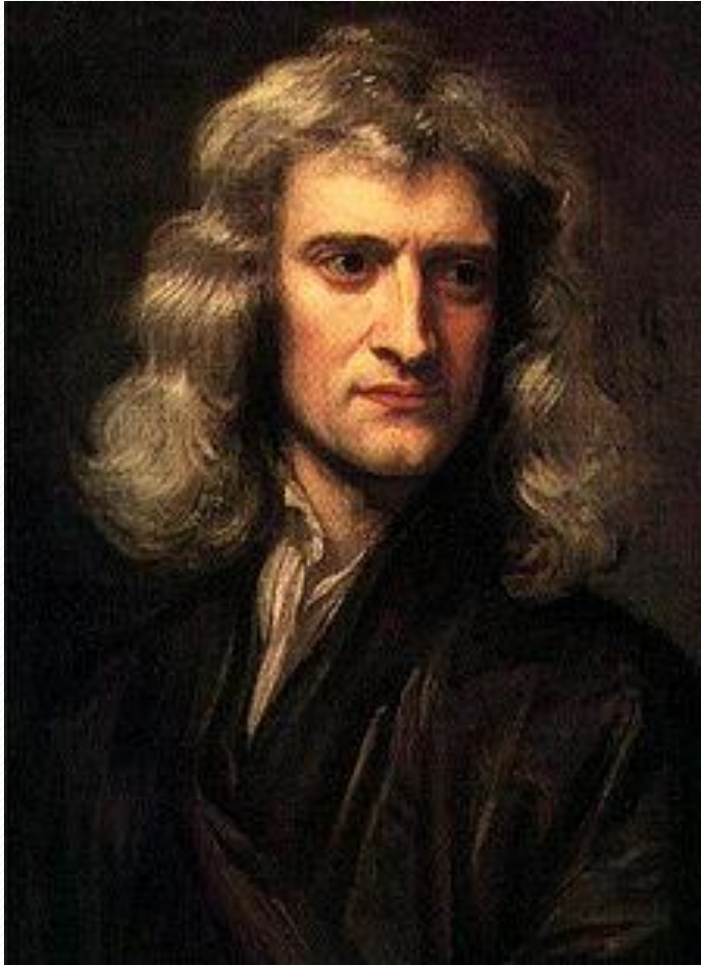


Tides and Sun's Fusion

To explain Tides we need to understand Gravity

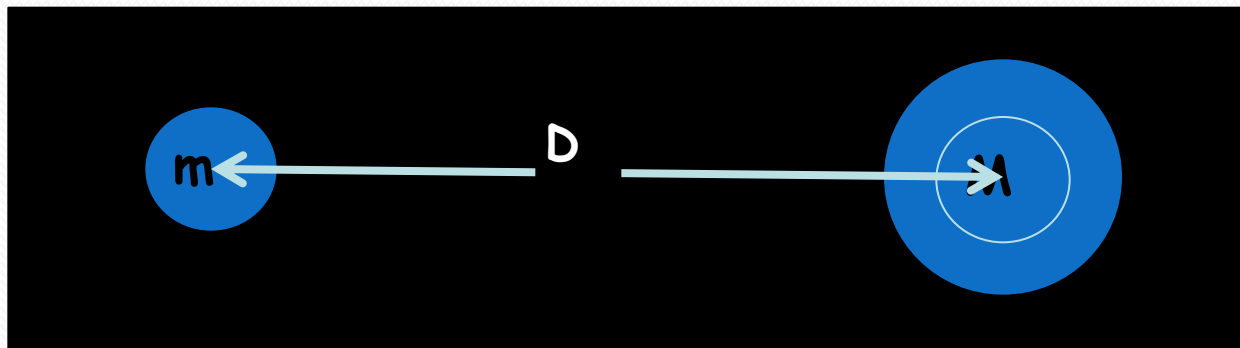


Sir Issac Newton
1642-1727
English Scientist



Newton's Universal Law of Gravitation

- All objects attract or pull on each other with an **invisible force without contact**
- The pull of gravity between 2 objects depends on their masses and distance distance between them
- The bigger the objects the greater the attraction
- Gravity gets weaker as distance gets bigger



Tides

- Are daily changes in the elevation of the ocean surface
- Ocean tides result from the gravitational attraction exerted upon Earth by the moon and, to a lesser extent, by the sun.
- Tide-Causing Forces
 - *Gravity
 - *Inertia

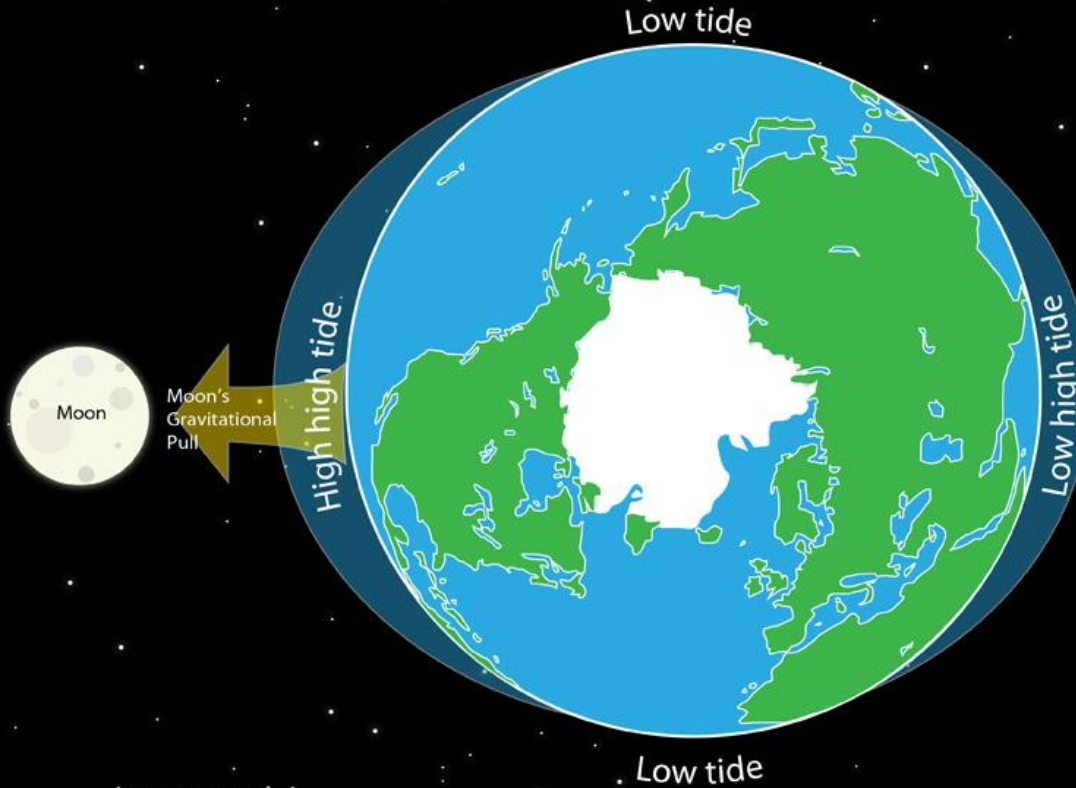
[Explain-it: How do the tides work? - YouTube](#)

The moon affects the oceans.
The moon's pull is called **gravity**.

