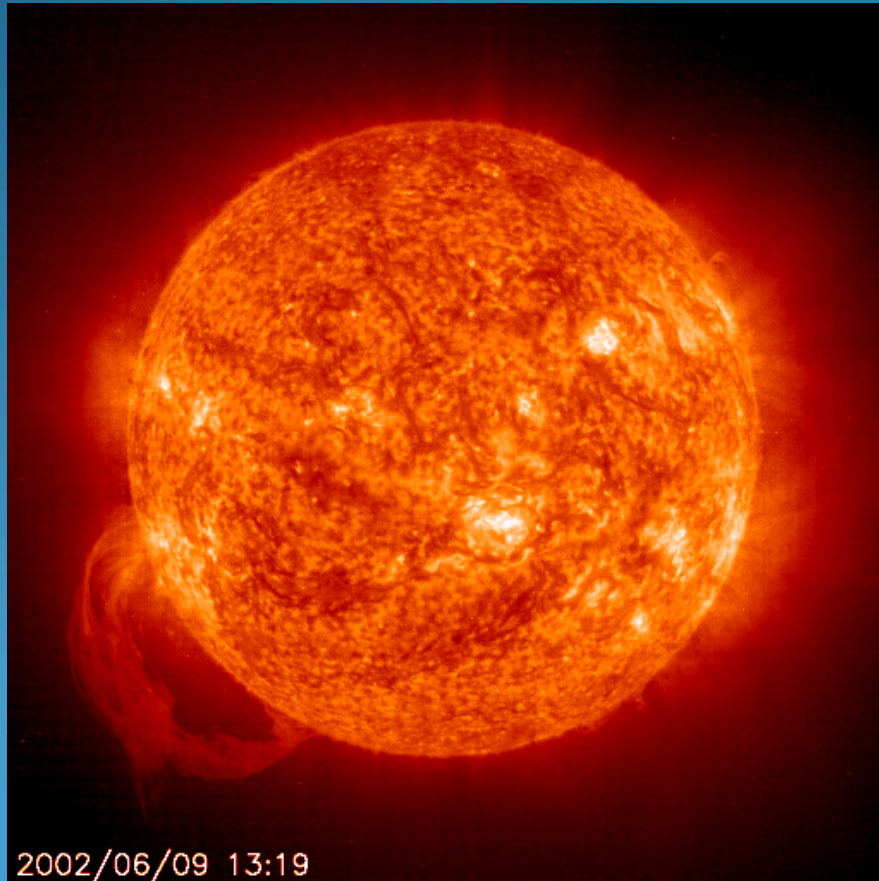


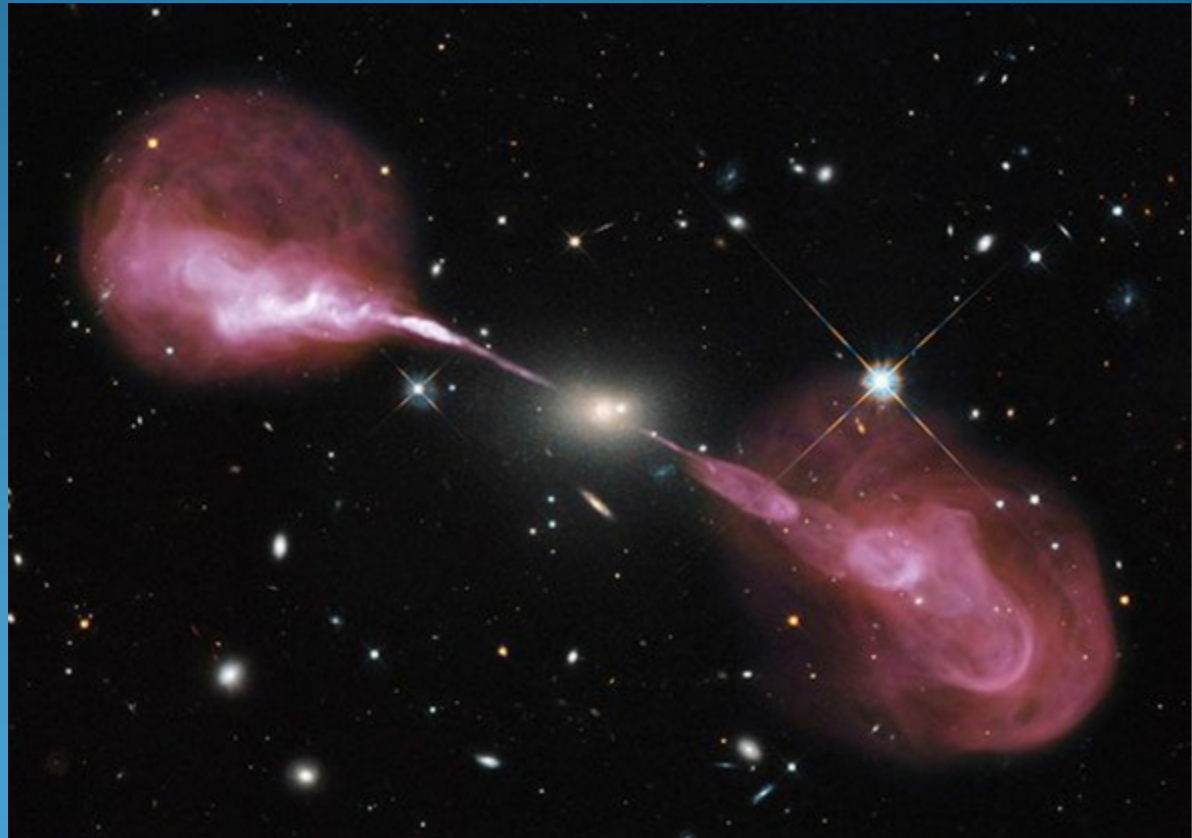
# Photons, Charged Particles, and the 4<sup>th</sup> State of Matter



[nasa.gov](http://nasa.gov)

# Life in Space brings radiation and flashes of light seen by astronauts outside and INSIDE the ISS!

What's making them?

