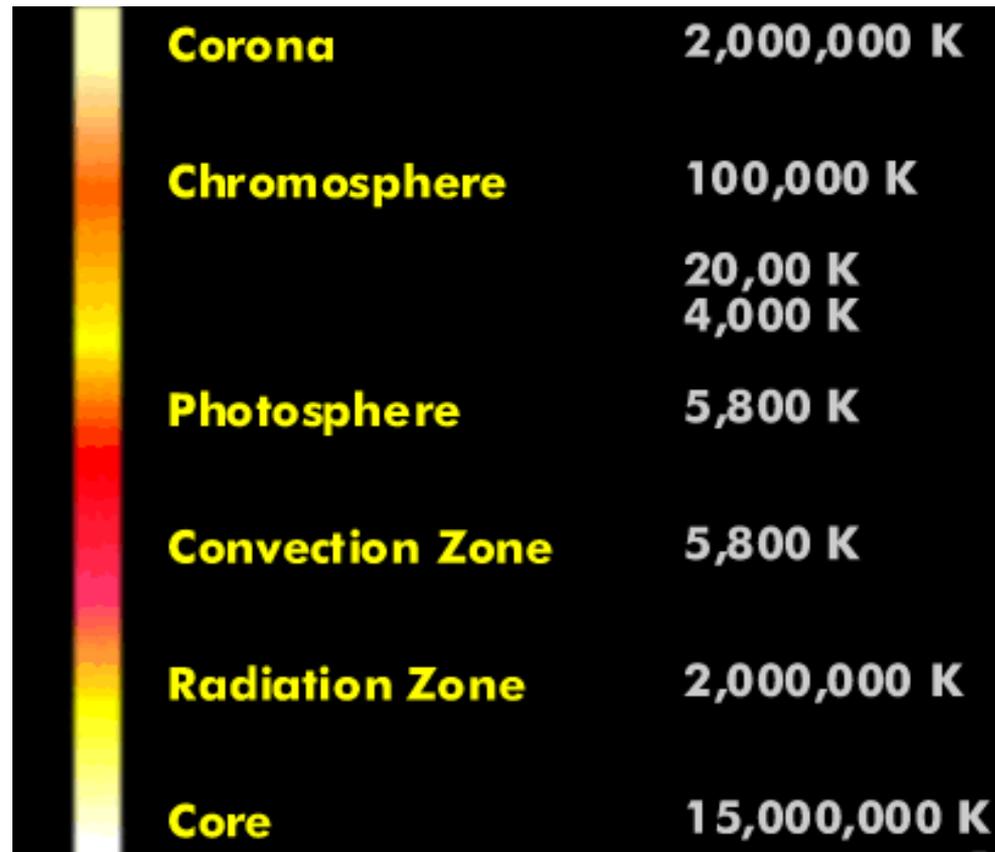
- The core lies in the heart of the sun and is 15,600,000 degrees Celsius
- The nuclear process known as hydrogen fusion occurs in the core
- During Hydrogen Fusion, 4 hydrogen combine to form 1 helium nucleus releasing tremendous amounts of energy
- $4 \text{ H} = 1 \text{ He} + \text{energy}$
- *Think Hydrogen Bomb!*