Gravity pulls on the oceans and causes the tides.



Earth's Tides



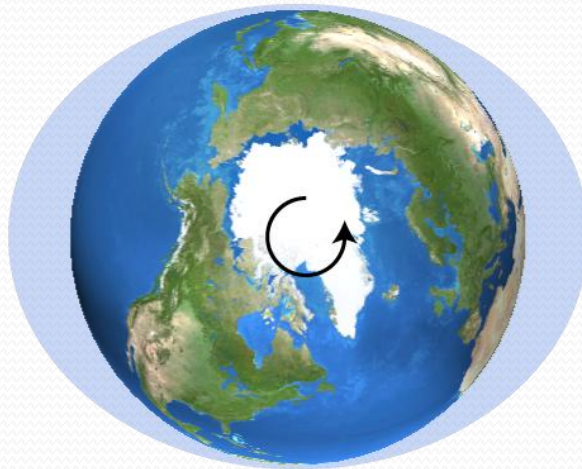
(not to scale)

Sun's Influence on Tides

- Sun is:
 - larger than moon
 - Further away from Earth than is Moon
 - Effect is about 46% of that of the Moon

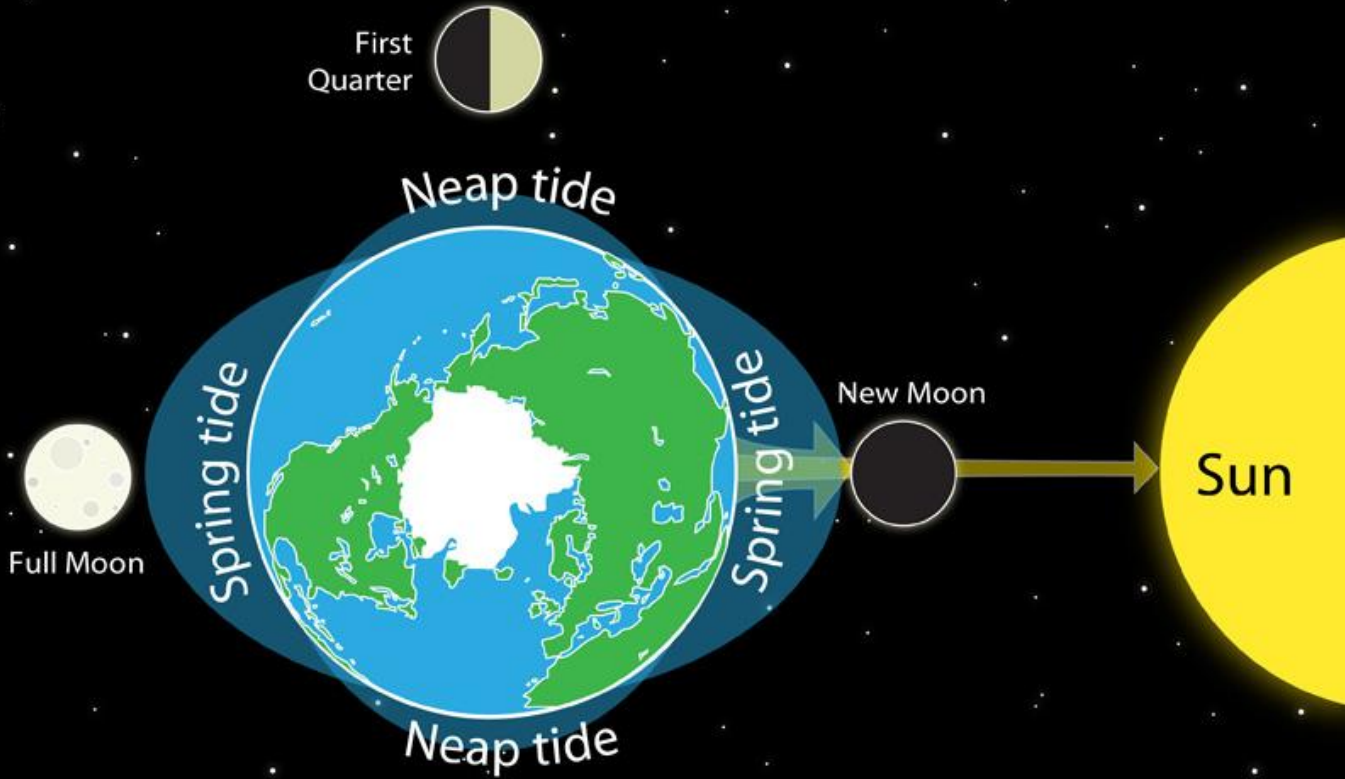
What causes tides?

- The gravitational field of the Moon causes the Earth's oceans to bulge. It is the Earth rotating through these 'tidal bulges', which causes the tides.
- For the majority of locations, two high tides and two low tides are experienced every day.
- This is due to the presence of a tidal bulge in the Earth's oceans, which appears on both sides of the planet.



