



Stars & Galaxies

Stars

A black and white photograph of a starry night sky. The background is dark, filled with numerous bright stars of varying sizes and colors. In the lower center, a hand is visible, pointing its index finger towards a particularly bright star. The overall scene is a classic representation of stargazing.

- **Ancient Greeks believed that stars were burning objects**

Stars

- **Stars give off a lot of heat by Nuclear fusion**

There are more than 200,000 stars in our galaxy that have been seen and catalogued

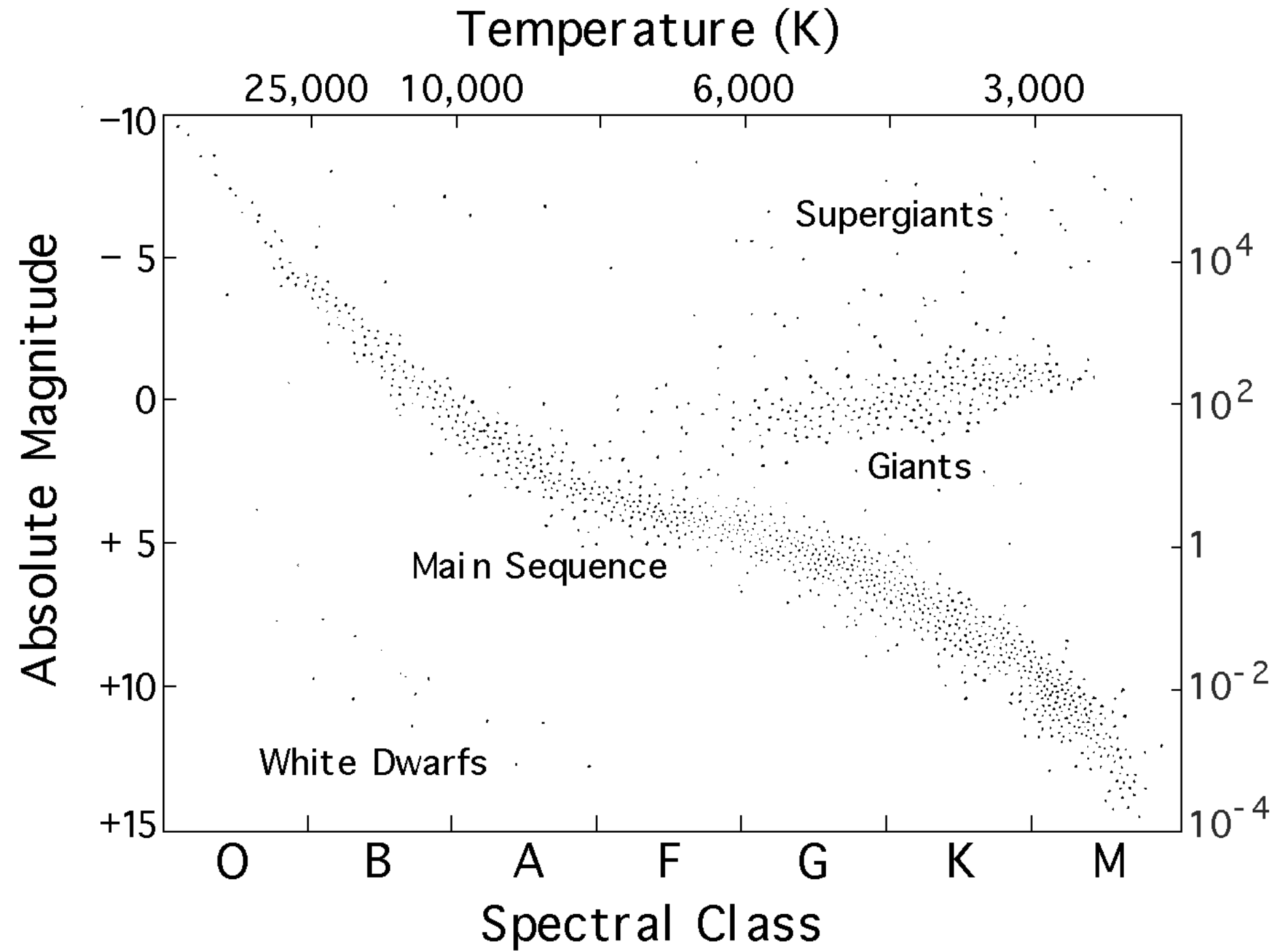
What is the energy source behind star light?*

Not All Shiny Objects are Stars

- Some bright points of light that can be seen in the sky may planets such as Venus, Mars, Jupiter, Saturn and Mercury
- Planets have a more steady glow, while stars twinkle because it is refracted as it comes through the earths atmosphere

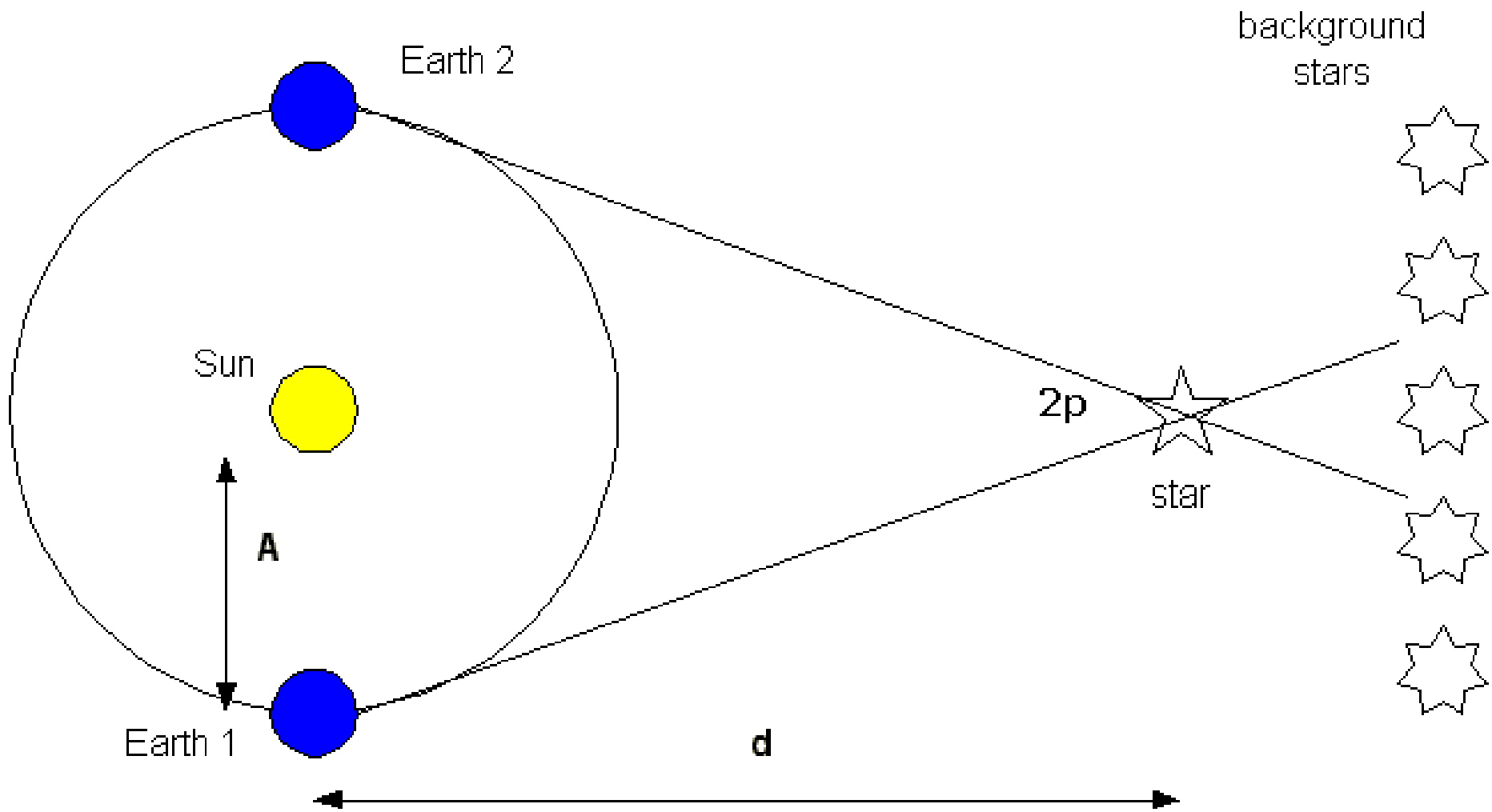
Stars Brightness

- A stars brightness as seen from earth is called its apparent magnitude
- Apparent magnitude depend on the size distance and color
- Apparent magnitude differs from actual magnitude