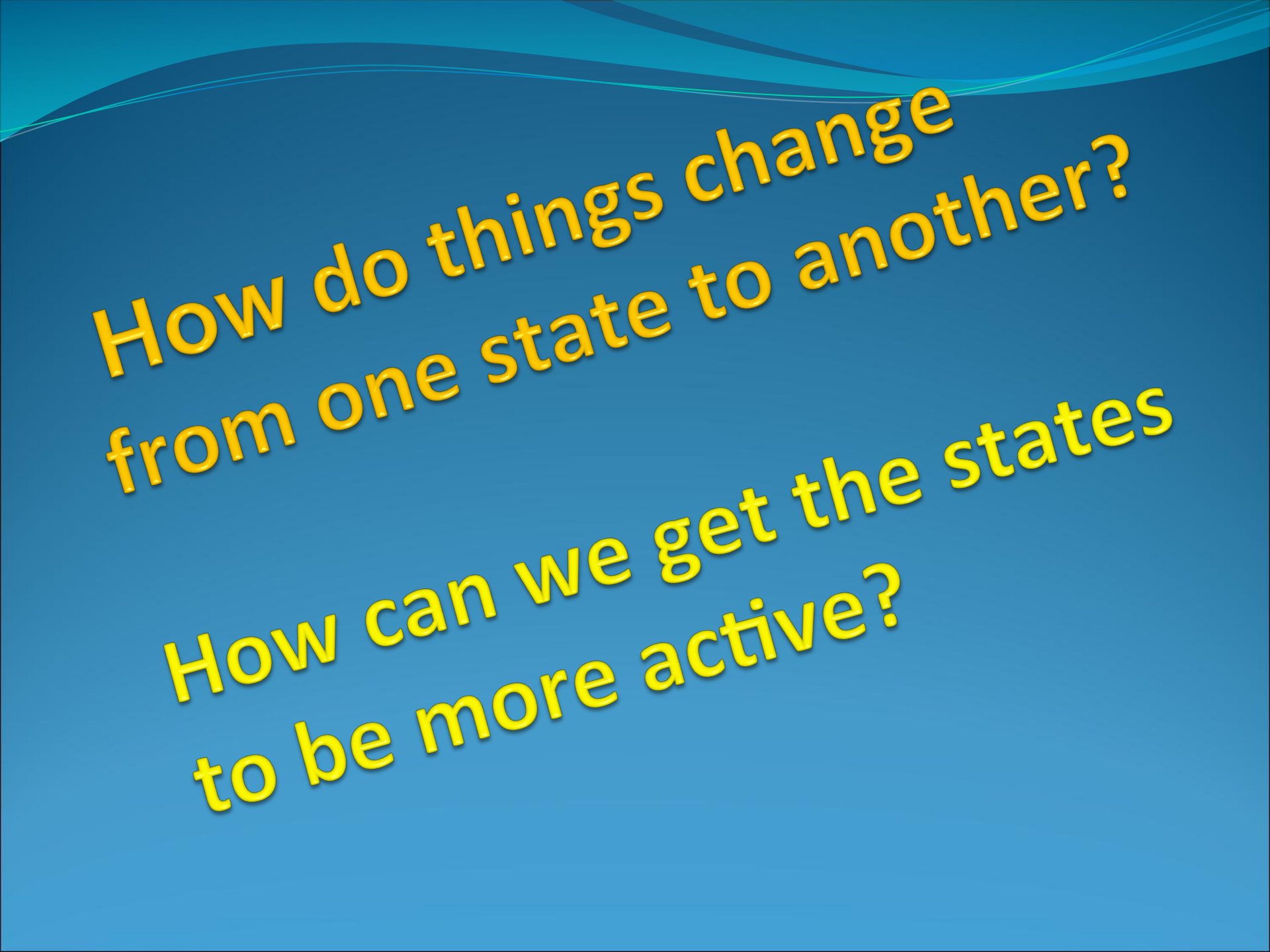


# What are the 'states of Matter?'

Solid

Liquid

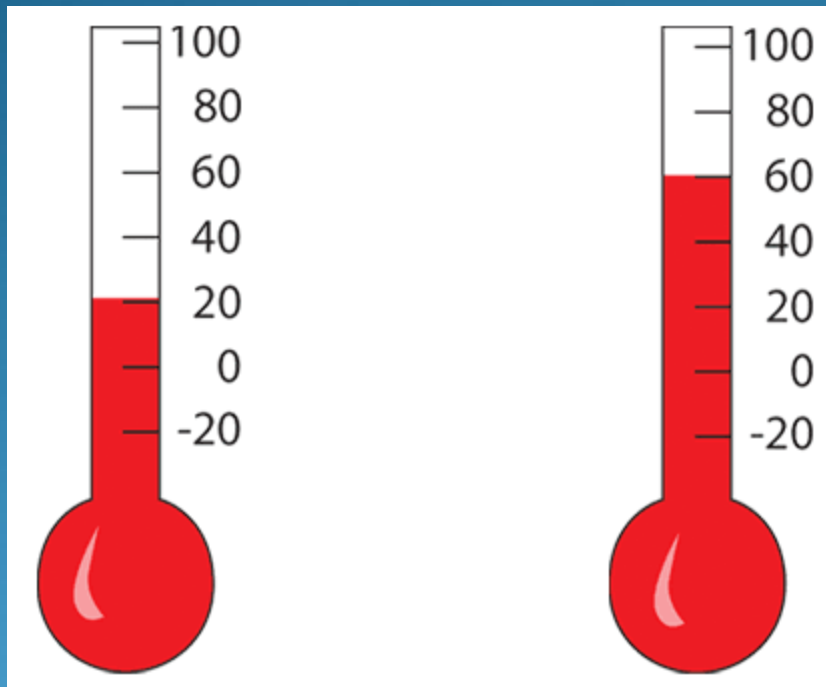
Gas



How do things change  
from one state to another?

How can we get the states  
to be more active?