Note : The tidal bulge in this image is exaggerated for demonstration purposes

Neap Tides and Spring Tides



First Quarter



Neap tide

Full Moon

Spring tide

New Moon

Spring tide

Sun

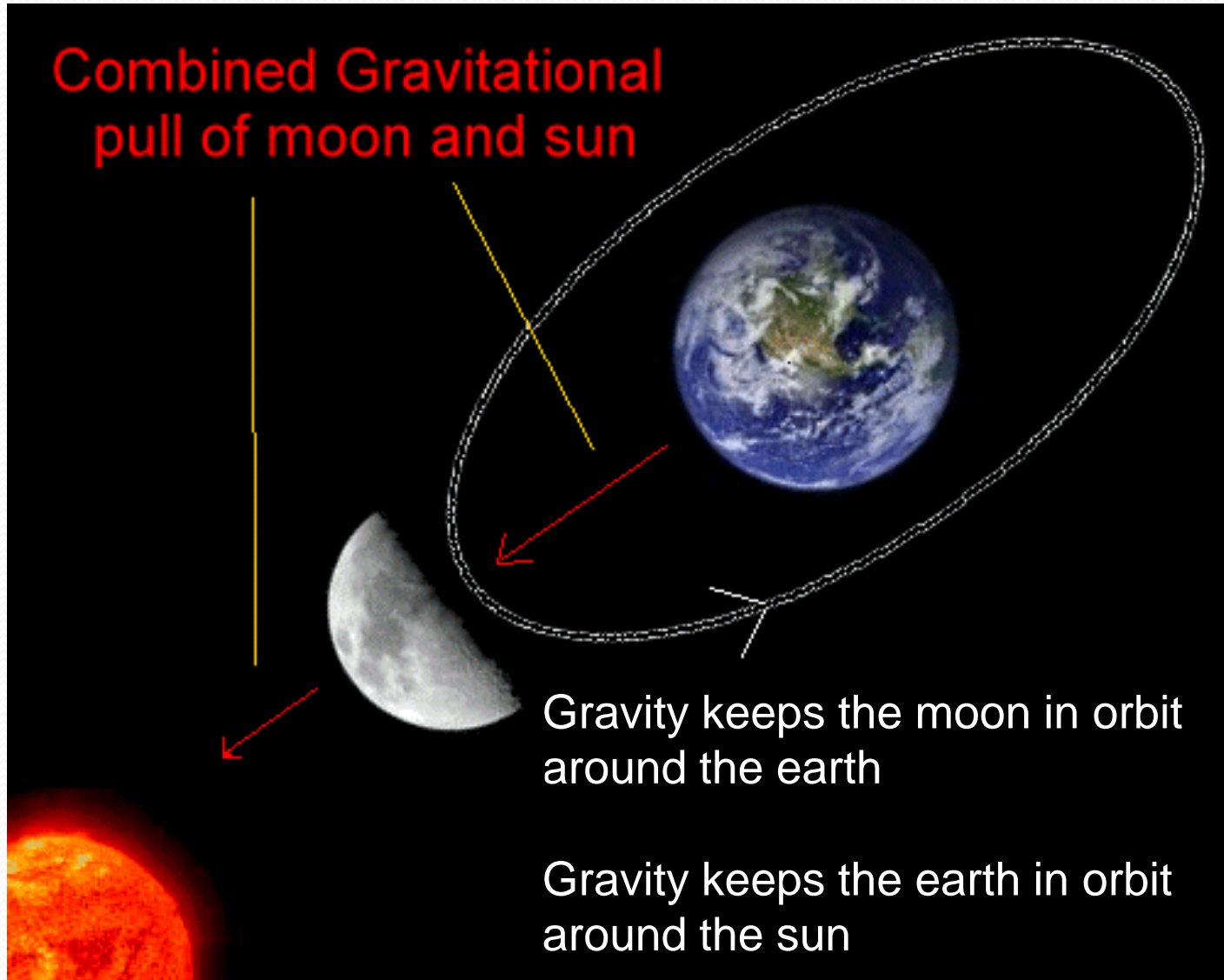
Neap tide

Last Quarter



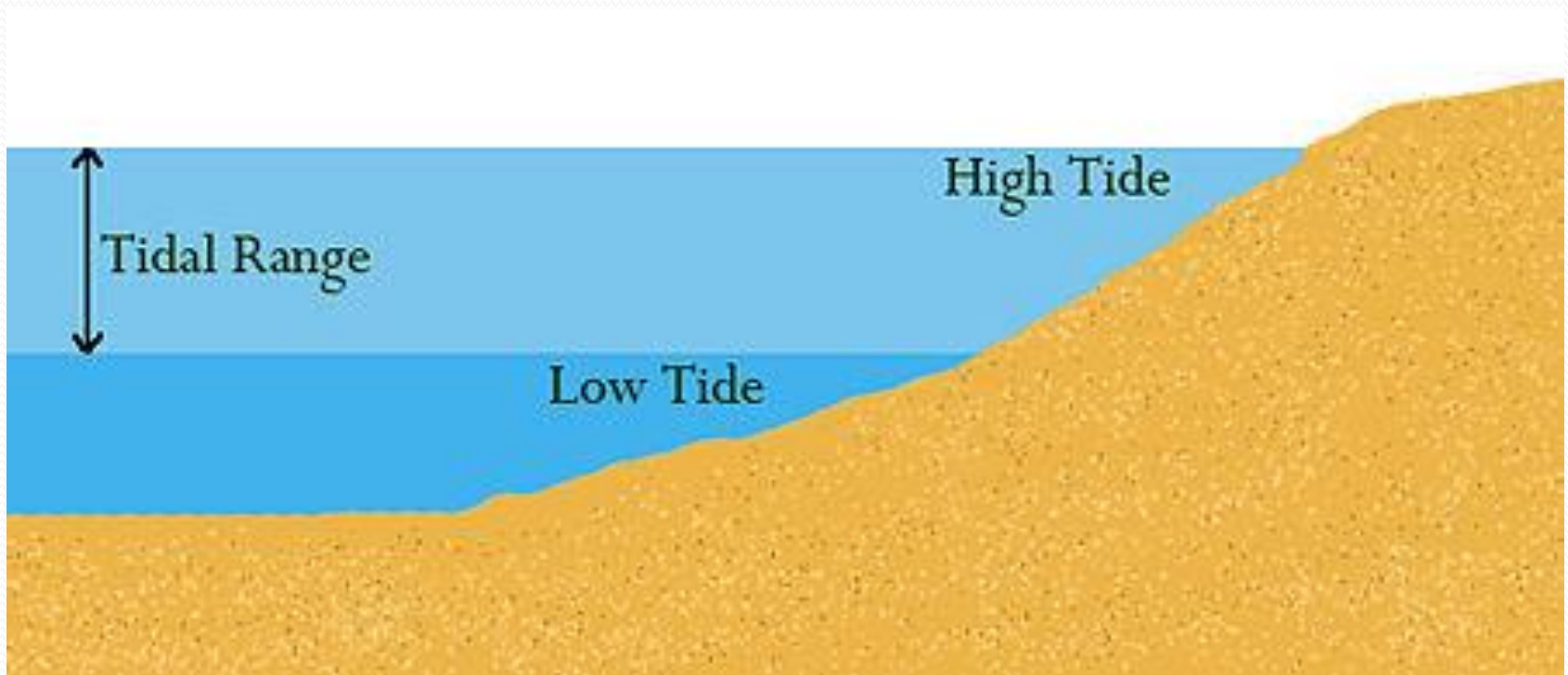
(not to scale)