# Sun Temperatures



# Sun Temperatures

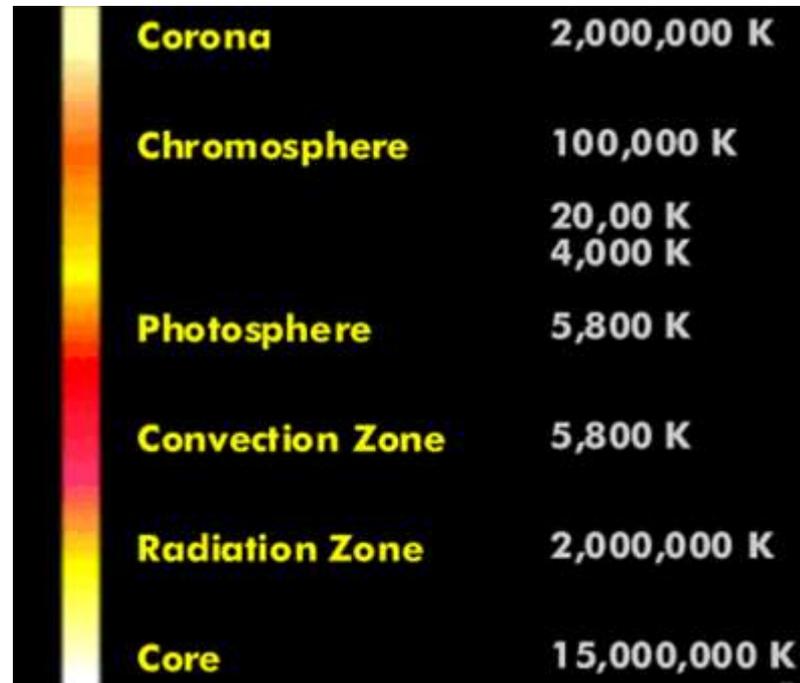
**Core = > 15,000,000 °C**



# Sun Temperatures

Core = > 15,000,000 °C

**Photosphere = 6,000 °C**

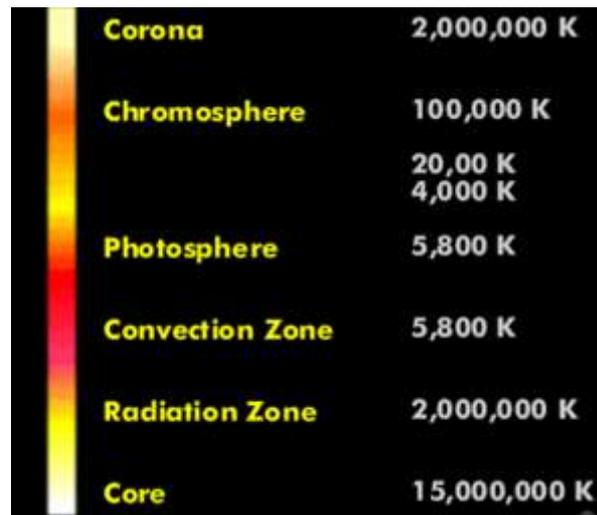


# Sun Temperatures

Core = > 15,000,000 °C

Photosphere = 6,000 °C

