explore SPACE

A Cosmic Journey

Sun is A Dynamic Star

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Bentonville Public Library
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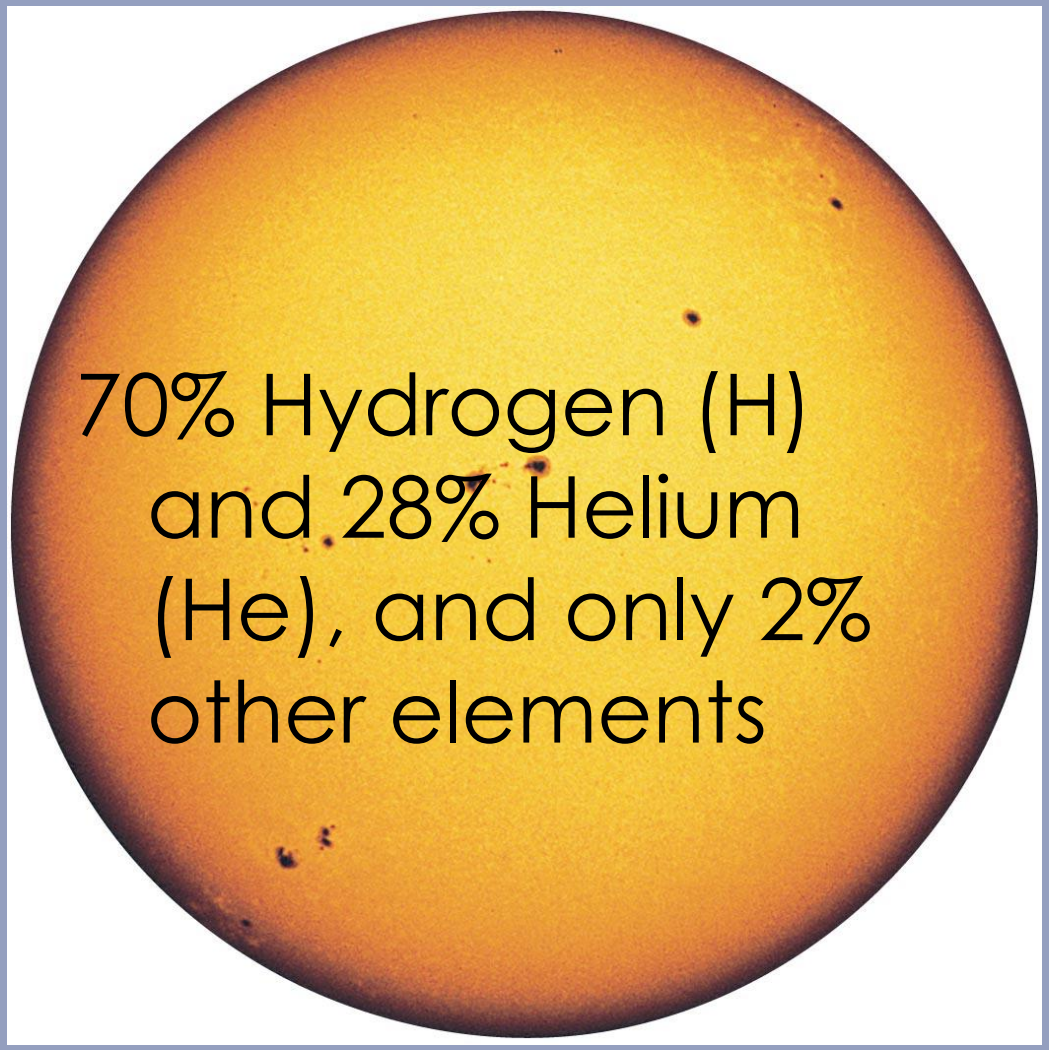
Overview

* Basics
* Energy Source
* History
* Food production
* Sunspots
* CME
* Solar wind
* Energy production

The Basics



Radius:

6.9×10^8 m

(109 times Earth)

Mass:

2×10^{30} kg

(300,000 Earths)

Volume:

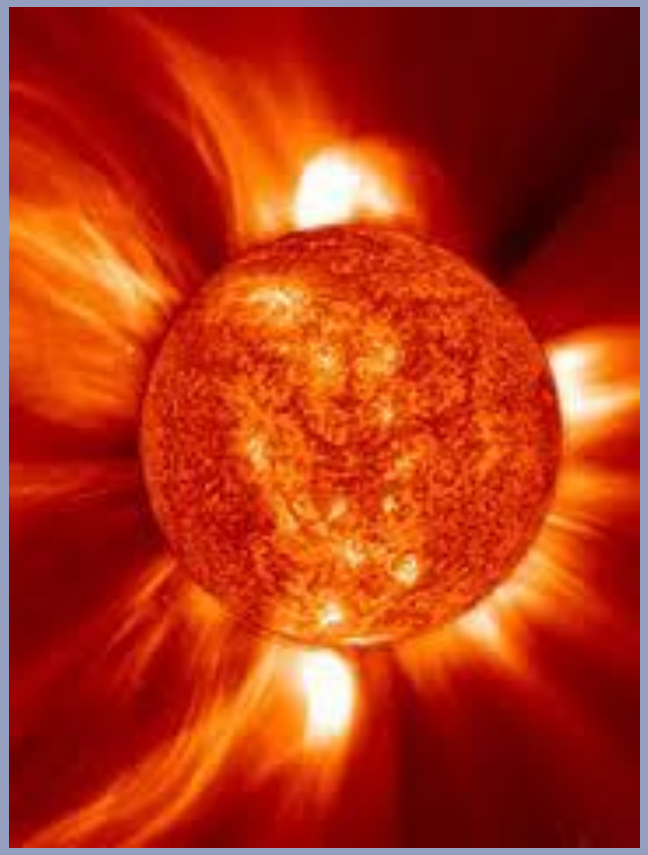
~ 1 million Earths

Luminosity:

3.8×10^{26} watts

The Basics

Hydrogen	91.2	71.0
Helium	8.7	27.1
Oxygen	0.078	0.97
Carbon	0.043	0.40
Nitrogen	0.0088	0.096
Silicon	0.0045	0.099
Magnesium	0.0038	0.076
Neon	0.0035	0.058
Iron	0.030	0.014
Sulfur	0.015	0.040



Fe/H: 0.00032

Keller's Star

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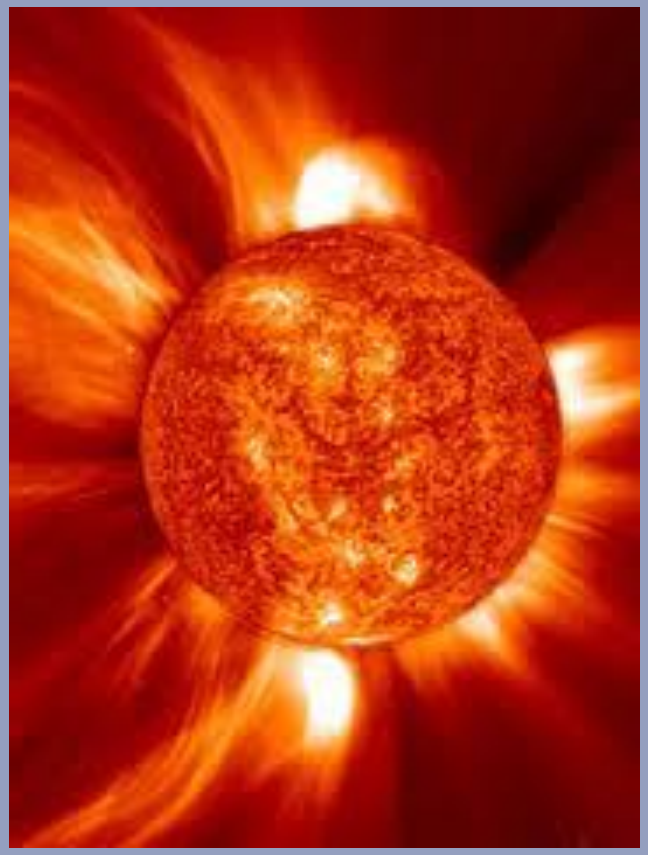

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Our Sun

* For centuries humans wondered about, and worshipped, the Sun

Our Sun

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Sun Shine?