Gravity of Moon & Sun pull on Earth's Oceans



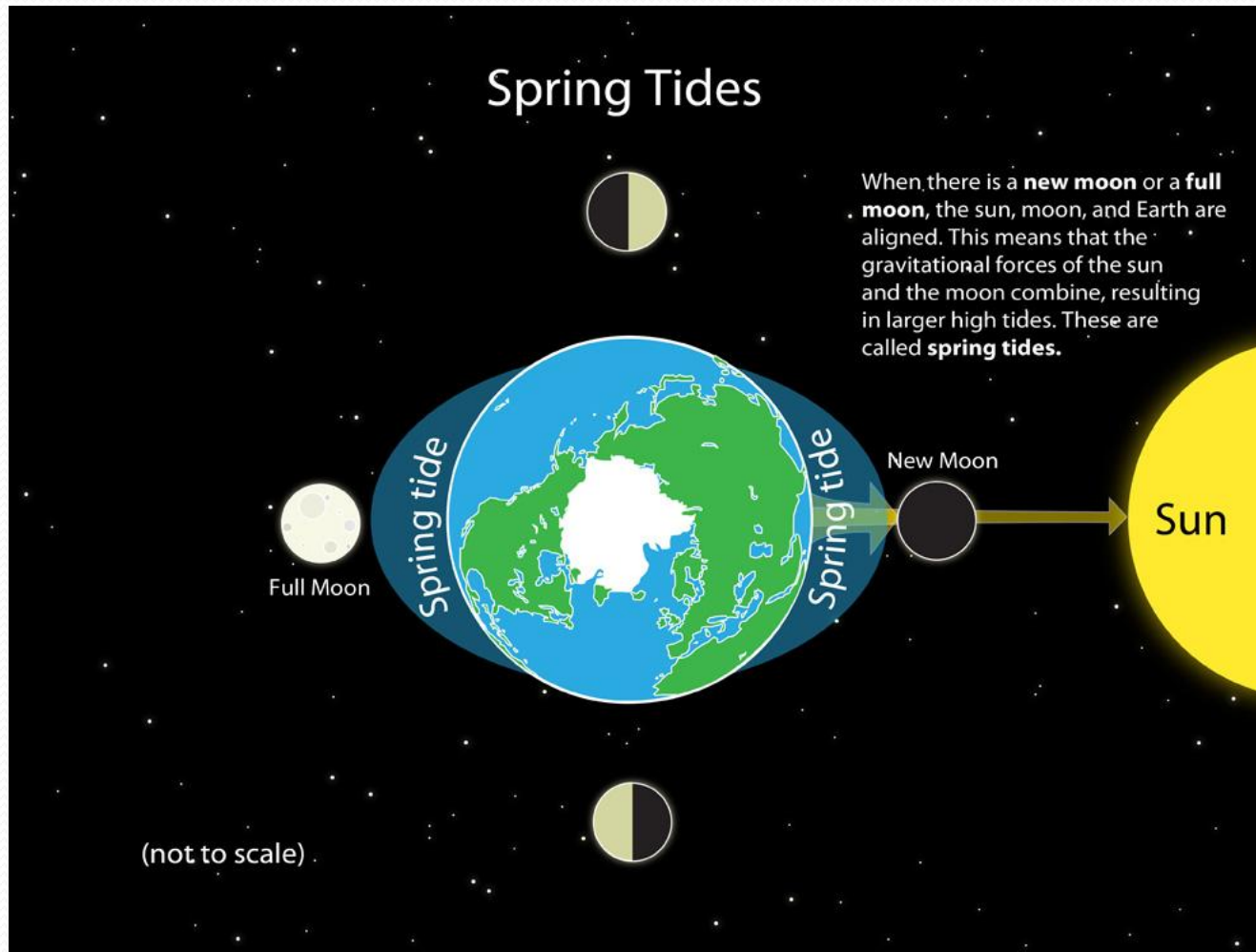
Tide Cycles

Tidal range is the difference in height between successive high and low tides.



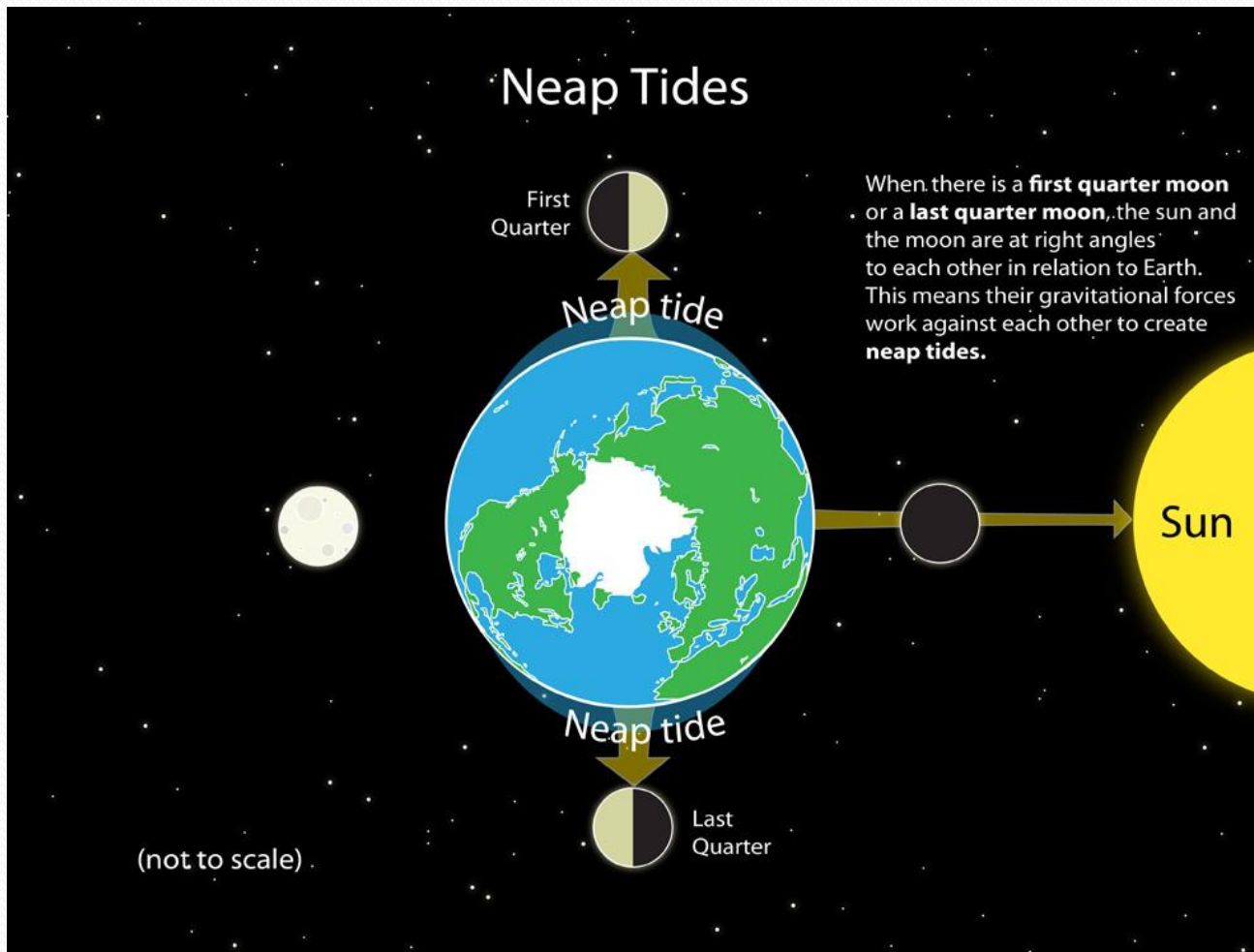
Tidal Cycles

- Spring Tides – are tides that have the greatest tidal range due to the alignment of the Earth-Moon-Sun system.