# ENERGY !!!



# What are the 'states of Matter?'

1. Solid

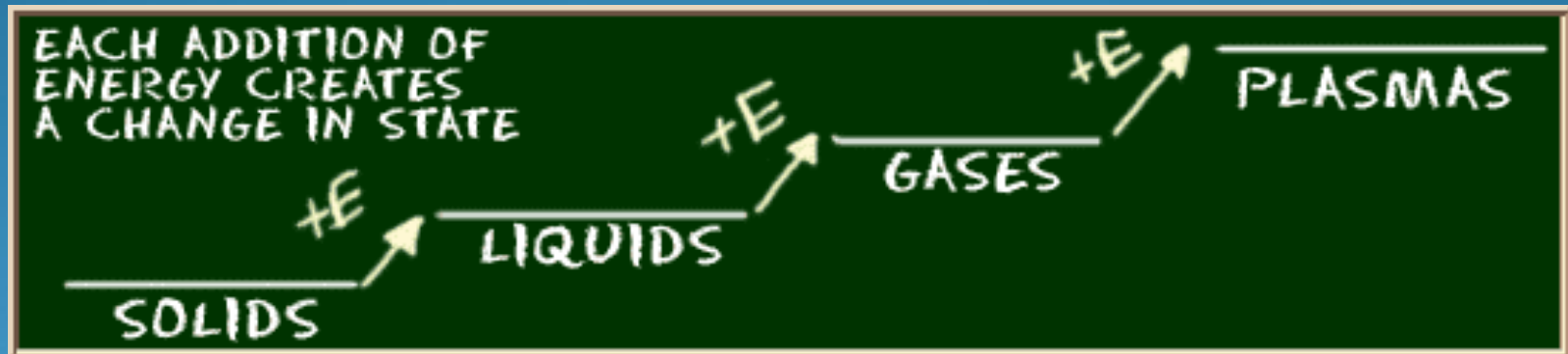
2. Liquid

3. Gas

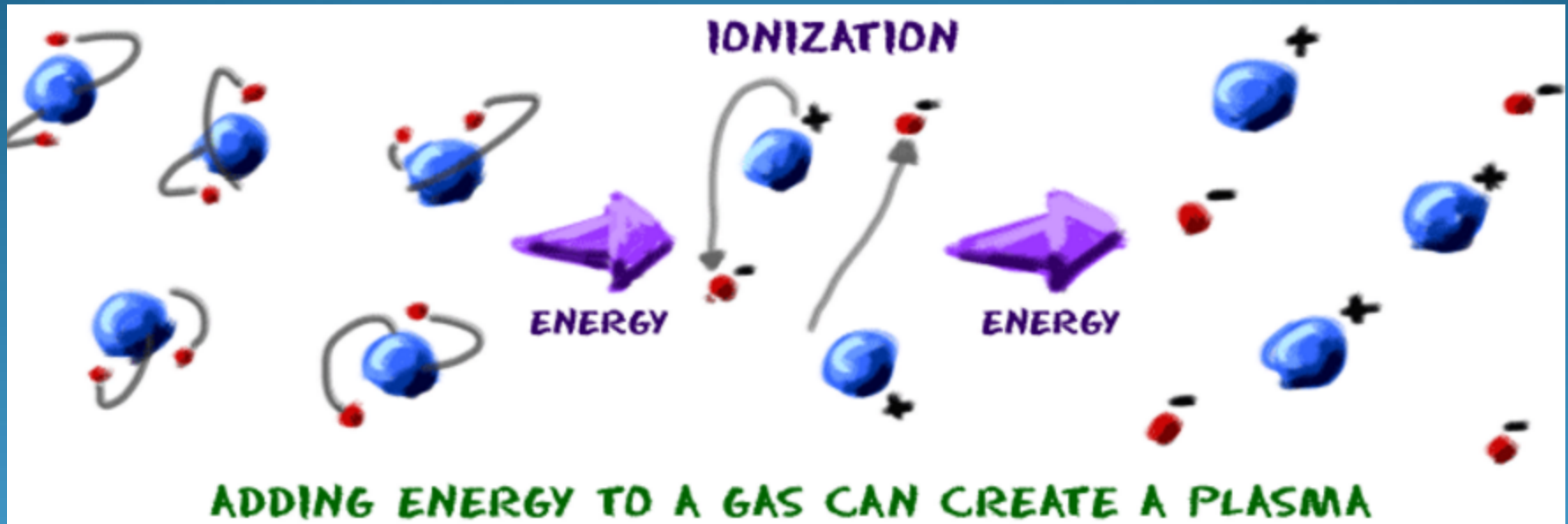
4. Plasma !!