**Chromosphere = 27,800 °C**



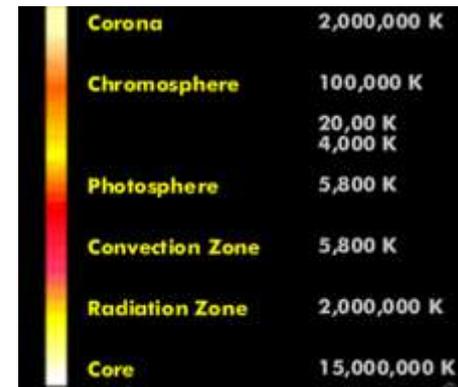
# Sun Temperatures

Core = > 15,000,000 °C

Photosphere = 6,000 °C

Chromosphere = 27,800 °C

**Corona = 1,700,000 °C**



# Solar Activity

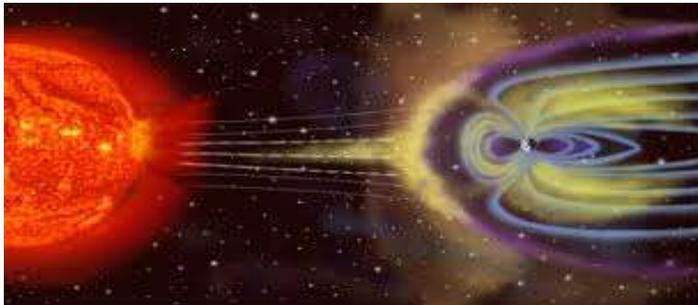
**Prominence**

**Solar Flare**

**Sunspots**

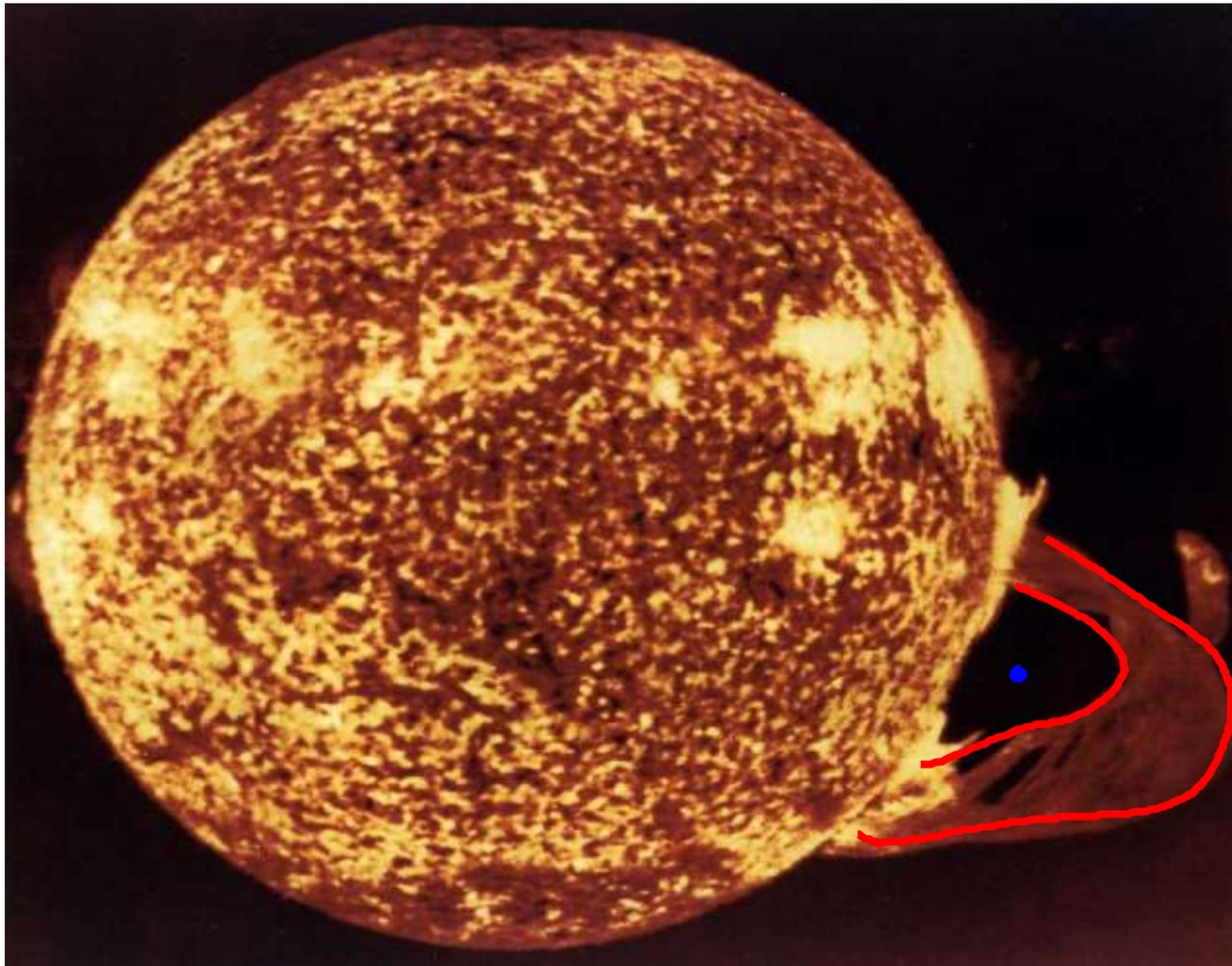