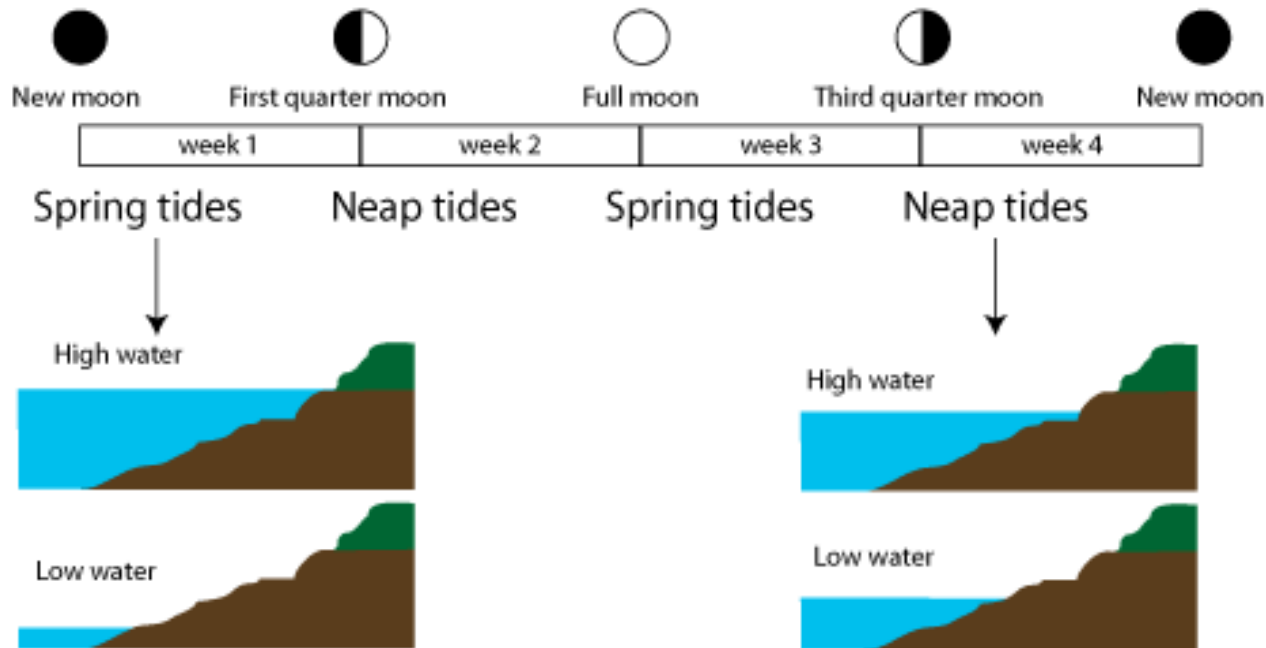


Tidal Cycles - Cont

- **Neap tides** are tides that have the lowest tidal range, occurring near the times of the first-quarter and third-quarter phases of the moon.



Based on the diagram,
which types of tides have a larger range?



SPRING TIDES



How tides work <https://www.youtube.com/watch?v=5ohDG7RqQ9I>

Spring and Neap tides - Song https://www.youtube.com/watch?v=KFYf_it461s

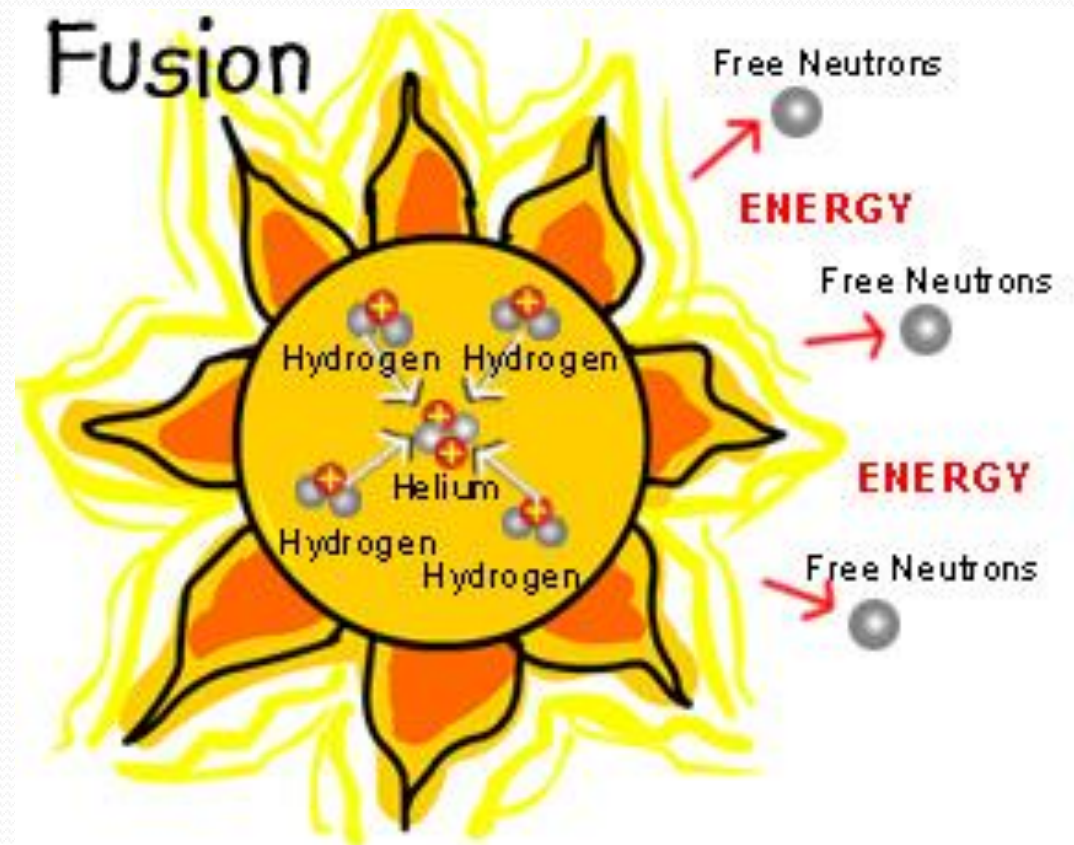
Tides explained in a minute <https://www.youtube.com/watch?v=gftT3wHJGtg>

Fusion and Fission

- Nuclear energy is energy in the nucleus (core) of an atom. Atoms are tiny particles that make up every object in the universe. There is enormous energy in the bonds that hold atoms together.
- Nuclear energy can be used to make electricity. But first the energy must be released. It can be released from atoms in two ways: nuclear fusion and nuclear fission.