Stellar distance

- the distance of a star from earth
- **Stellar distance can be measured by parallax**
 - Parallax is an apparent change in position caused by the earth's motion
 - Parallax is then calculated to determine the stars distance from earth
 - Parallax decreases with distance



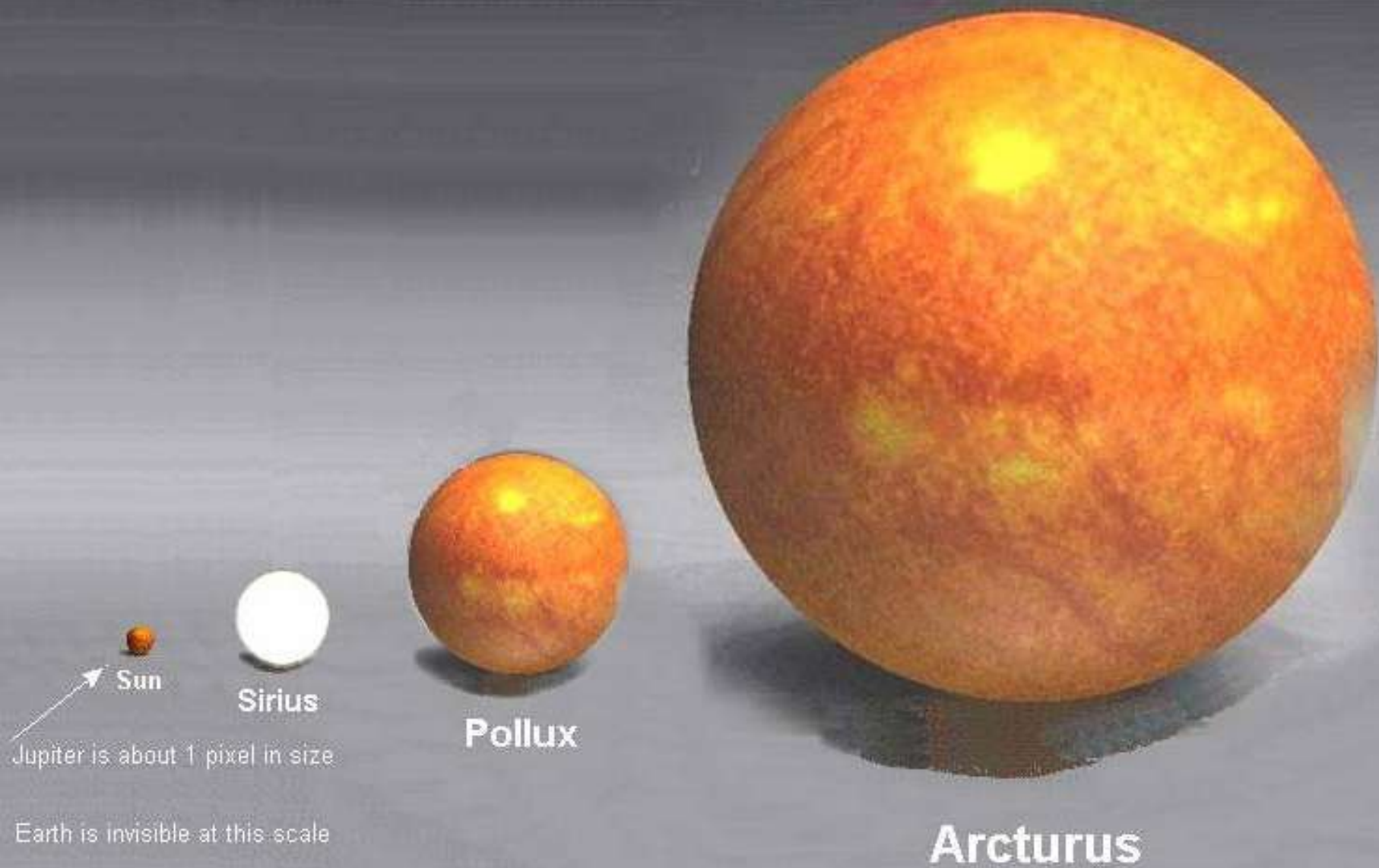
Light Year



- Astronomers work with very large numbers.
- The closest star to earth is 38,000,000,000,000 km away from the sun 3.8×10^{13}
- Light travels at 9.5 trillion km/year

The Sun

- The sun is a star (average in size)
 - The sun is a sphere of hot glowing gas
 - The sun contains more than 99% of the solar system's mass
 - The sun is about 150,000,000 km from the earth about 8minutes at the speed of light
 - The sun's radius is about 696,000 km, 109x that of earth
- The sun rotates on its axis





Betelgeuse



Antares



Rigel



Aldebaran



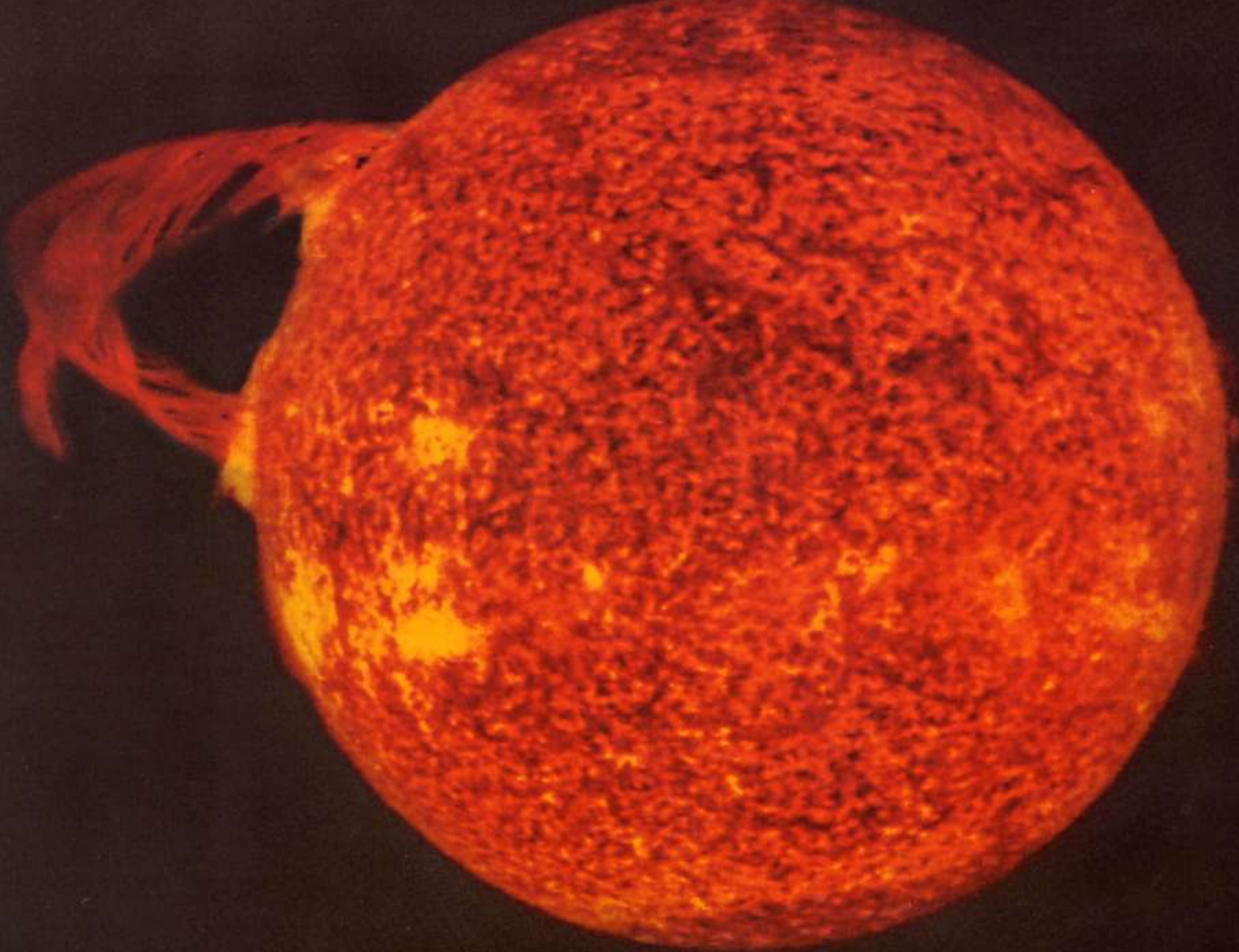
Jupiter is invisible at this scale

Sun (1 pixel)