**Solar Wind**

**CMEs**



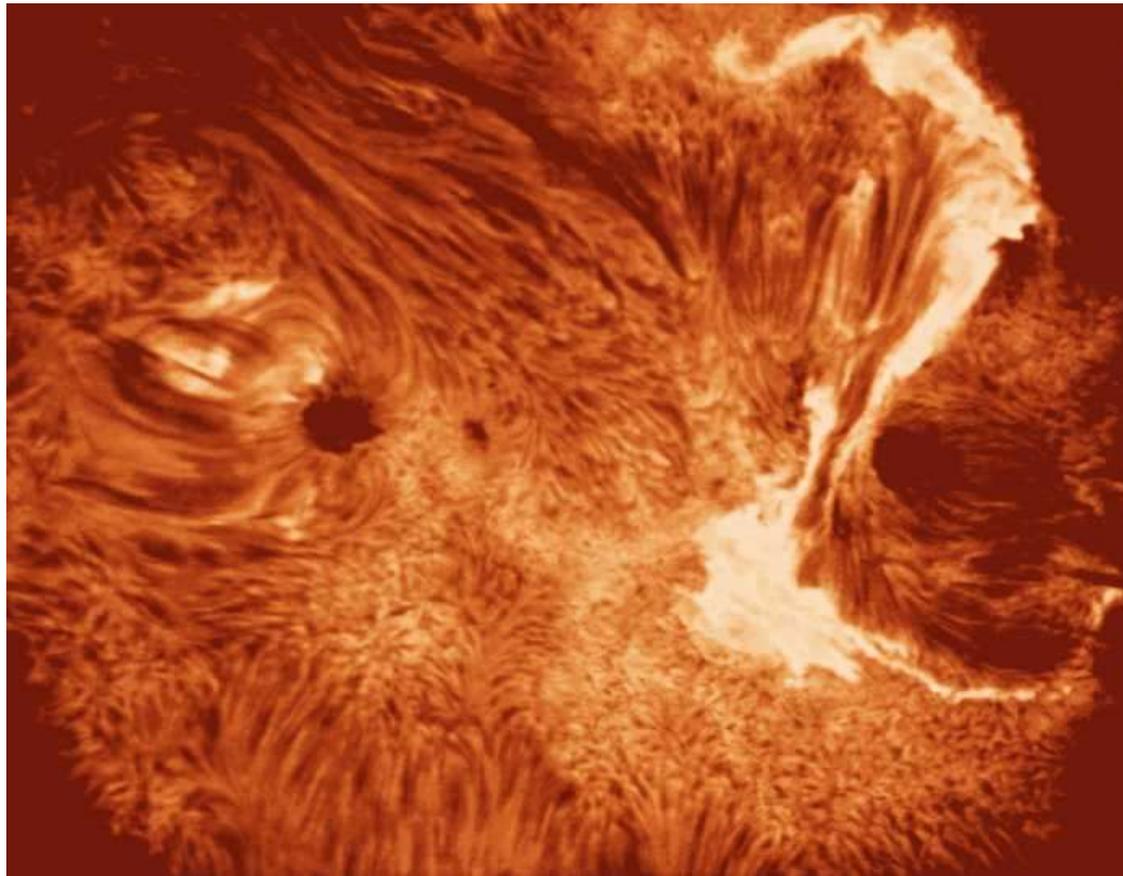
# Prominence

huge bright arches or loops of gas



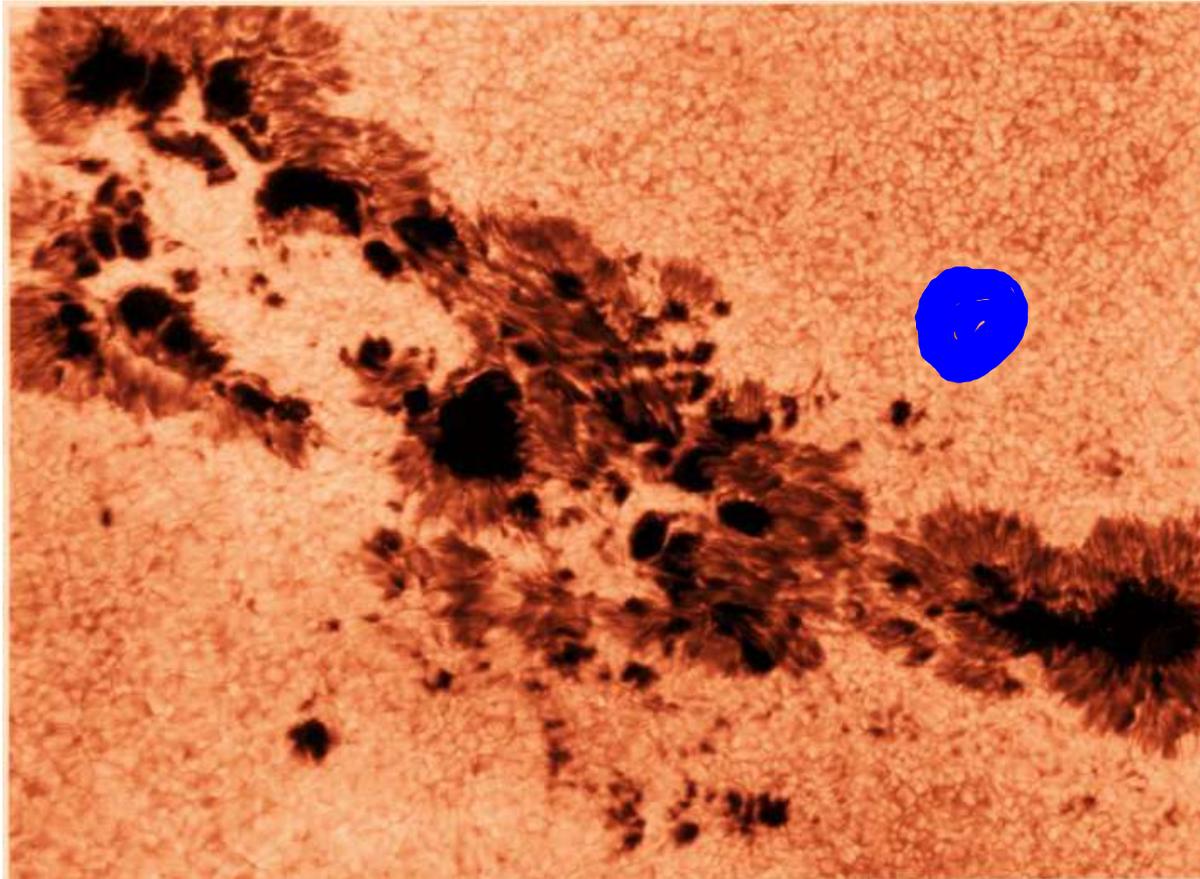
# Solar Flare

**burst of light on photosphere  
(temp 2x – bright & hot)**



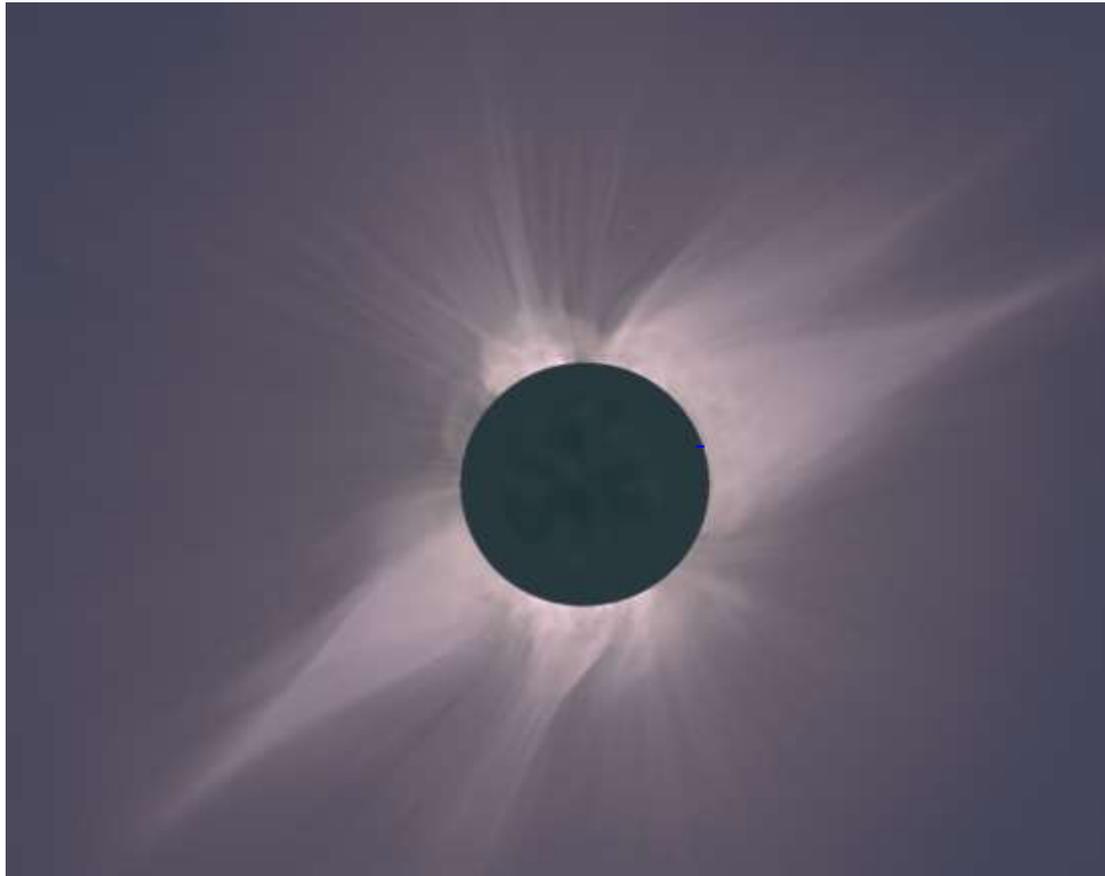
# Sunspots

dark, cooler areas on sun's surface  
(solar storms)