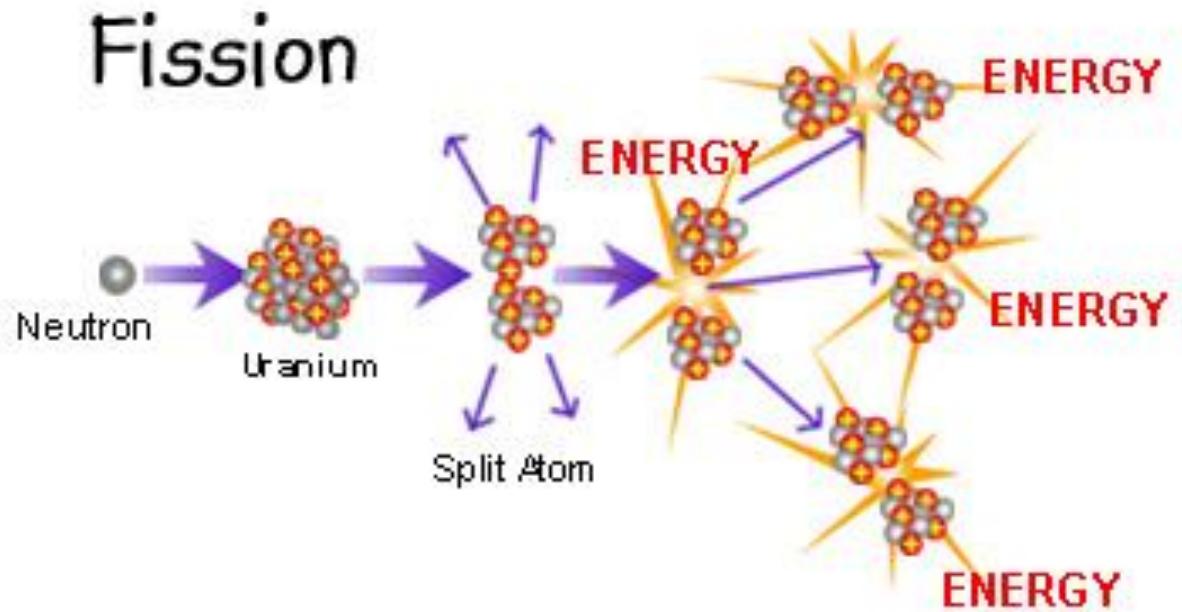
- In **nuclear fusion**, energy is released when atoms are combined or fused together to form a larger atom. This is how the sun produces energy.

When things **fuse** (fusion), you start with smaller objects (tritium, deuterium) and build larger objects (helium).



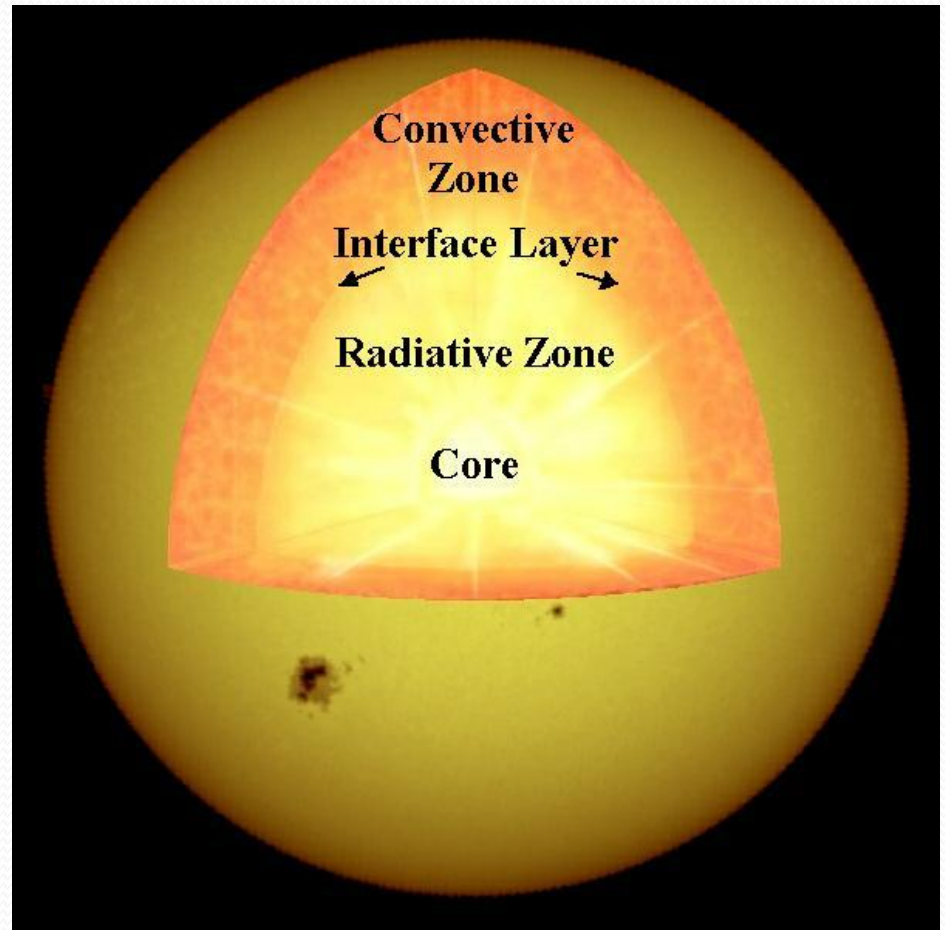
In **nuclear fission**, atoms are split apart to form smaller atoms, releasing energy. Nuclear power plants use nuclear fission to produce electricity.

When things "fiss" or break down, you start with a larger object (uranium) and finish with smaller objects



Inside the Sun

- Core
- Radiative Zone
- Convection zone



Energy from the Sun

- Nuclear chain reaction (hydrogen forming helium)
- Releases radiation (gamma rays)
- The **gamma ray** loses energy as it bounces around inside the Sun
- It is finally released at the photosphere, primarily as visible light