Sirius

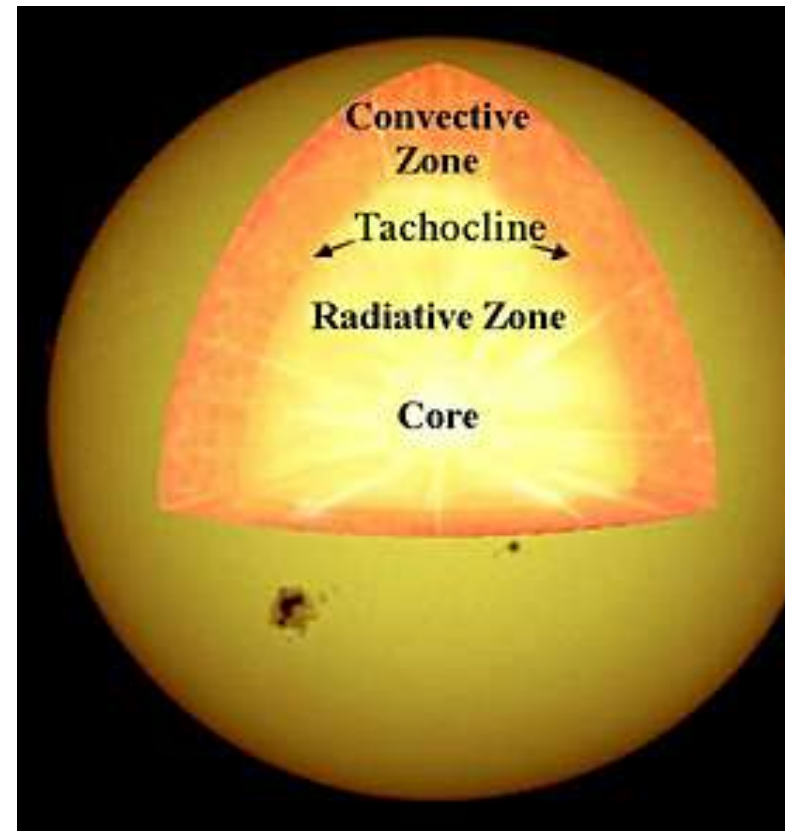
Pollux

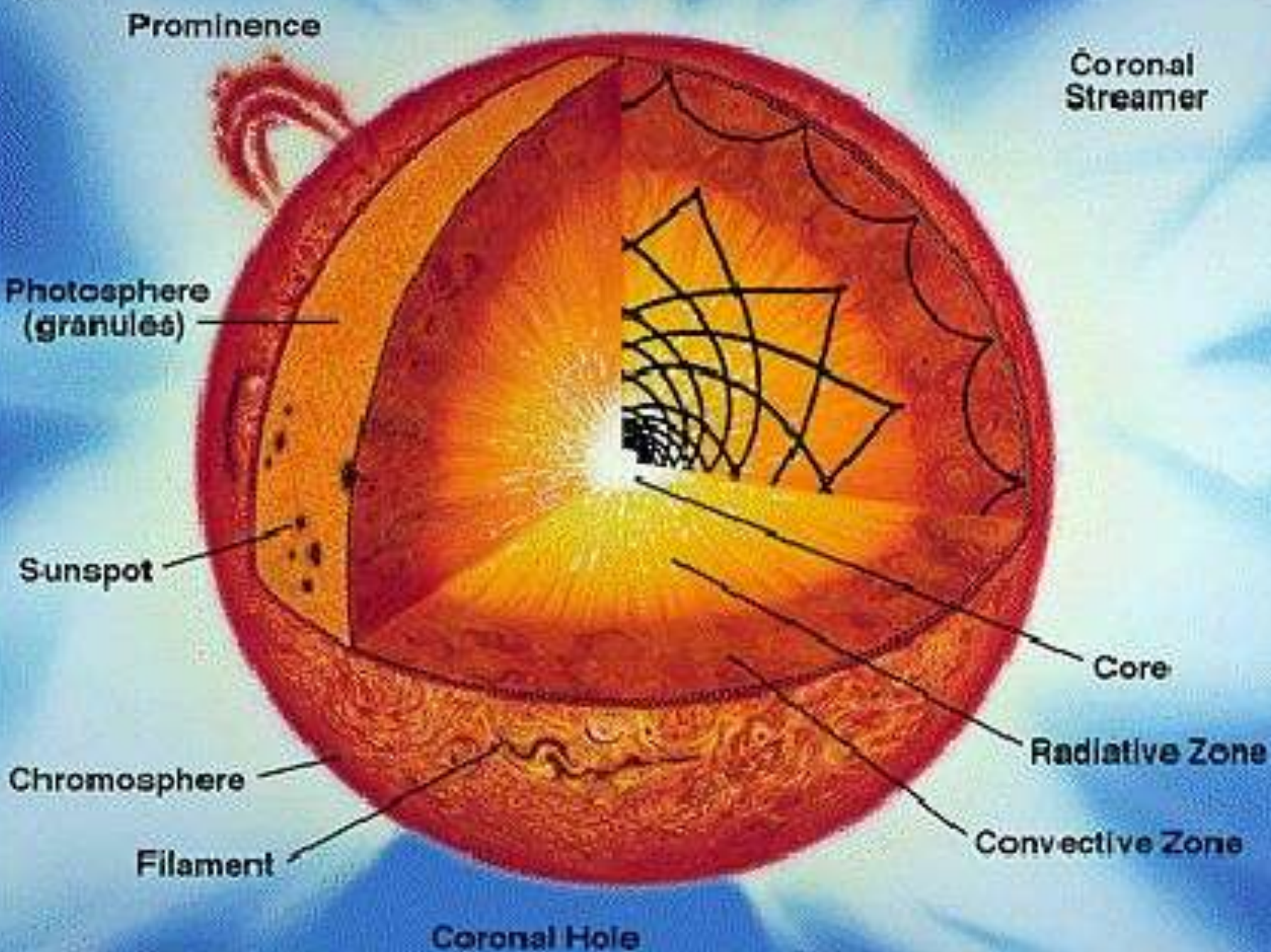
Arcturus

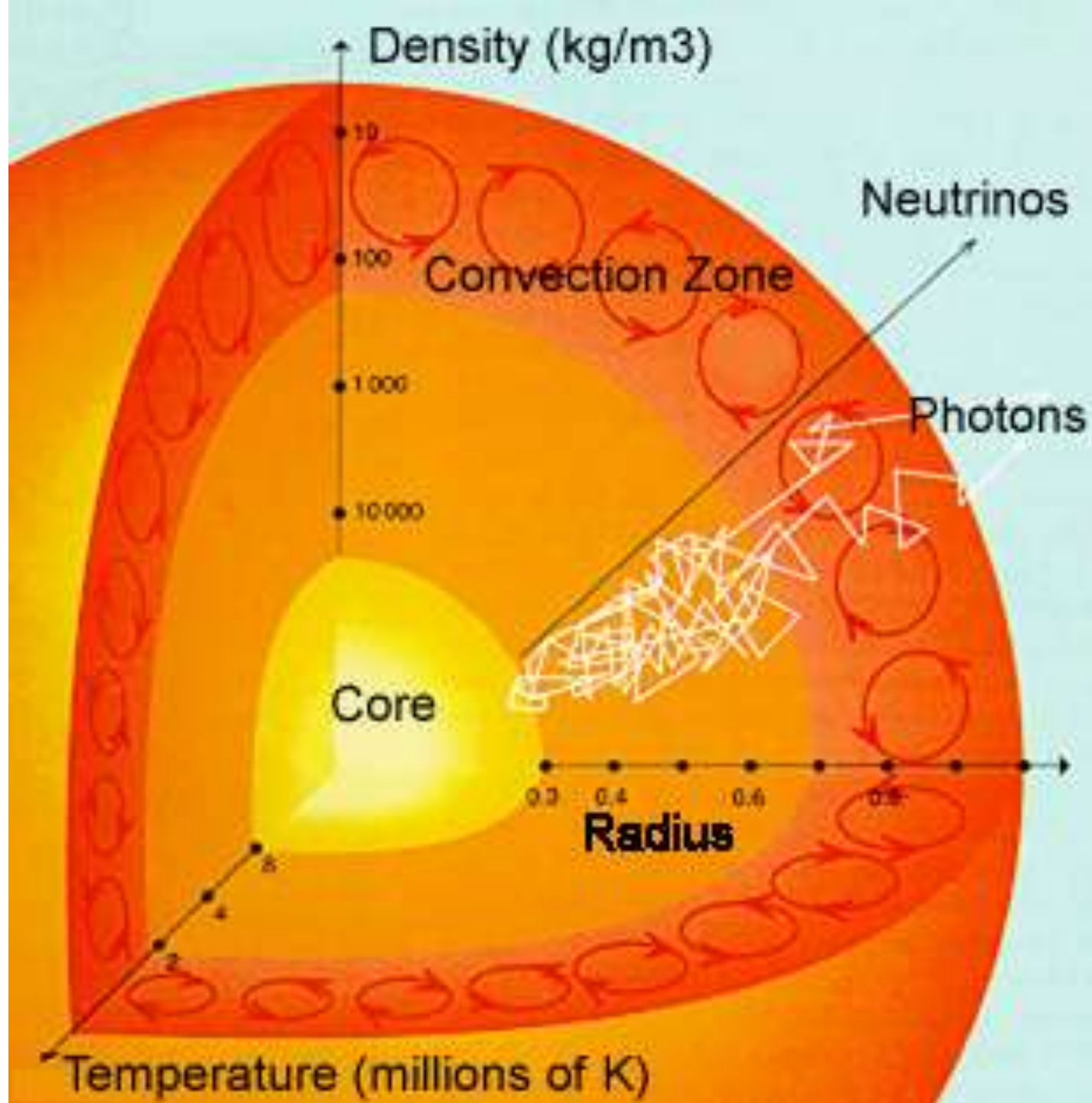


Regions of the sun

- The Core is made of dense helium and hydrogen about 15 million °C
- The radiative layer is warmed by the core 3 million °C
- Convective layer
- Sun's atmosphere has 3 parts
 - Photosphere – is the layer we see when we look at the sun
 - Chromosphere is the middle layer of the atmosphere and is about 2500 km thick
 - Corona extends above the Chromosphere
Visible during total solar eclipse

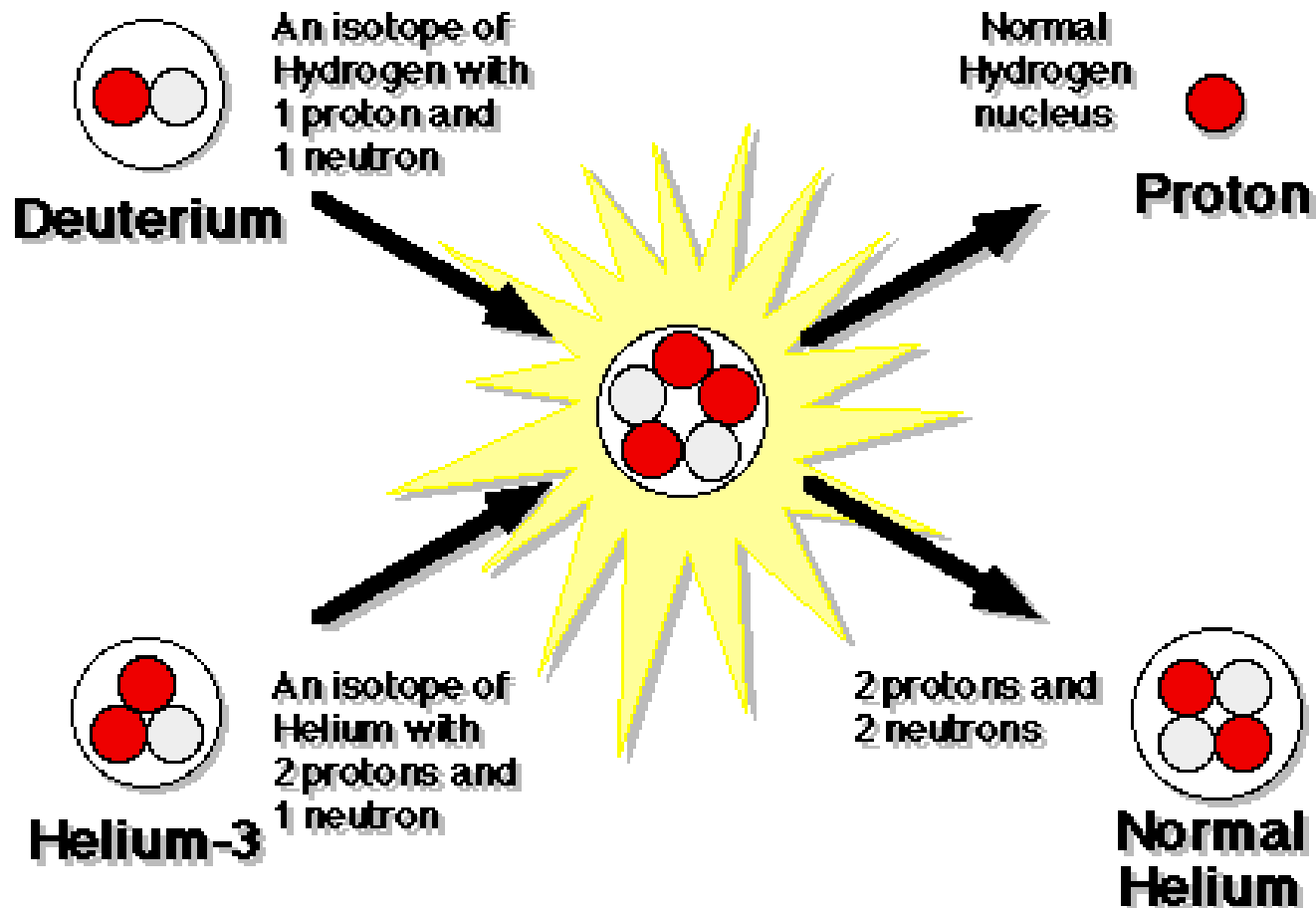






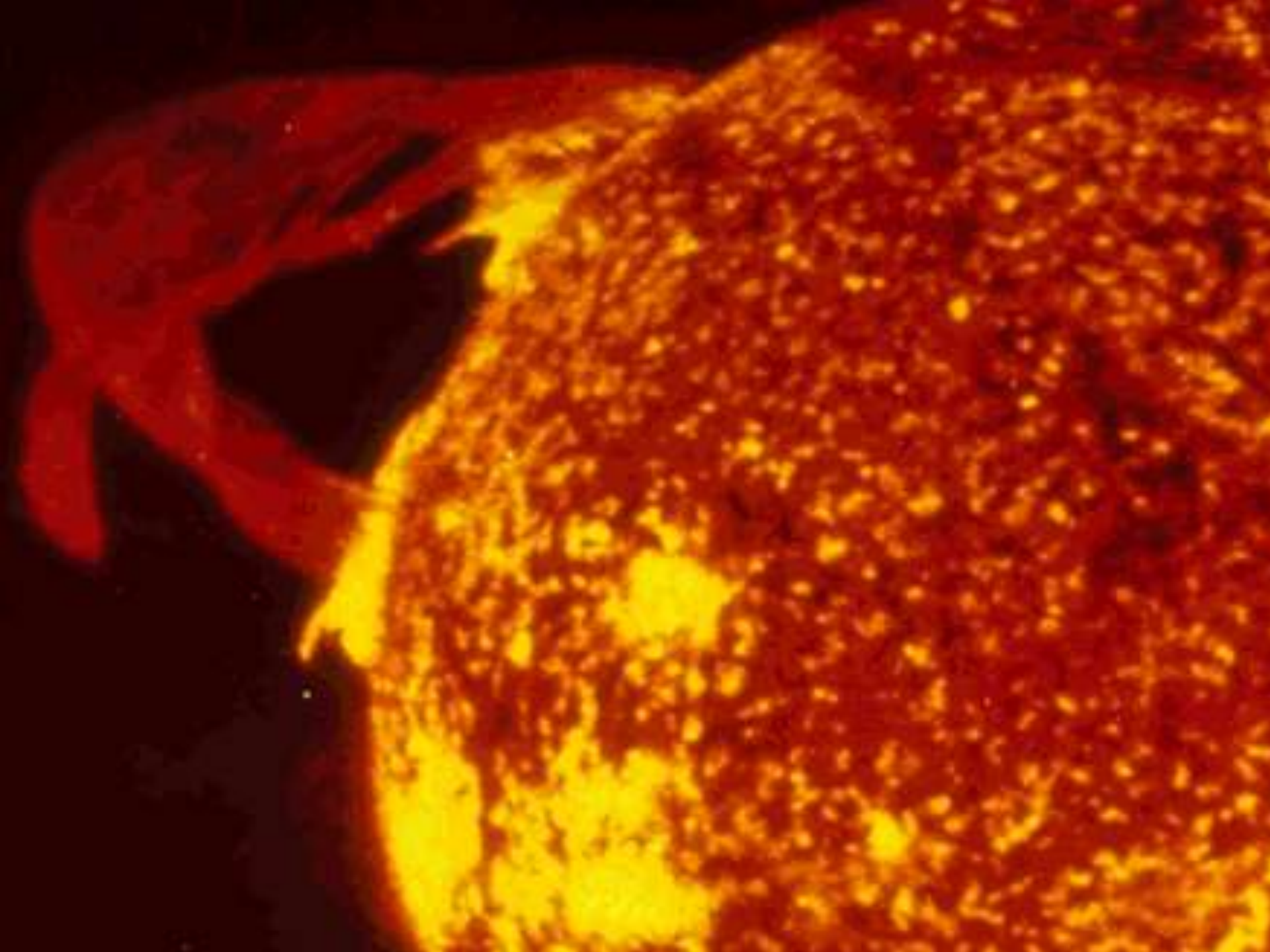
The suns energy

- is fueled by nuclear fusion
- Hydrogen fusing to form helium



Sunspots, Solar Flares, & Solar wind

- **Sunspots are cooler dark areas in the photosphere**
- **Sunspots are the result of magnetic storms on the sun**
- **Galileo studied sunspots in 1612**
- **Sunspots have a strong magnetic field**
- **Most sunspots last from 1-7 days**
- **Sunspots go in an eleven year cycle**
- **During active periods of the sun glaciers retreat and global temperatures are warmer**
- **When the sun is not as active global temperatures are colder**
- **Solar wind is produced during active phases of the sun**