# Solar Wind

**continuous stream of high energy  
from corona**



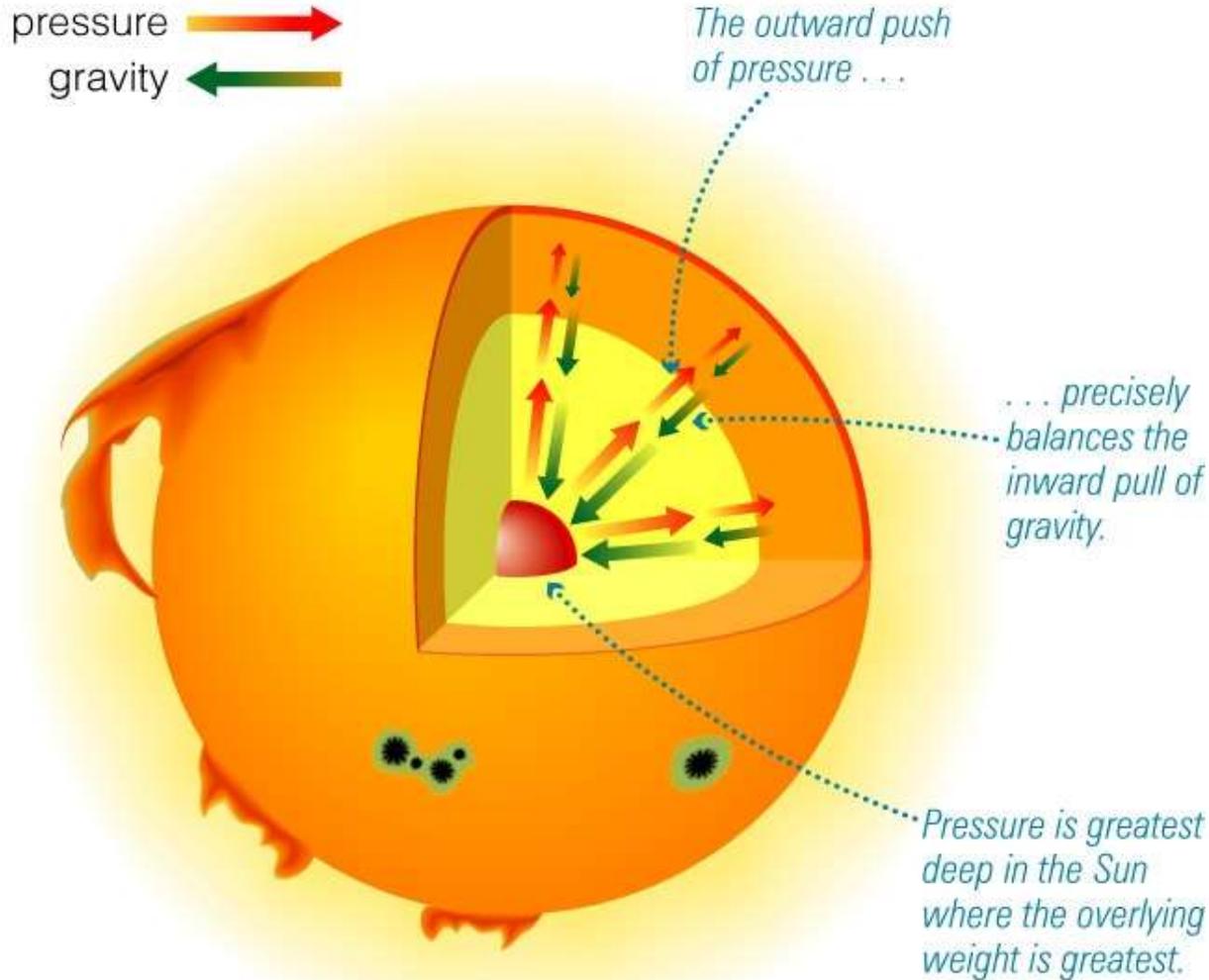
# Coronal Mass Ejection (CME)