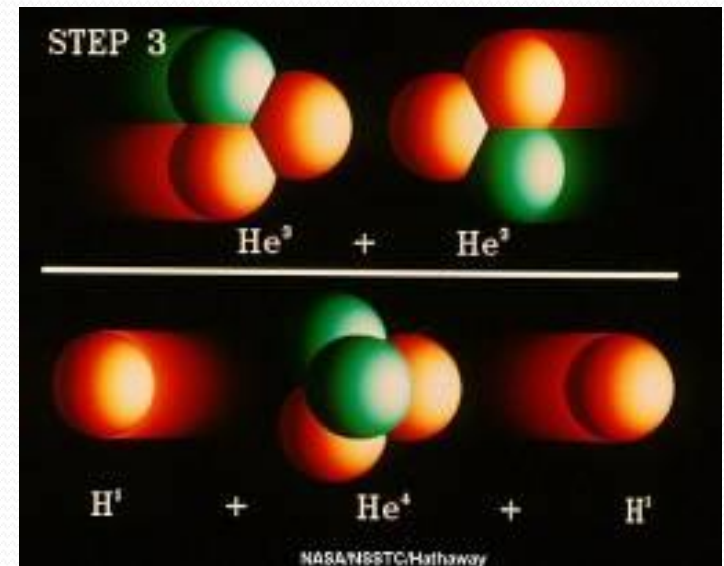
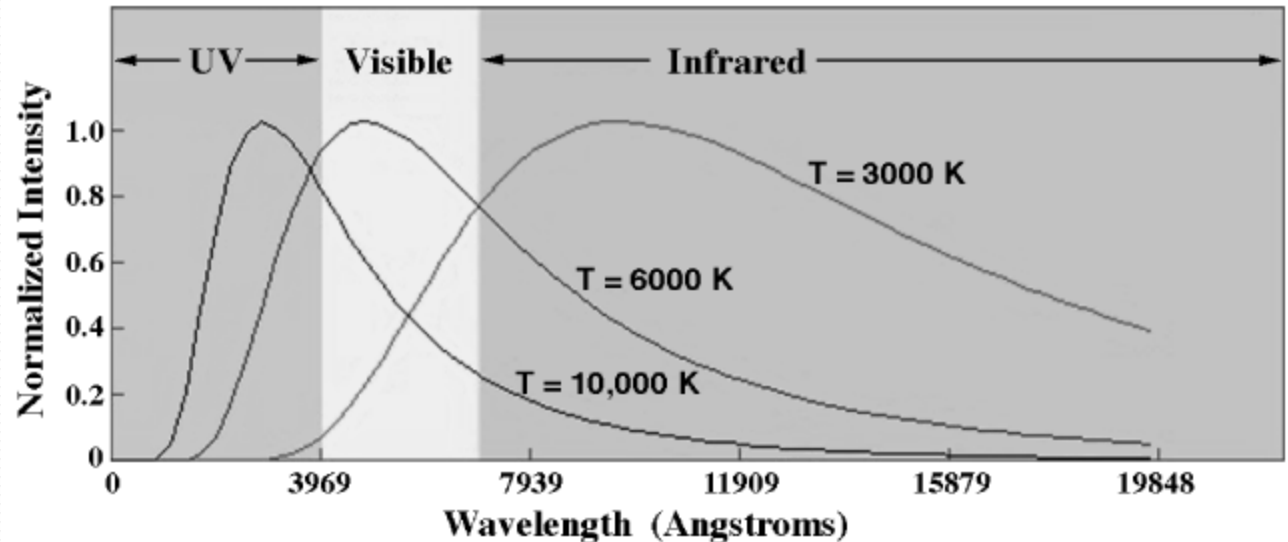
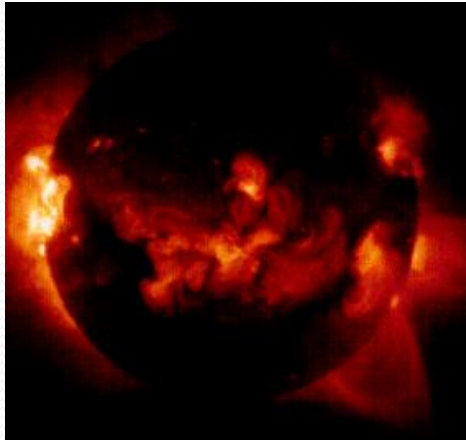


Image at <http://solarscience.msfc.nasa.gov/interior.shtml>

Radiation

- Our Sun (and all active stars) emits radiation
 - Radio, infrared, visible, ultraviolet, x-ray and even some gamma rays
 - Most of the sunlight is yellow-green visible light or close to it



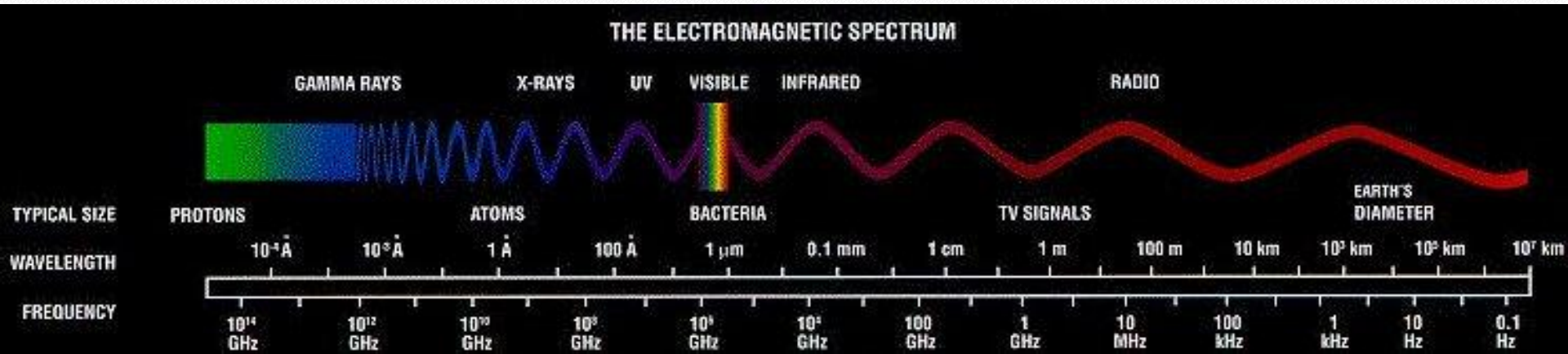
The Sun at X-ray wavelengths

Image and info at

<http://imagine.gsfc.nasa.gov/docs/teachers/gammaraybursts/imagine/page18.html> and
http://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level2/sun.html

Sun's Radiation at Earth

- The Earth's atmosphere filters out some frequencies
 - Ozone layer protects us from some ultra-violet, and most x-rays and gamma rays
 - Water and oxygen absorb some radio waves
 - Water vapor, carbon dioxide, and ozone absorbs some infrared