# How do things change from one state to another?

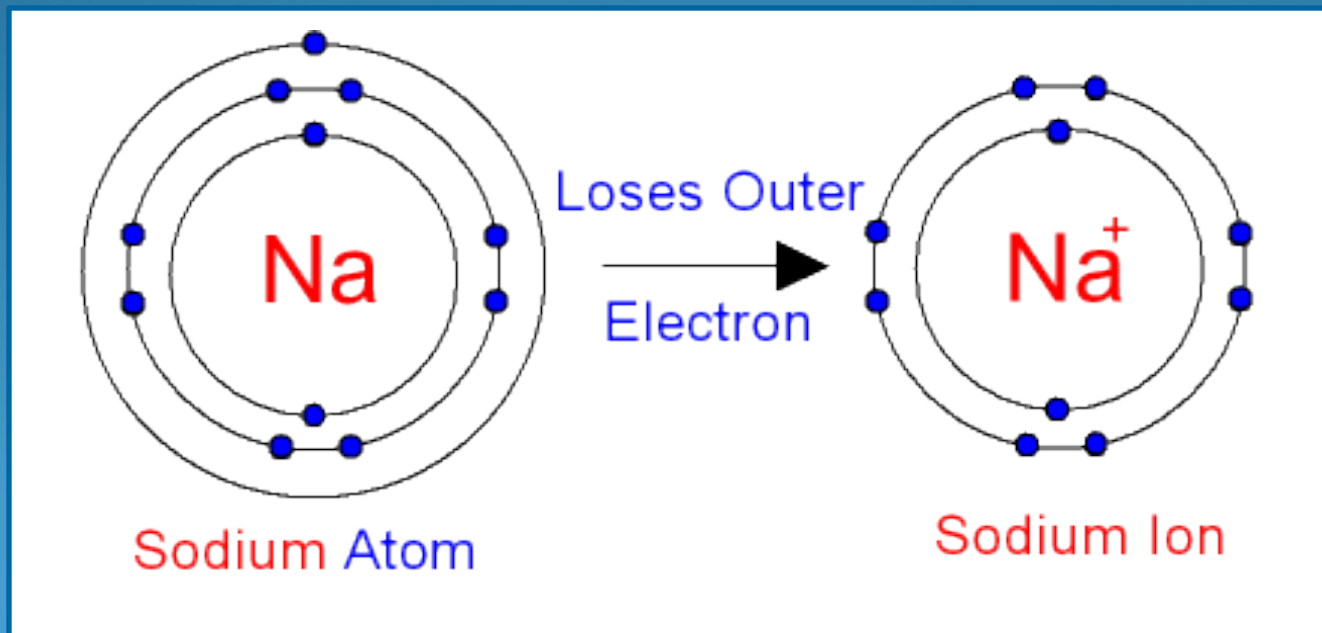


# Why is this change of activity possible for gases?