* Is sunshine like fire? (a chemical bonding change)

$$\frac{\text{Chemical energy content}}{\text{Luminosity}}$$

~ 10,000 years

So… No.

Sun Shine?

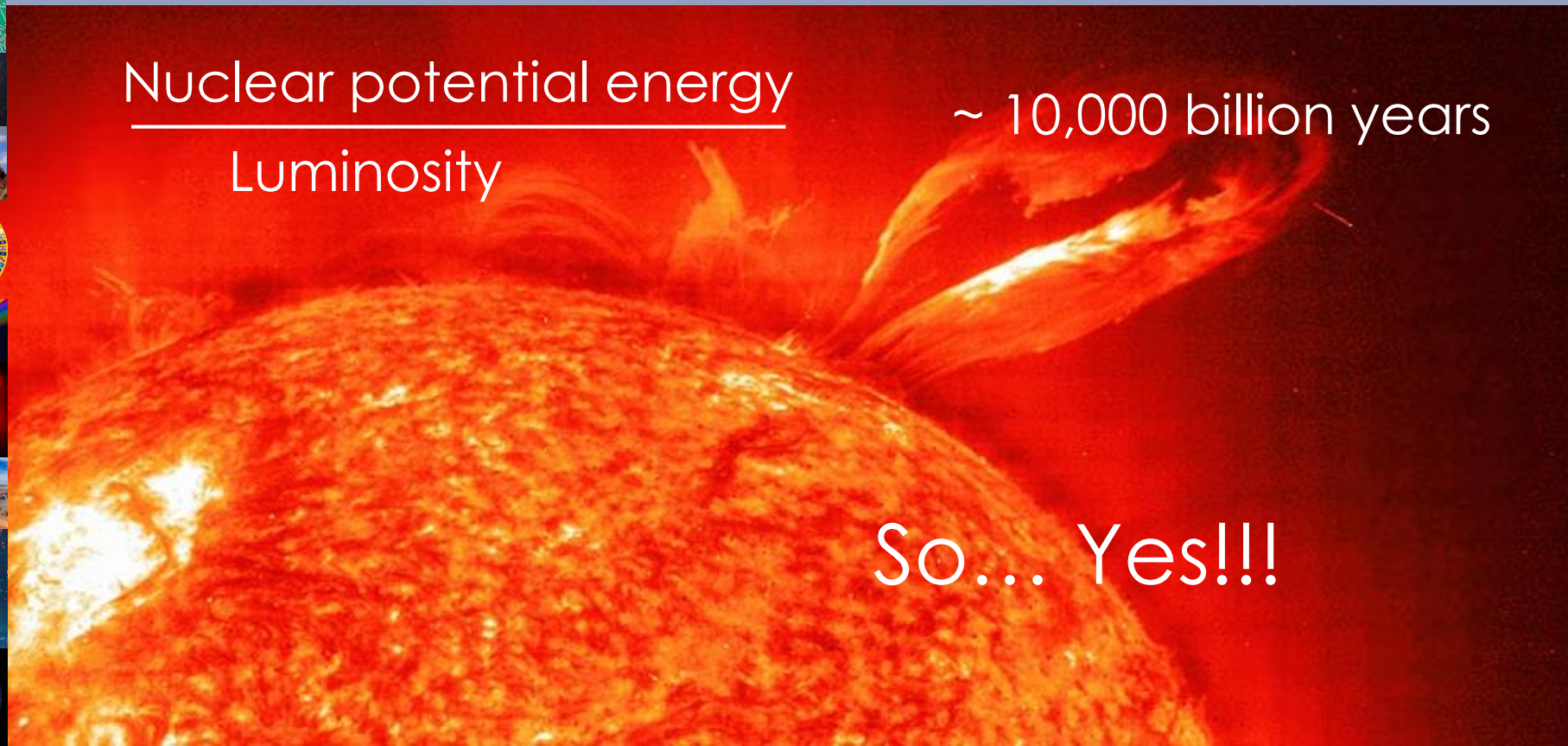
* Is the sun contracting?

$$\frac{\text{Gravitational potential energy}}{\text{Luminosity}} \sim 25{,}000 \text{ million years}$$

So… No.