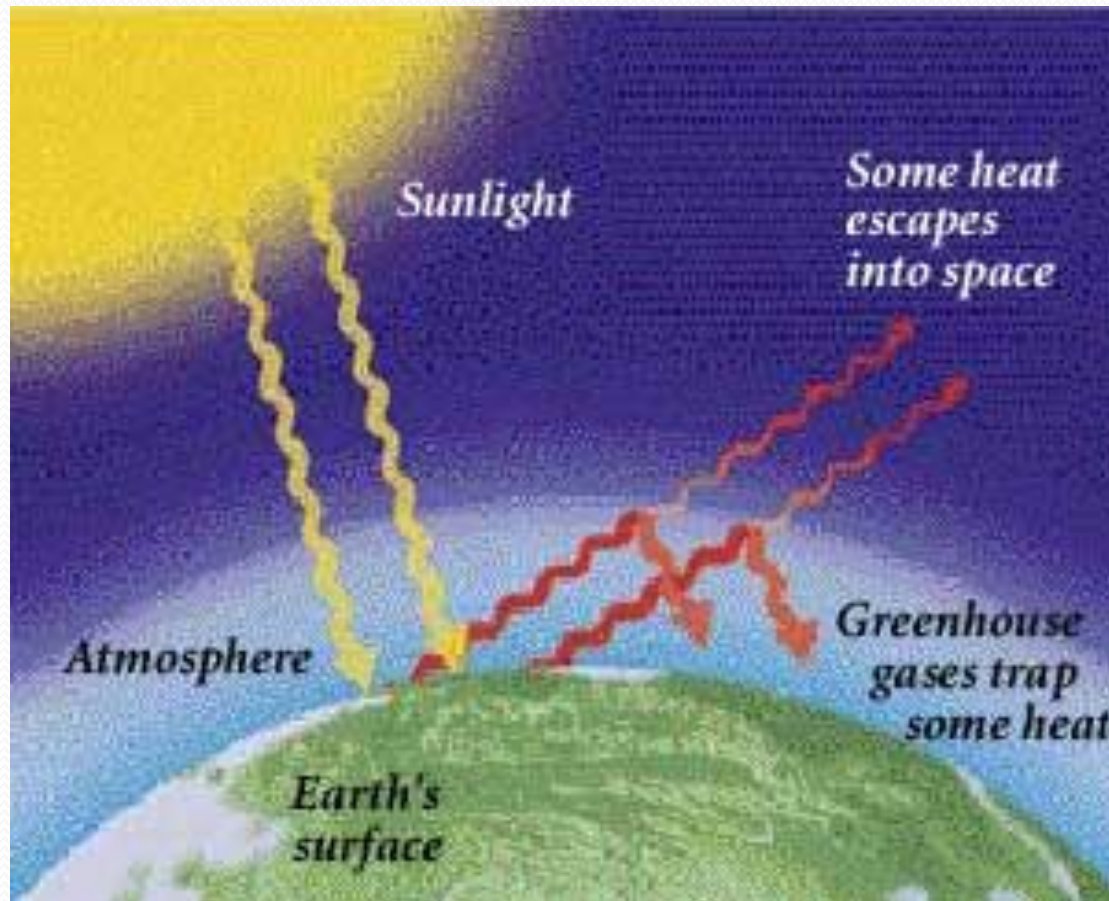
Electromagnetic spectrum

http://coolcosmos.ipac.caltech.edu/cosmic_classroom/ir_tutorial/what_is_ir.html



Radiant Energy

Radiant Energy Electromagnetic energy that travels in transverse waves



Radiant Energy from the Sun

- **Radiant energy** is also called electromagnetic energy.
- Almost every reaction that happens on the surface of the Earth is the result of energy coming to the Earth from the Sun.
- Radiant energy is also called electromagnetic energy because it is made up of two combined fields.
- One of the fields is electrical and the other is magnetic.

Thermal Energy (a.k.a. Heat)

Internal energy of a substance due to the vibration of atoms and molecules making up the substance

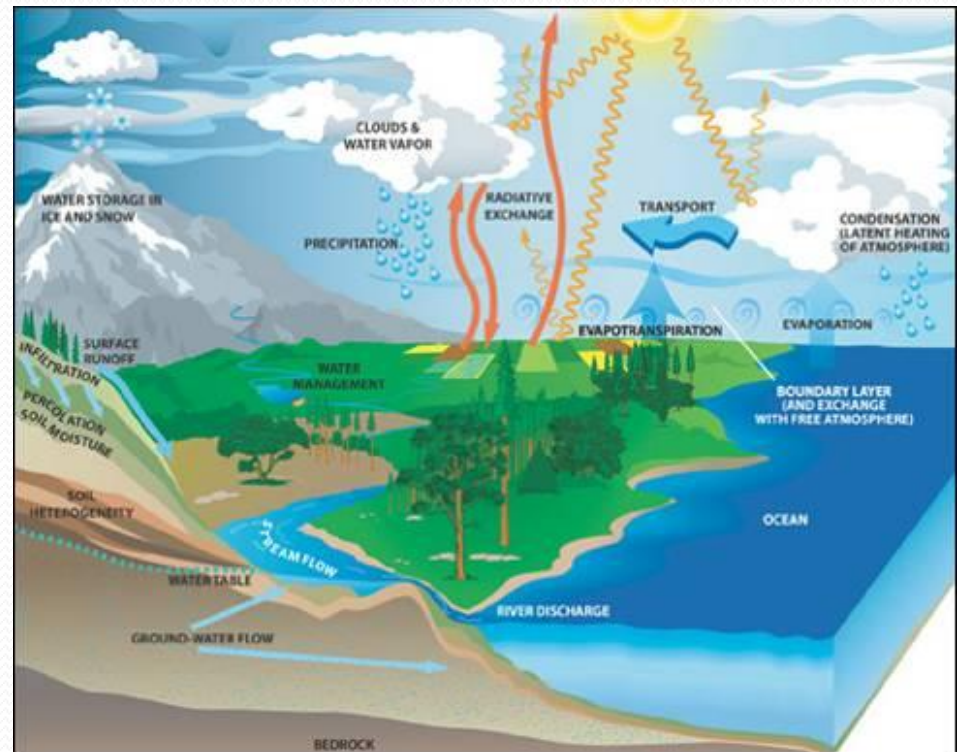
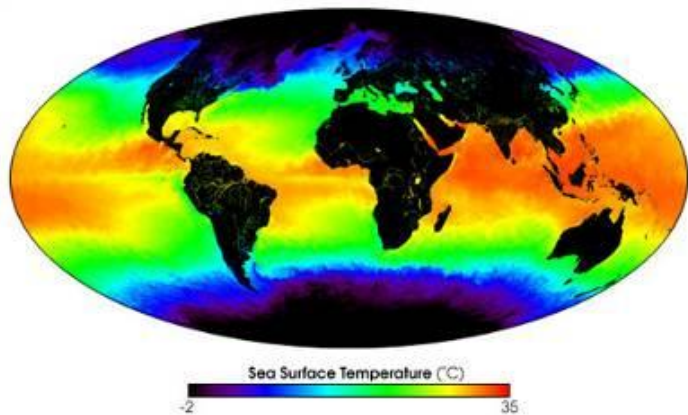


Sunlight is absorbed by Earth

- The Sun does NOT send “heat rays” into space. Some of its light is infrared, but that is not the same thing as heat.
- The Sun’s light is absorbed by Earth (clouds, plants, oceans, rock...)
- By absorbing the light, we are transforming it into heat energy

Sun as a Source of Energy

- Light from the Sun is absorbed by the Earth, unevenly to:
 - drive wind bands – which drive surface currents
 - drive deep ocean currents
 - drive water cycle
 - drive weather



Sun as a Source of Energy

- Plants need light for photosynthesis
- Without its heat, the only inhabitable areas on Earth would be near volcanic vents