Classifying the stars

- Stars can be classified by color
- Blue - white are hot stars
- Yellow orange and red are cooler stars, red is the coolest
- Stars are also classified according to their actual brightness

Star Classification

- **Most stars fit in to the group called the main sequence stars**
- **Stars that do not fit into this category are giants, dwarfs, and super giants**



Size of Star

Size of Earth's Orbit

Size of Jupiter's Orbit



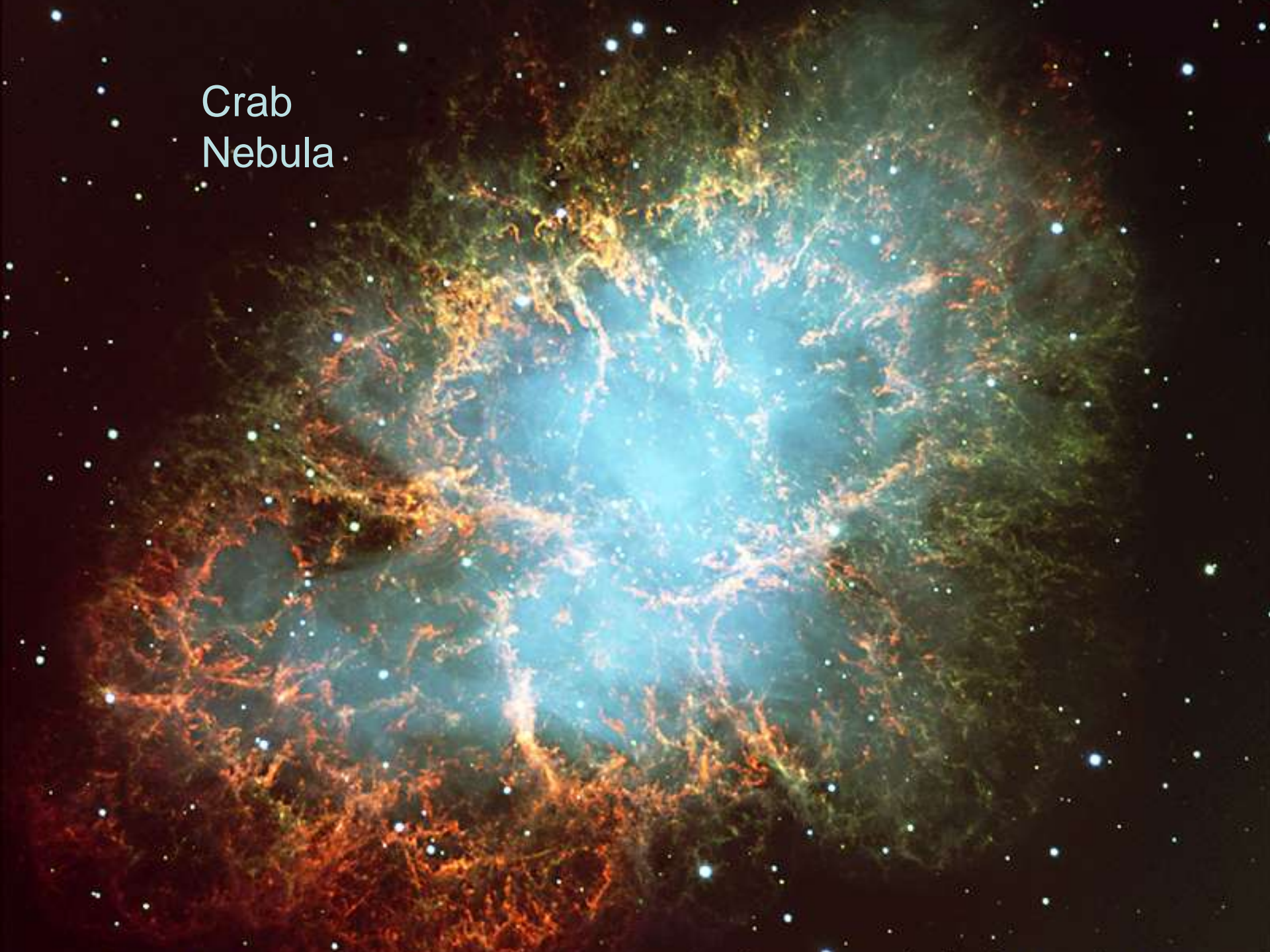
Atmosphere of Betelgeuse

HST • M

Evolution of stars

- **Early stages of a star**
- **A star begins when matter in a region of space of gas and dust, called nebulas**
- **Gas and dust is pulled together by gravity into a spinning cloud**
- **The increase of matter and gravitational pull cause the particles to collide which causes increased heat along with increased pressure**

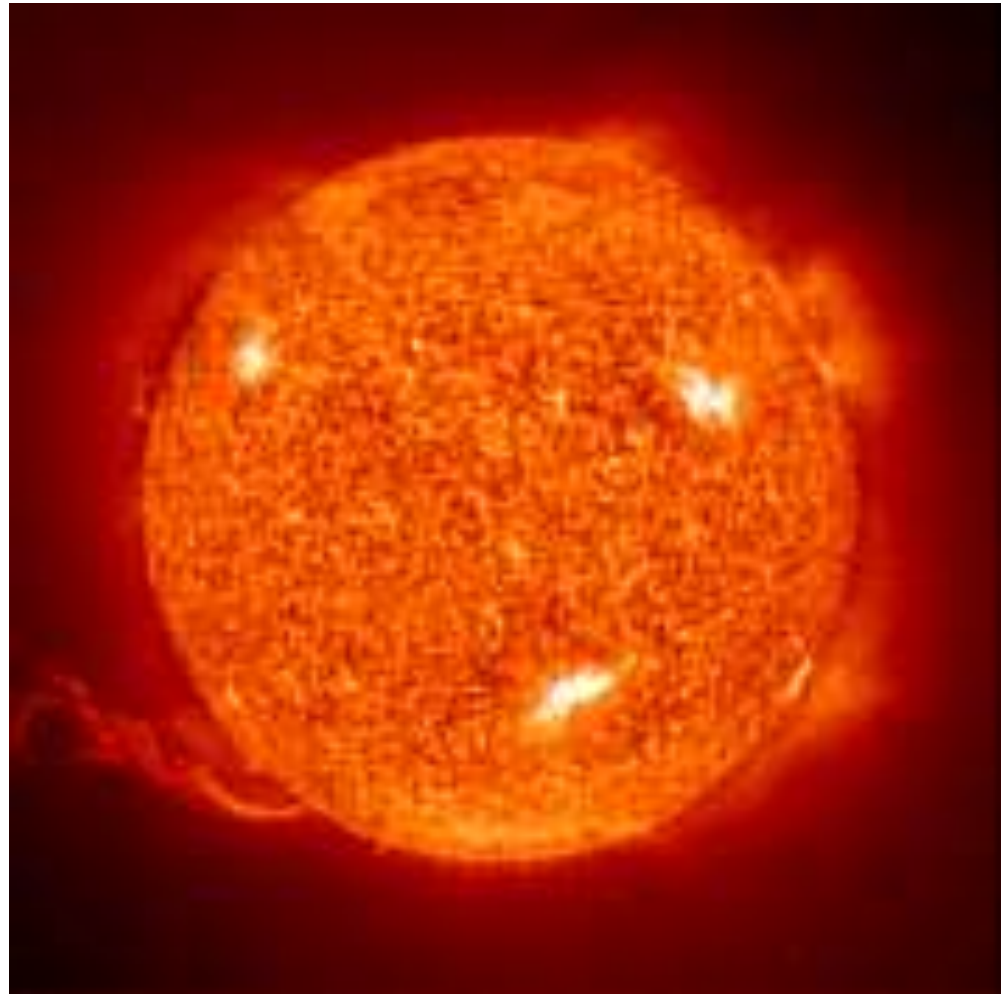
Crab
Nebula



Evolution of Stars

- As the amount of matter is increased to the it no longer falls toward the center
- Through this slow process matter is added to the outer layer of the star
- Much time must pass before the energy released by the matter raises to fusion point in the core
- Fusion point is about 10,000,000 °C