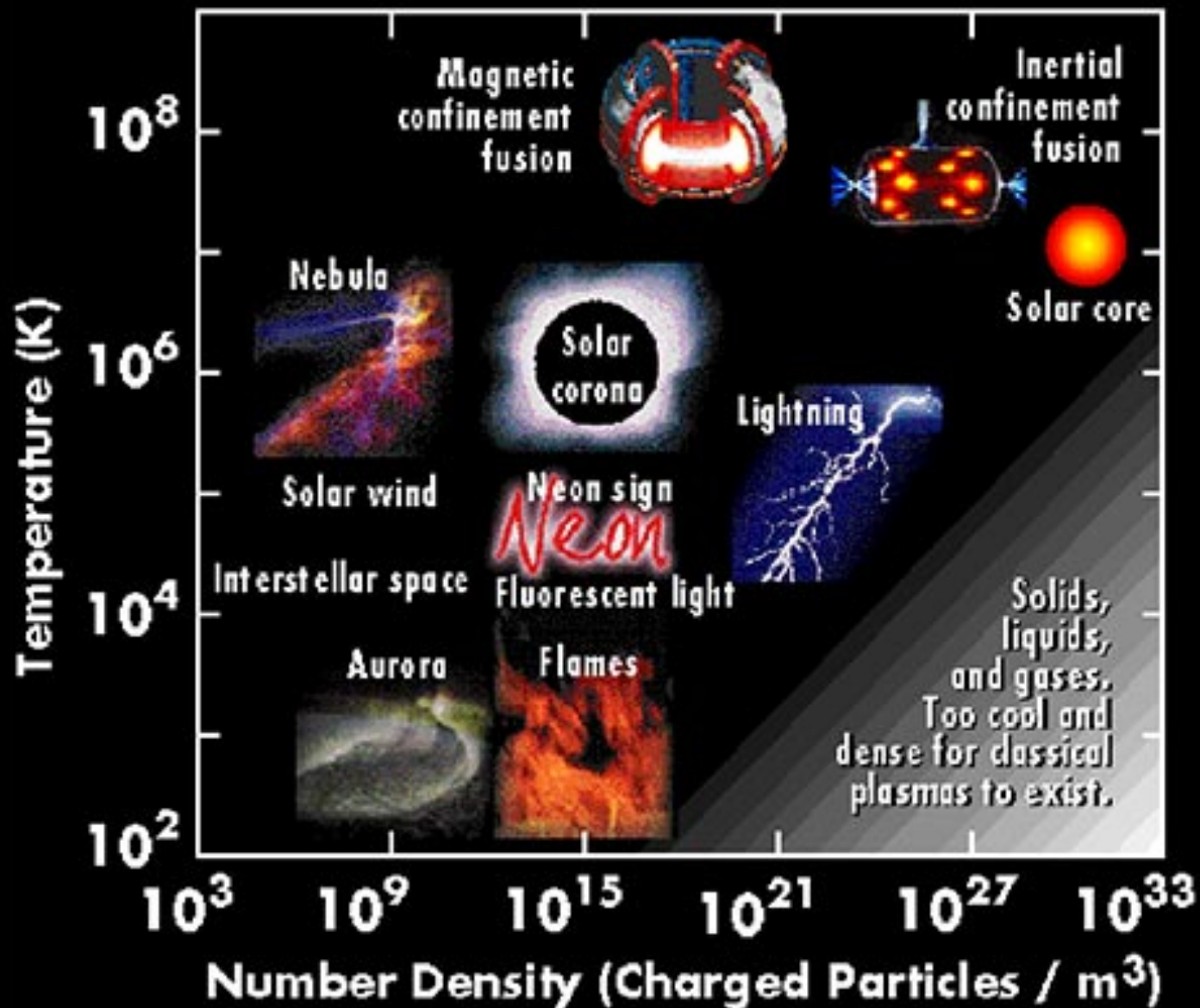


Ions are created by either losing or gaining electrons in its outermost electron shell