unusually large release of plasma  
and magnetic field from corona



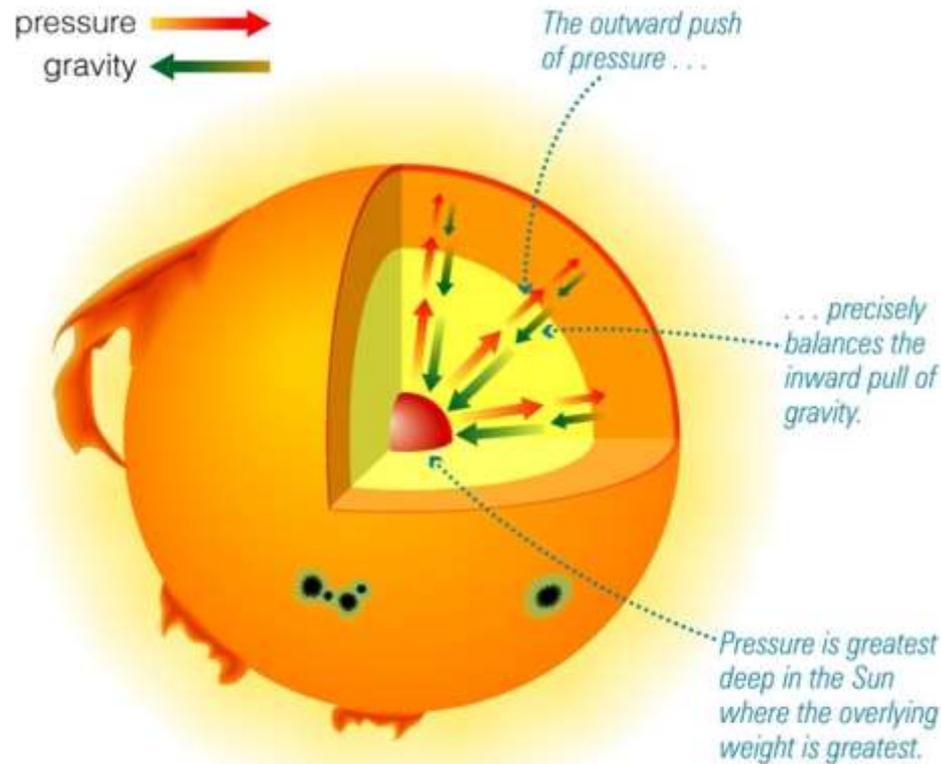
# Life Cycle of Sun

pressure   
gravity 



# Life Cycle of Sun

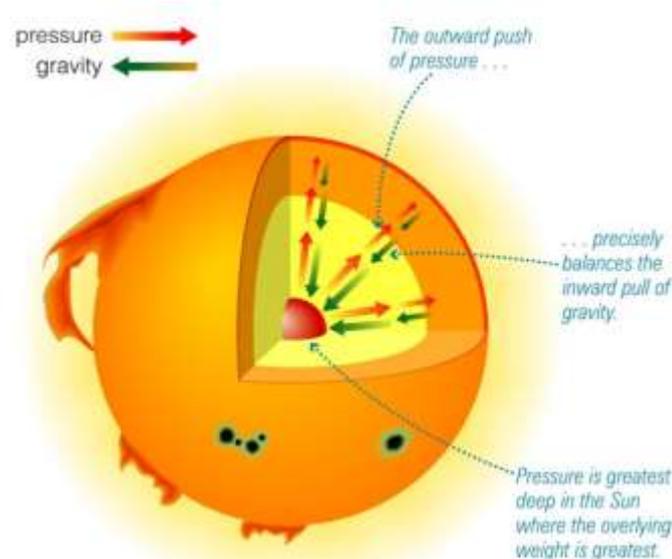
## 10 billion-year “battle of the bulge”



# Life Cycle of Sun

10 billion-year “battle of the bulge”

**pressure vs. gravity:**  
**powered by nuclear fusion**



# Life Cycle of Sun

10 billion-year “battle of the bulge”

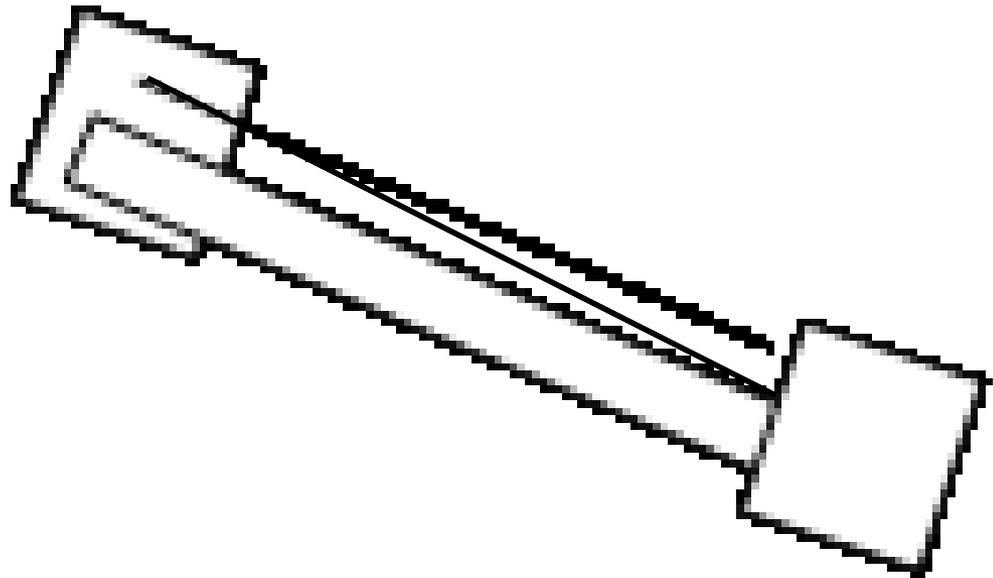
pressure vs. gravity:

powered by nuclear fusion

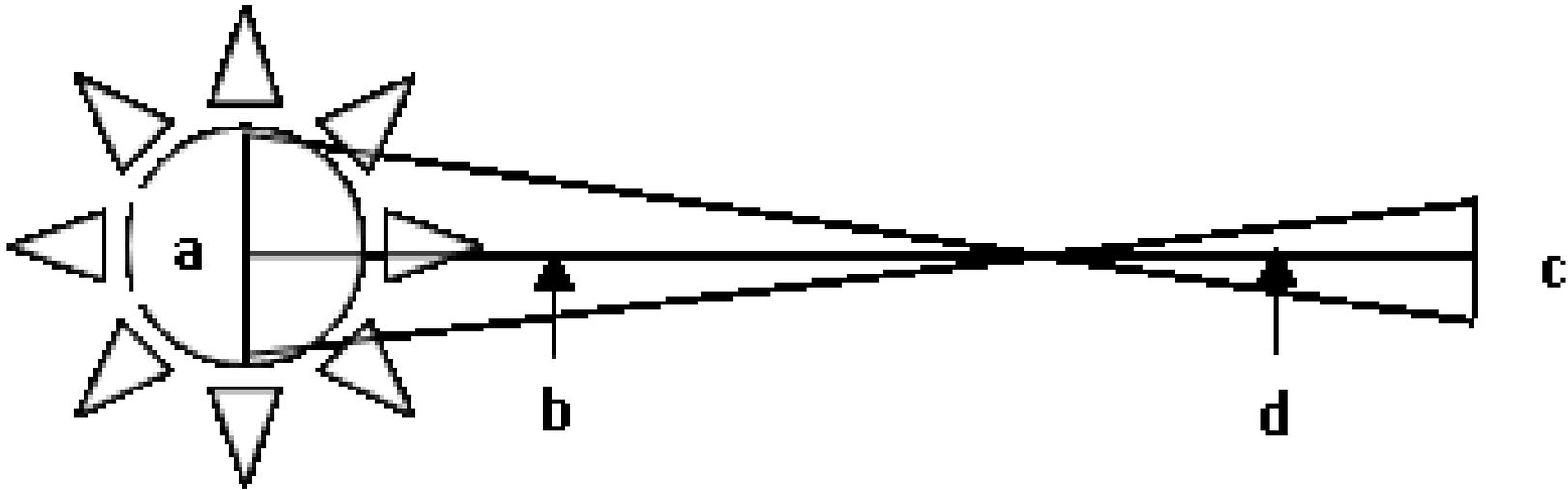
**when fuel runs out, gravity wins**



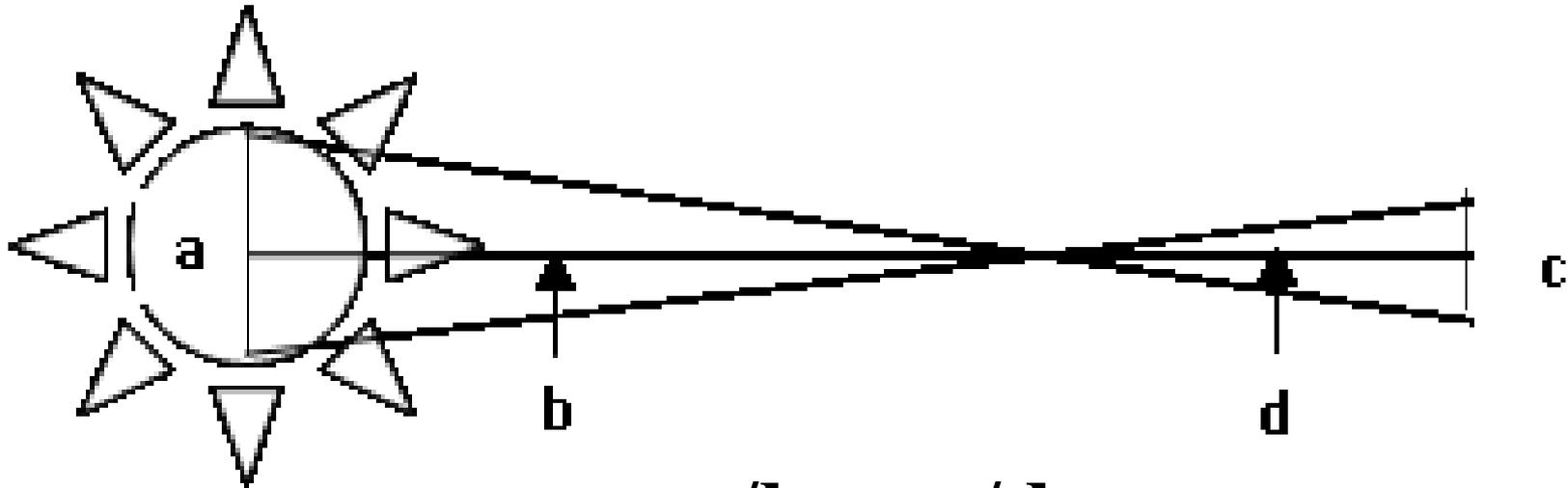
# How Big is the Sun?