Sun Shine?

* Is sunshine due to nuclear energy? (a chemical bonding change)



$$\frac{\text{Nuclear potential energy}}{\text{Luminosity}}$$

~ 10,000 billion years

So… Yes!!!

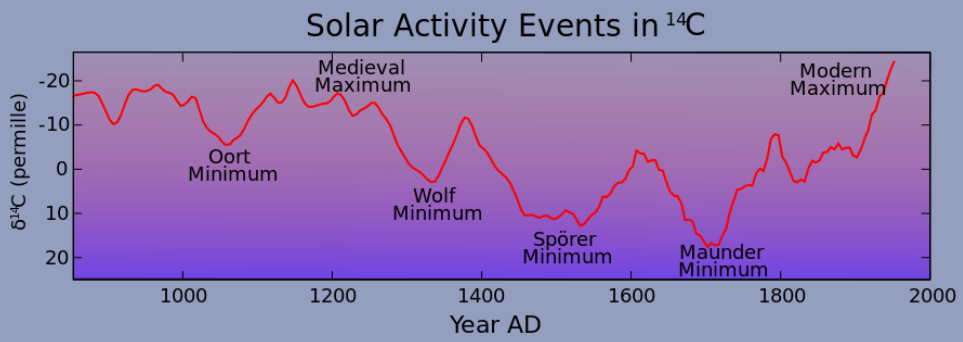
History

* 150 CE Greek scholar Claudius Ptolemy writes *Almagest*

* 1543 Nicolaus Copernicus publishes *On the Revolutions of the Celestial Spheres*

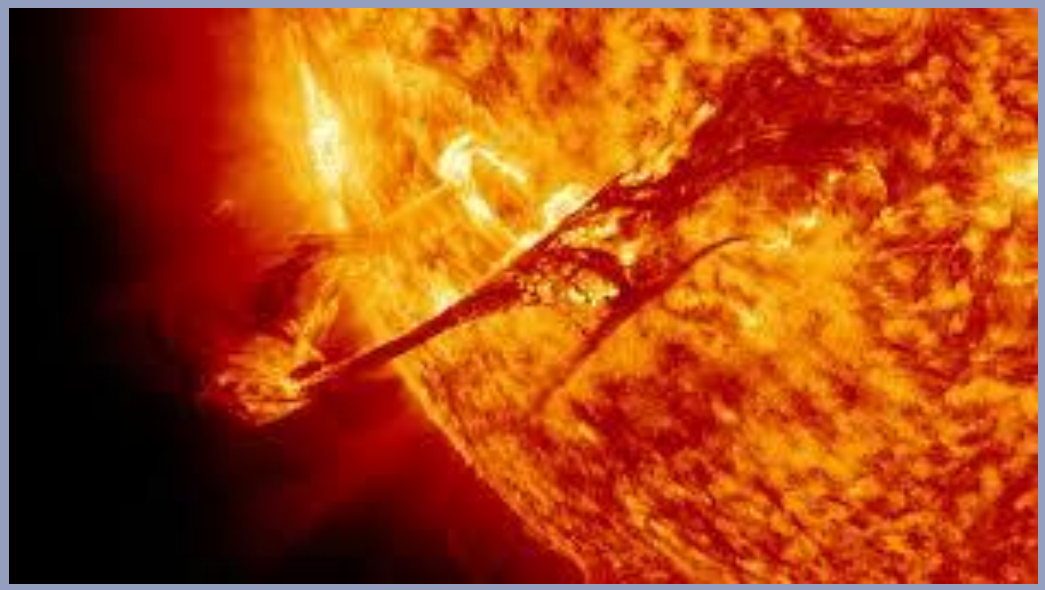
History

* 1610 First observations of sunspots through a telescope made independently by both Galileo Galilei and Thomas Harriot
* 1645-1715 Maunder Minimum Sunspot activity declines to almost zero
    Corresponds with "Little Ice Age



Changes in the Sun

* Neutrinos leave the sun all the time. When there is a solar prominence or CME (coronal mass ejection) there are more.