**So how does ionization  
happen in space-what's this  
got to do with the sun?**



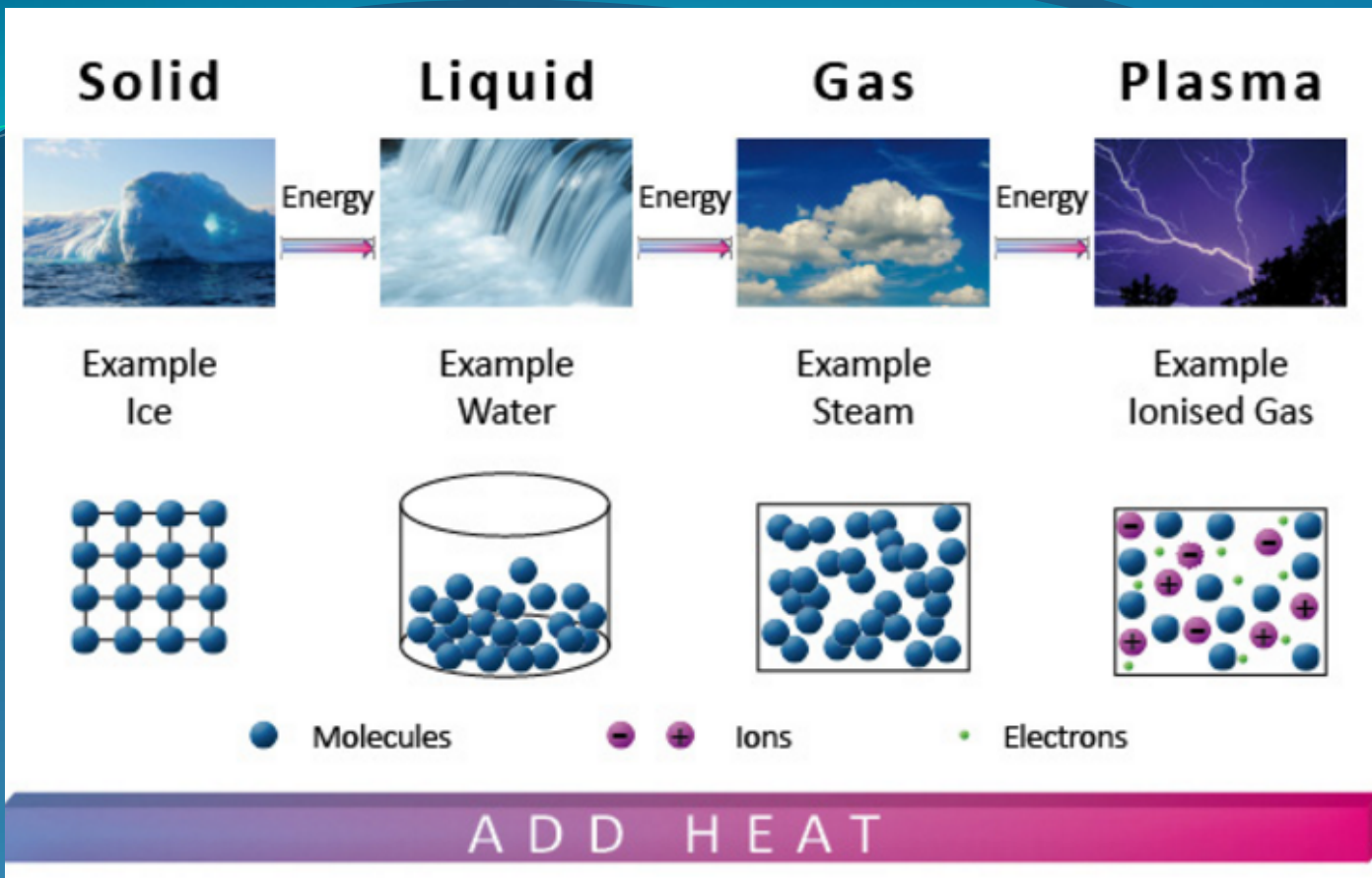


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Images courtesy of DOE fusion labs, NASA, and Steve Albers.





Inside the  
Eagle  
Nebula,  
plasma from  
a supernova  
about 6,000  
years ago  
sends out  
plasma, seen  
here in  
different  
wavelengths.  
(Astronomy  
Picture of  
the Day)



Plasma is a gas that has been energized by heat or electricity to the point that the electrons that move around the atoms of the gas actually leave the atom and it causes the atom to have a positive charge.

**Rememeber: in a stable atom you need:  
electrons = protons!**



# Astronauts and Equipment in space will need to be protected from SPE (Solar Particle Events).

## Galactic Cosmic Rays:

Low-level, slowly-varying radiation. Think of GCR as background noise.

Martin Corporation

## Solar Particle Event:

Intense peaks of radiation lasting hours to days. It is difficult to predict when exactly a SPE will occur.