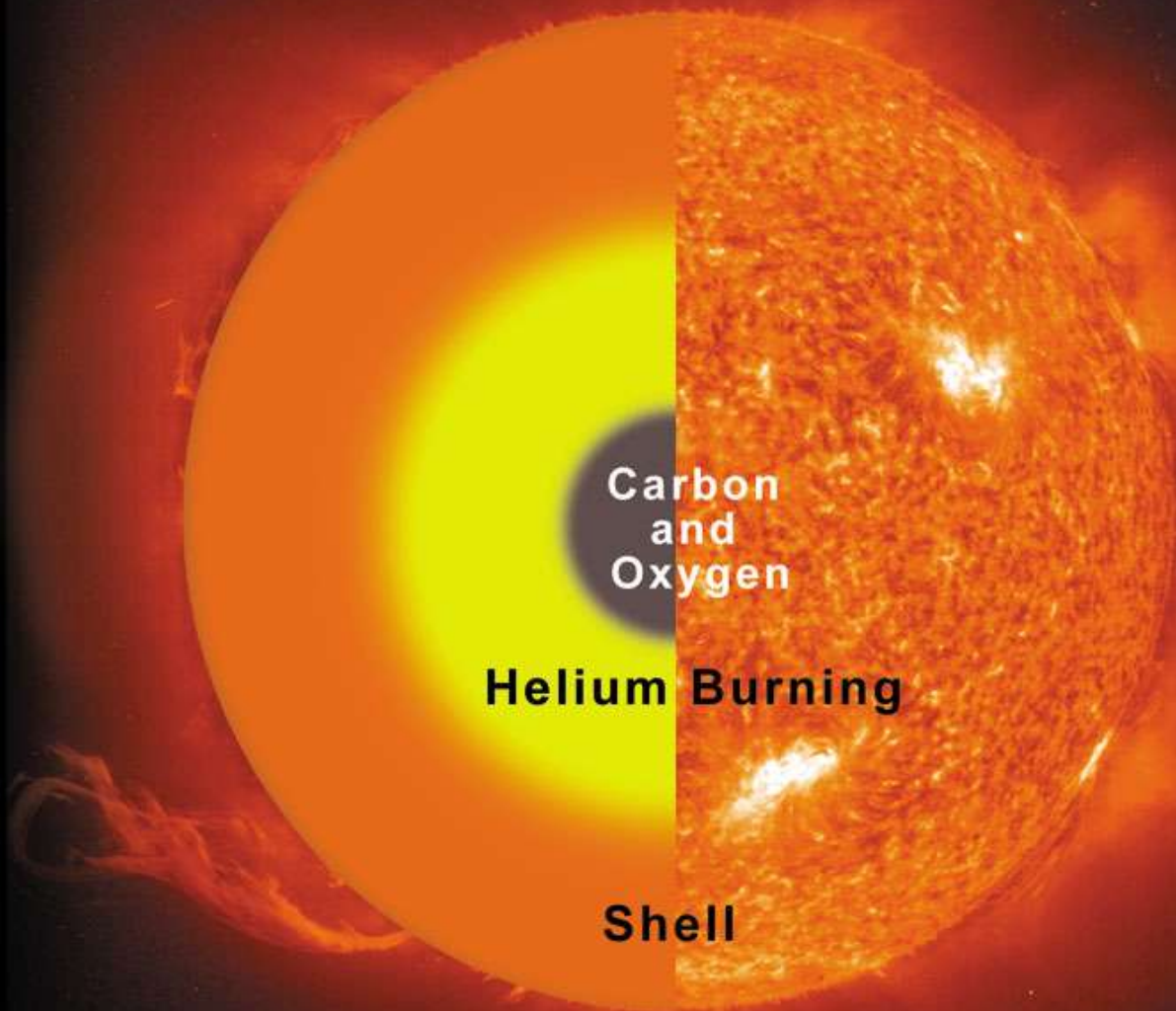
- **This results in a main sequence star**
The life of a star depends on its mass



Death of a star

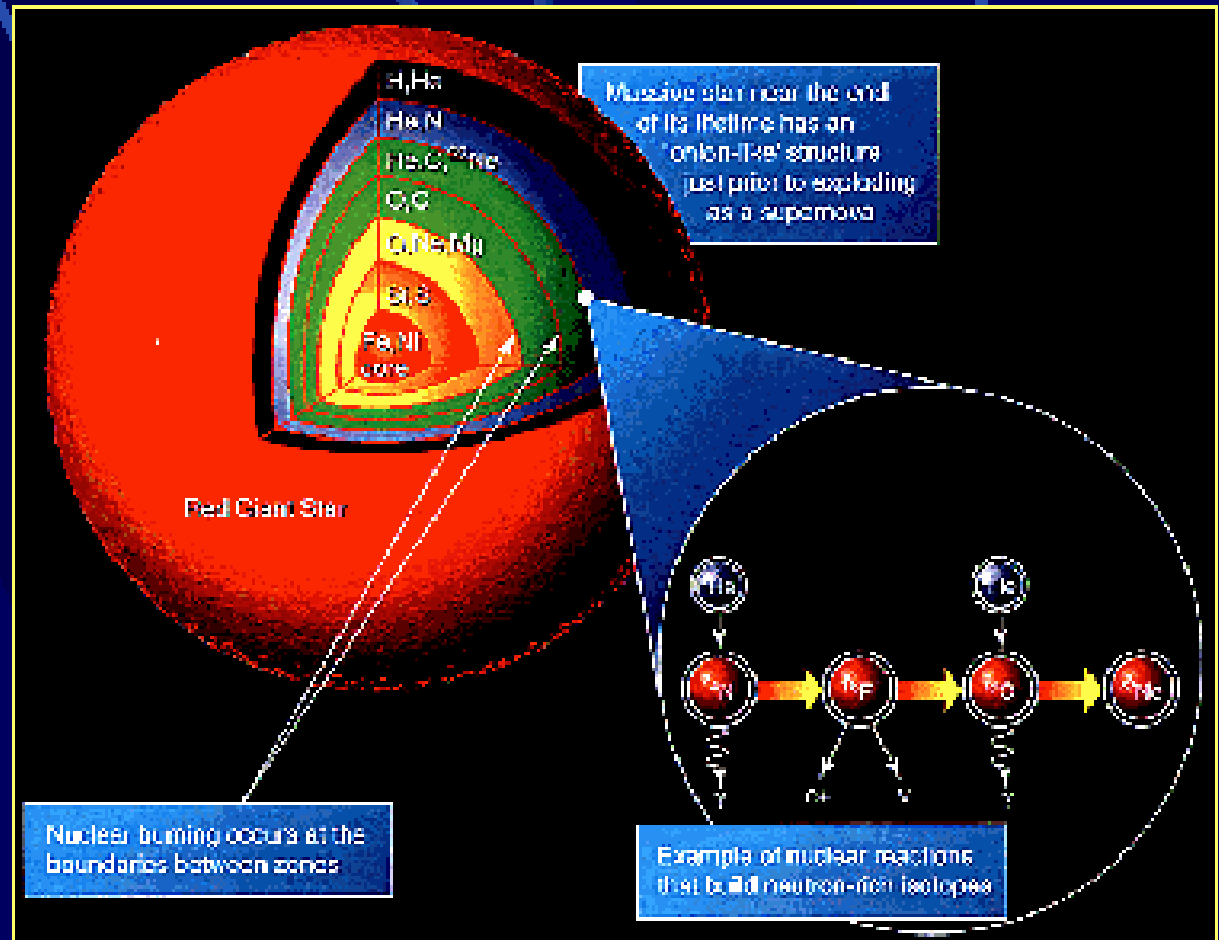
- When all the hydrogen fuses to helium the star begins the next stage
- The core then contracts and the outer regions expand
- The amount of light the star produces changes by decreasing and increasing
- The outer region will begin to cool causing the star to become red
- This stage is called a red giant