STEREO

* When

SDO

* When

Hinode

* When

SOHO

* Solar and Heliospheric Observatory

Changes on Earth

Aurora

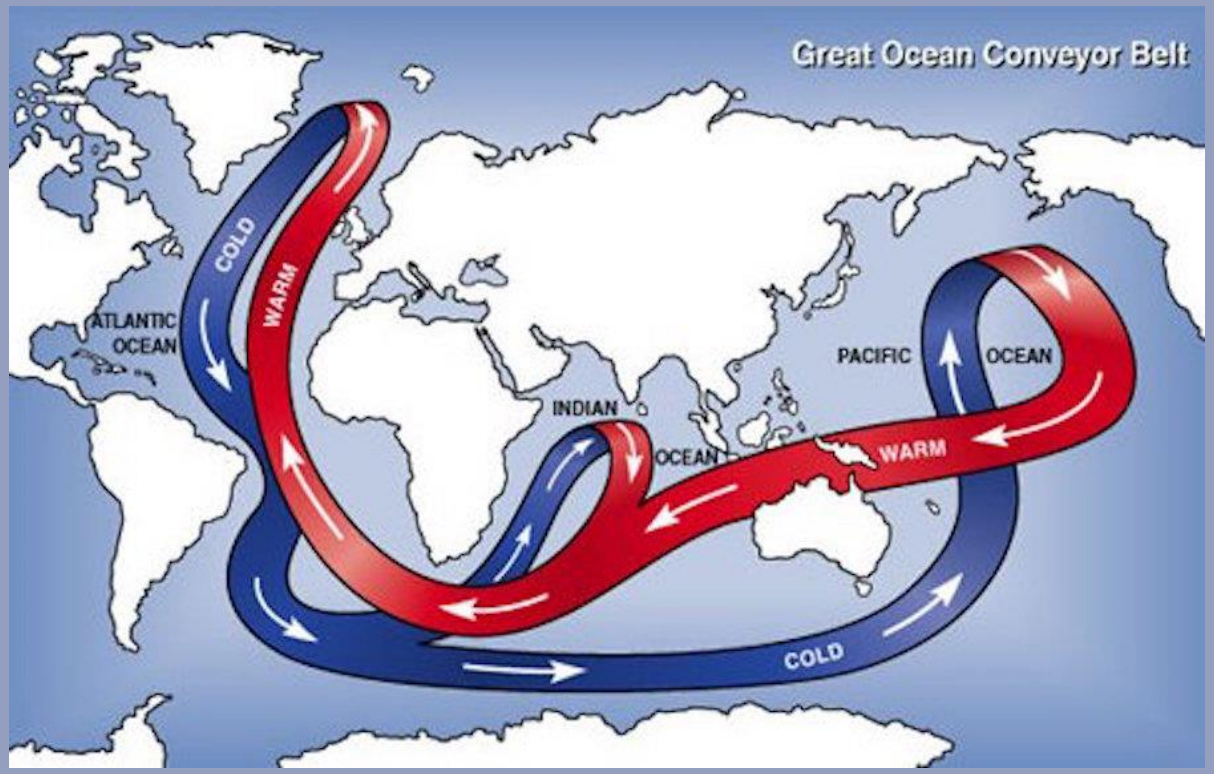
* When those neutrinos from the sun interact with atoms in the Earth's atmosphere, the atoms glow…

Ice Ages

* When the Sun has fewer Sunspots, it gives off less energy, less energy makes its way to Earth, and our planet cools down.

Ocean Currents

* The heat of the sun controls thermohaline circulation, or more simply, the "Global Conveyor Belt"



Questions?