# How Big is the Sun?



# How Big is the Sun?



$$a/b = c/d$$

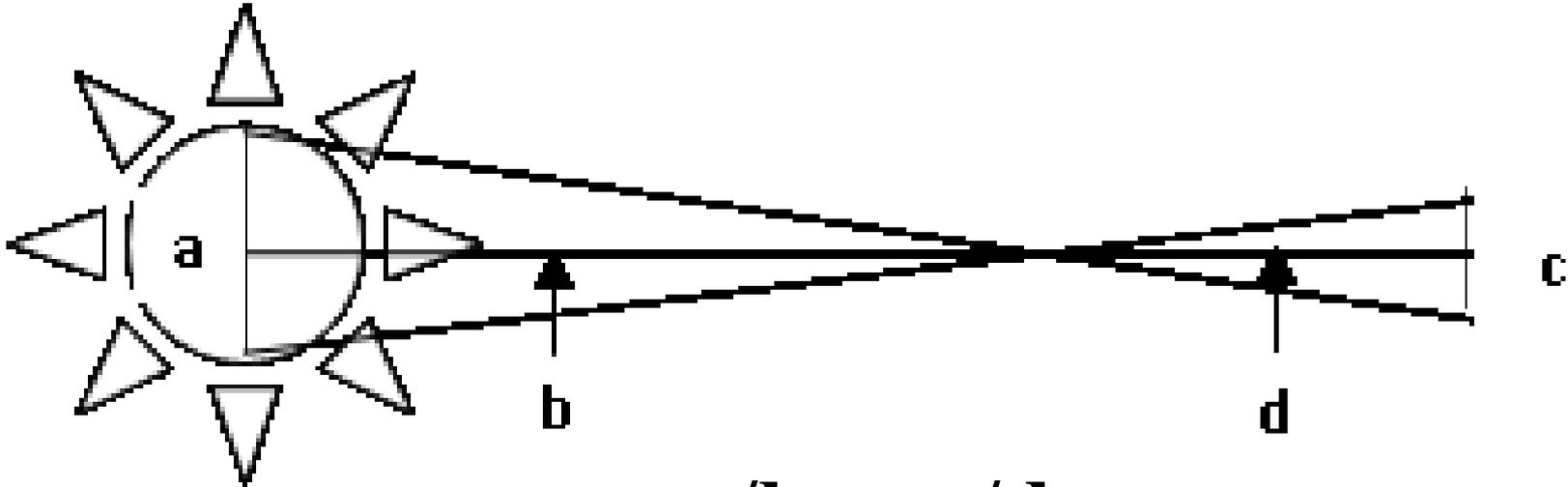
**a =**

**b =**

**c =**

**d =**

# How Big is the Light?



$$a/b = c/d$$

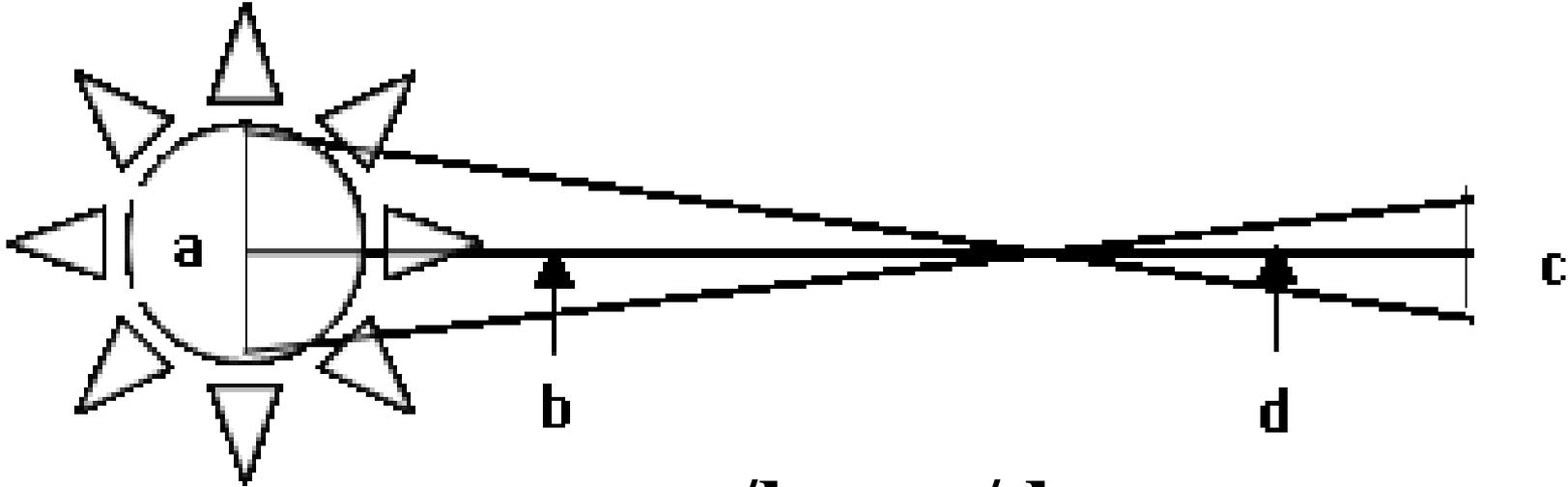
**a = *X* cm**

**b = 1000 cm**

**c = 0.1 cm**

**d = \_\_\_ cm**

# How Big is the Light?



$$a/b = c/d$$

$$a = X \text{ cm}$$

$$b = 1000 \text{ cm}$$

$$c = 0.1 \text{ cm}$$

$$d = \underline{\quad} \text{ cm}$$

$$\frac{X}{1000} = \underline{0.1}$$