Red Giant Star



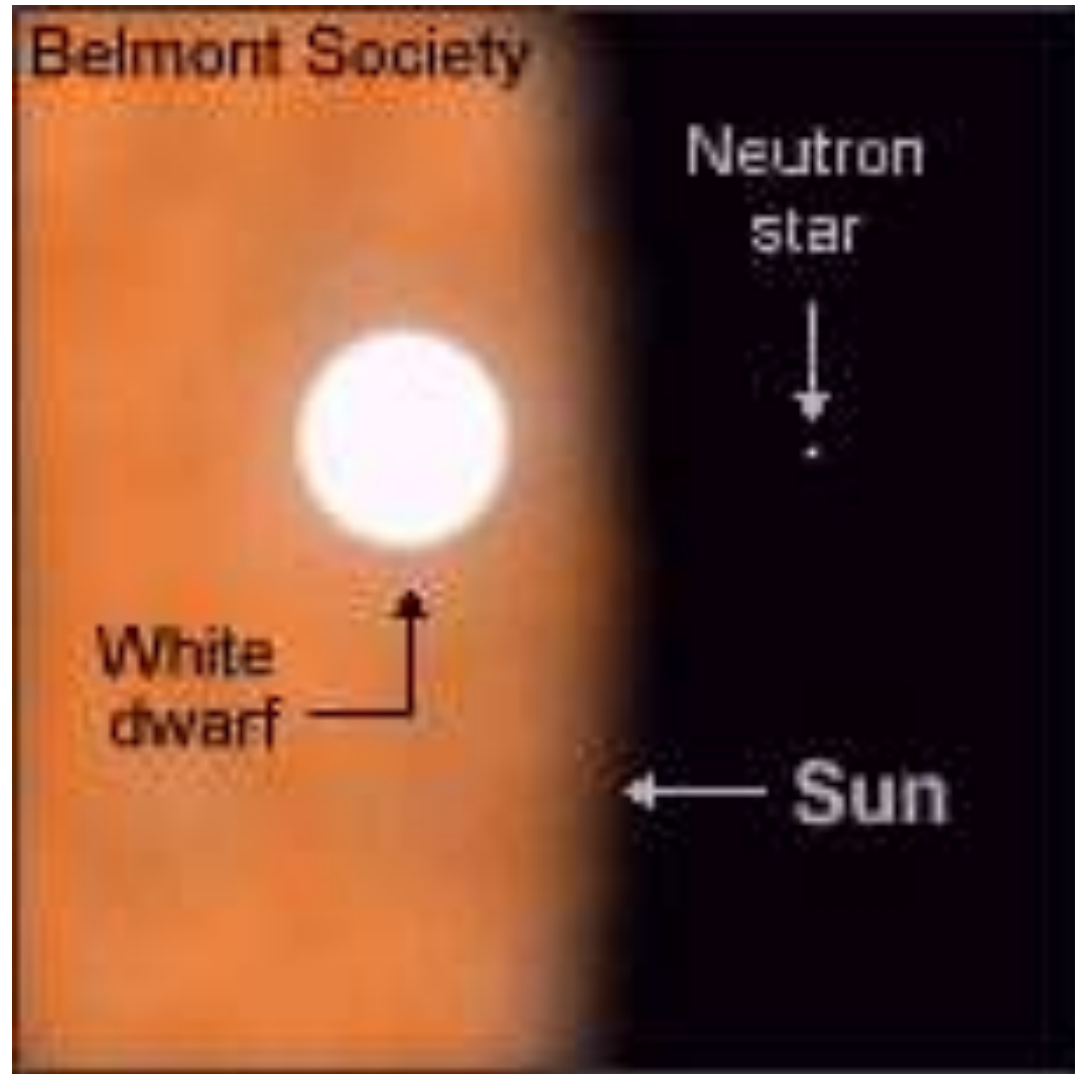
Red Giants and Supergiants

- Hydrogen burns in outer shell around the core
- Heavier elements burn in inner shells



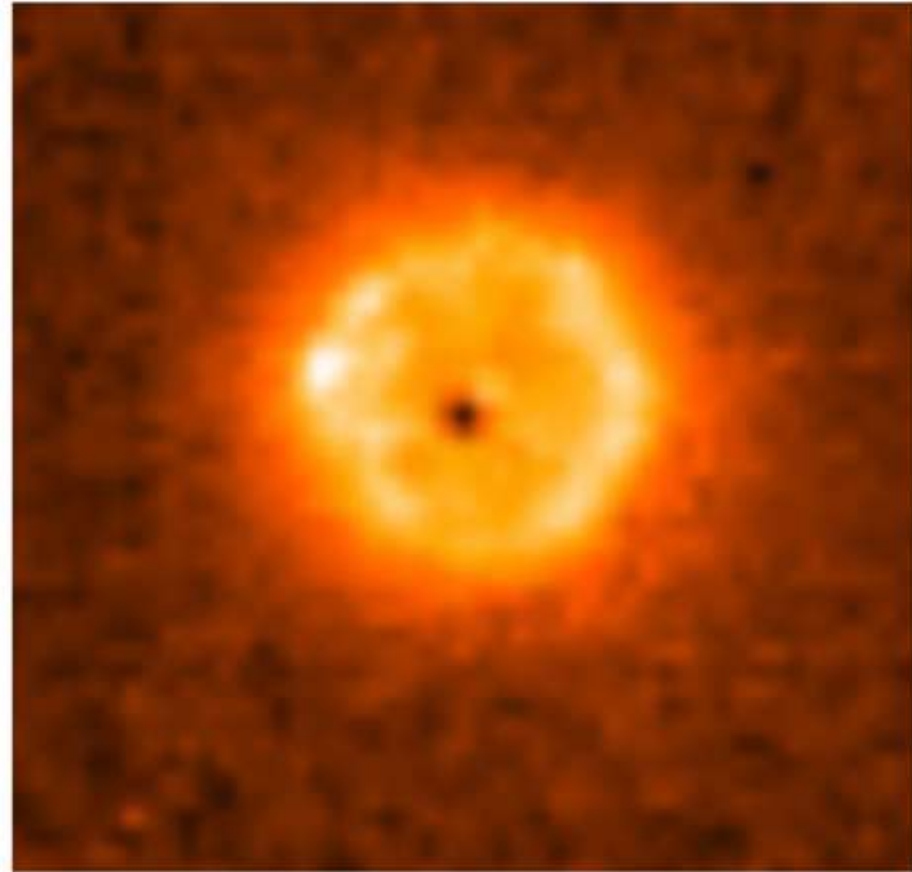
Final stages

- Once the nuclear fuel runs out the star collapses and become a dense ball of shining matter called a white dwarf
- A white dwarf will shine for many years



Final Stages continued

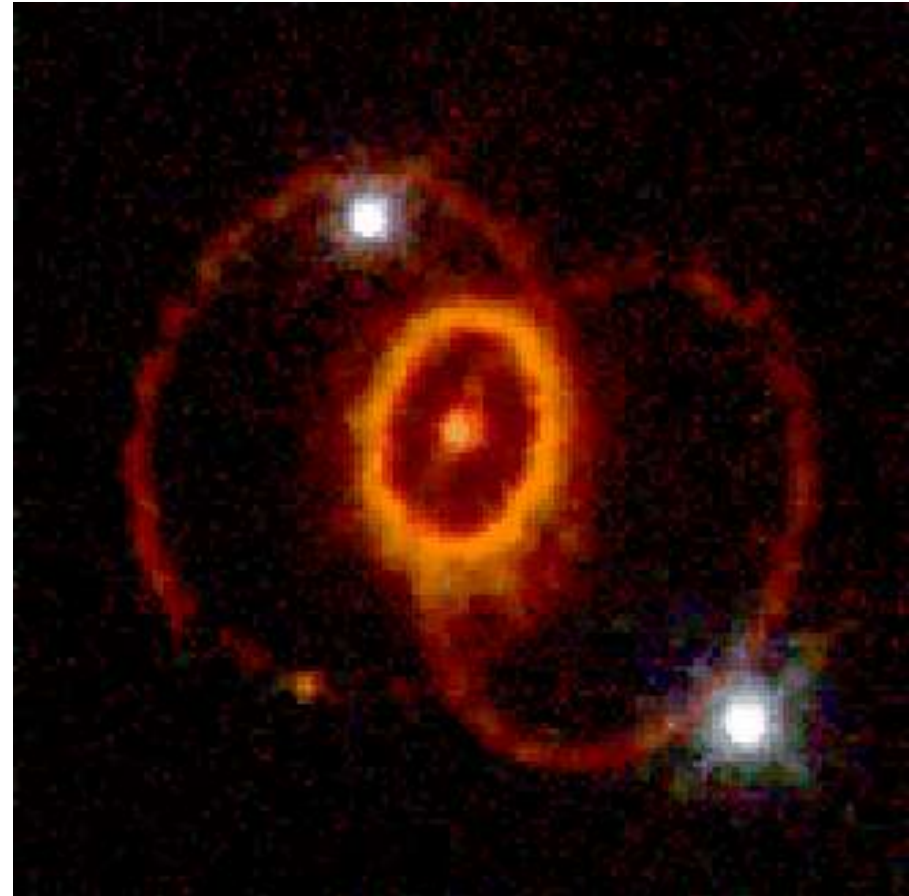
- **Some stars must eject some mass before they can become a white dwarf**
- **When a star does this it is called a nova**
- **When a nova ejects this mass it becomes many times brighter than before and after days or weeks becomes very faint**
- **Ancient Chinese called novas guest stars**
- **A Supernova is an exploding star**