## Areas of the Body Most at Risk:

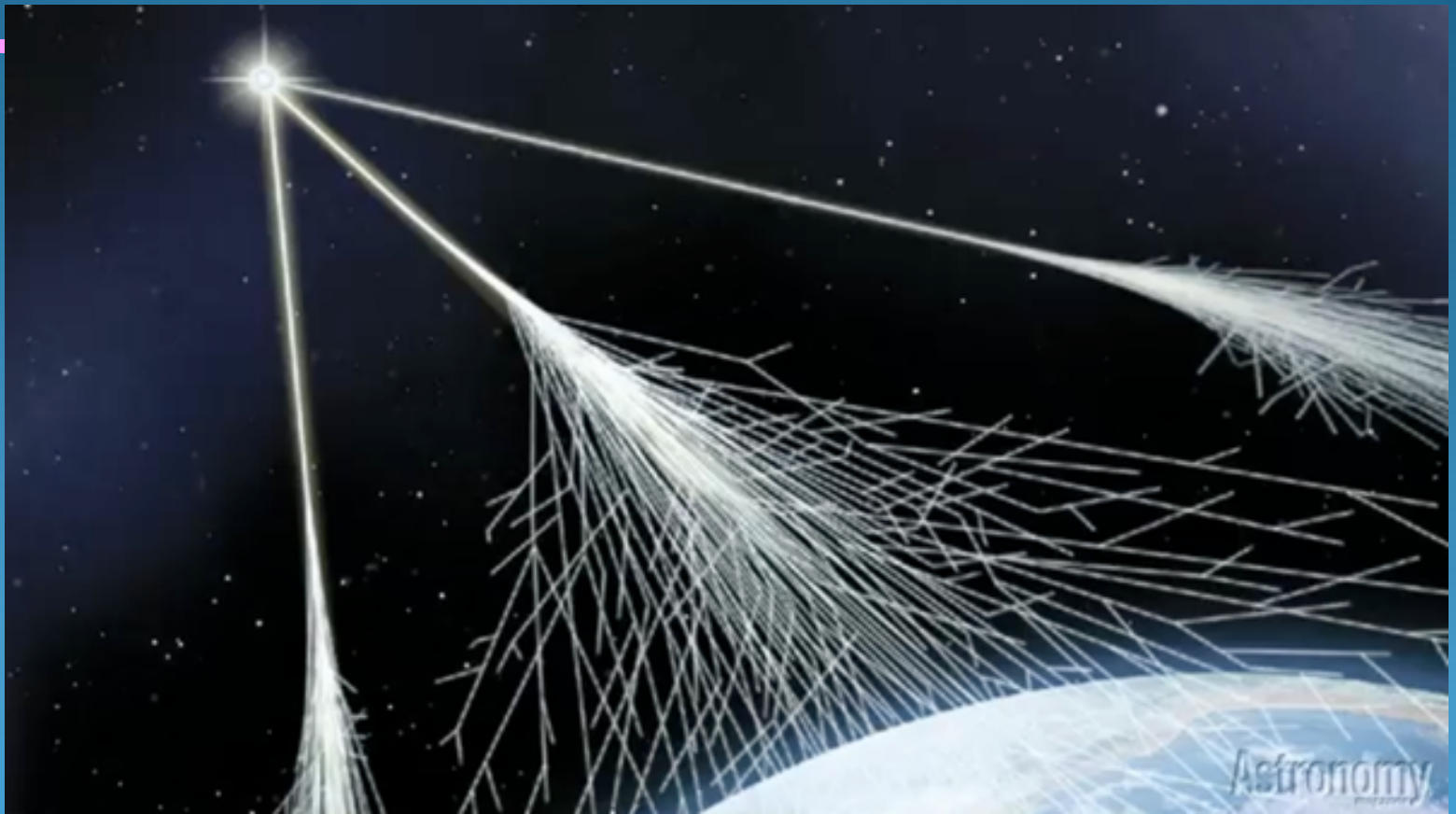


LOCKHEED MARTIN

**Thank Goodness –Earthlings have  
a protective ionosphere !**



**Ionized particles also come from other stars in the form of cosmic rays.**





BE CONDENSATES



SOLIDS



LIQUIDS



GASES



PLASMAS

By the way, there is a 5<sup>th</sup> state of matter – the Bose Einstein Condensate- very condensed, slow moving, near absolute zero, very fragile and unstable.



Enjoy the activities as we experiment  
with plasma –