Nova QUVul (Univ. of Wyoming / Space Telescope Science Institute)

Supernova

- **When a supernova occurs the star may become 100,000,000 times brighter**
- **The result of a supernova is gas and dust scattered in space**
- **The Crab Nebula is the result of a supernova**





Nebula are a source of strong x-ray radiation



Horse Head Nebula

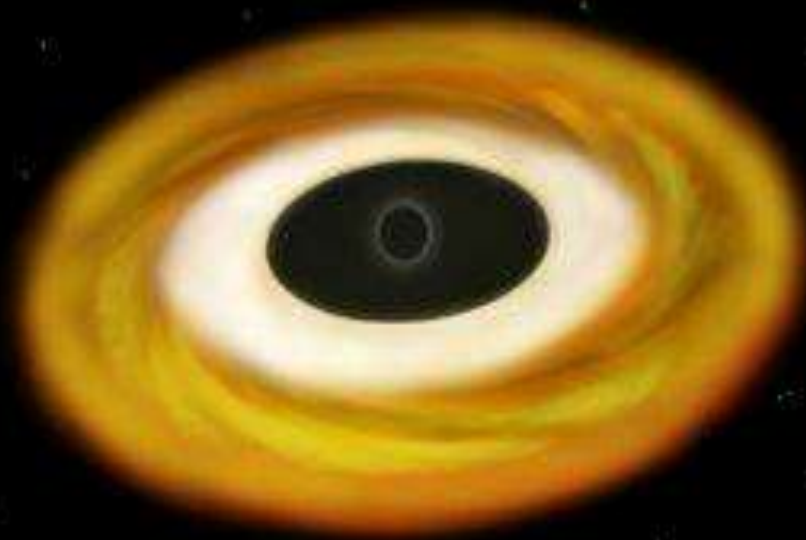
A neutron star

- A star that the electrons are forced into the protons so they become neutrons. Thus all matter in the star becomes neutrons
- A neutron star is very small
- A neutron star with the same mass of the sun has a diameter of 10 km
- A neutron star spins very rapidly releasing energy as they spin
- Spinning neutron stars are called pulsars which eventually stop spinning

A black hole

A black hole is depicted as a bright, glowing yellow and orange sphere in the center, surrounded by a swirling accretion disk of gas and dust. The disk is illuminated from within, creating a gradient of colors from yellow to red to dark blue. The background is a dark, starry space with some faint, wispy structures.

- An area in space where gravitation is so strong that light cannot escape
- Black holes could be the result of a neutrons star disappearing within itself



NON-SPINNING BLACK HOLE



SPINNING BLACK HOLE


The Sun's lifespan

- **A main sequence yellow star**
- **Scientists estimate that the hydrogen will change to helium in the sun in the next 5 billion years**
- **When 98% of the hydrogen turns to helium the sun will turn into a red giant and increase in size enough to engulf mercury and maybe earth**
- **The sun would be 1000 times brighter**
- **From this point the sun will slowly cool and collapse into a white dwarf and eventually into a neutron star and a black hole**

Interstellar space

- The area between the stars and galaxies is not empty
- Nebulas exist between stars
- The main gasses in space are hydrogen and helium
- Large amounts of dust around a star can make it appear red and absorb most of the radiation from the star.
- Galaxies

The Milky Way galaxy

- The one that the solar system is in
 - It is 100,000 light years across
- 
- In the center of our galaxy is the galactic nucleus maybe a black hole
 - Everything revolves around the galactic nucleus
 - It takes our sun 230 million years to make one revolution around the nucleus

Galaxies



- There are 16 galaxies within 3,000,000 light years of the Milky Way
- Andromeda is another spiral galaxy two times the size of ours about 2,000,000

Three types of galaxies

- **Spiral with arms that radiate from the nucleus**
- **Irregular, which has no specific shape.**
- **Elliptical which look like a slightly flattened sphere**



Milky Way



Magellenic Cloud

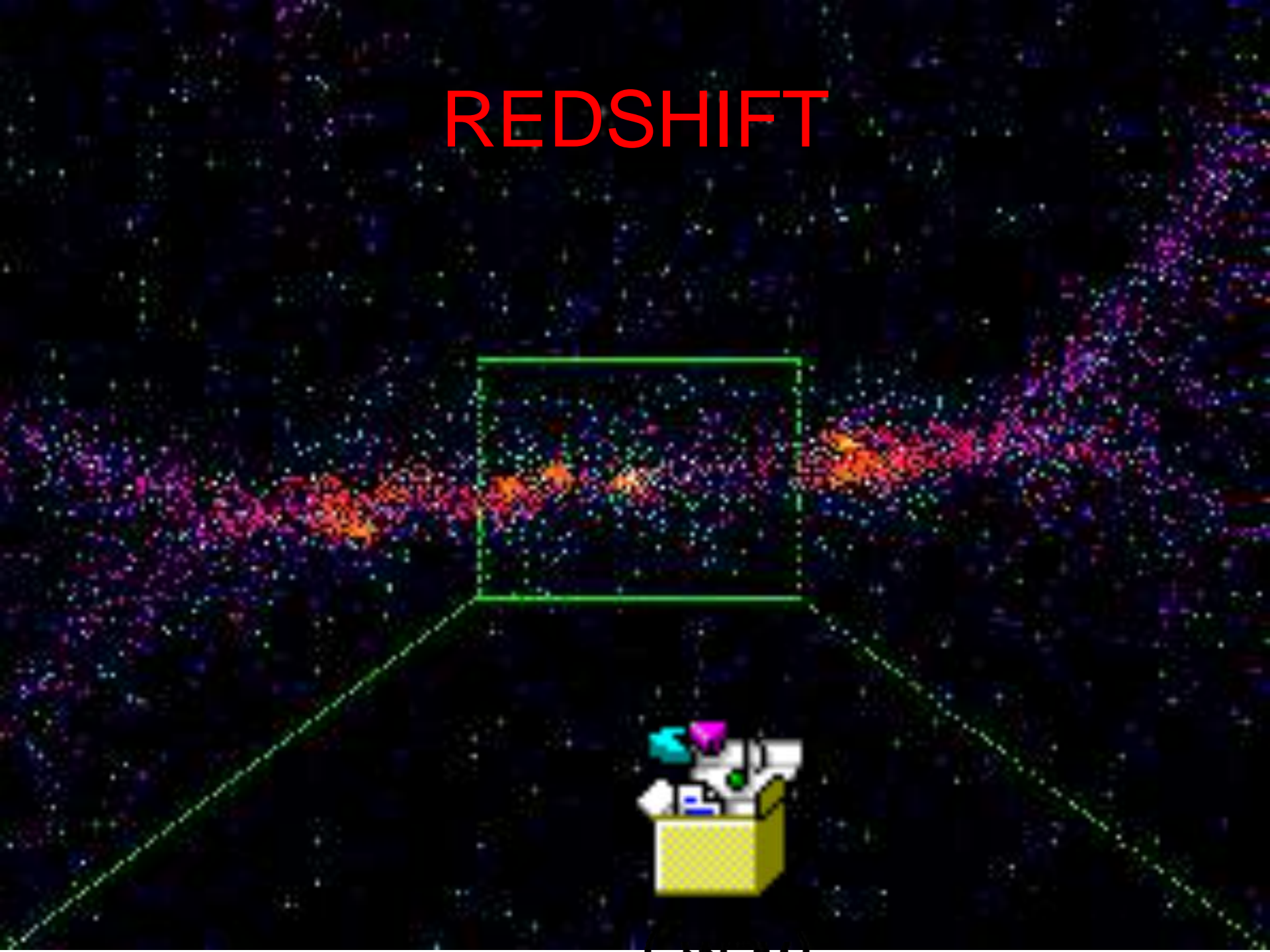


galaxy M87

Galactic Movement

- **Galaxies appear to be moving away from each other**
- **When light from other galaxies there is a shift to the red end of the light spectrum called the red shift**
- **This supports the idea that the galaxies are moving away from each other**

REDSHIFT



Origin to the universe

- **Three theories**
 - **Big bang**
 - **Study State**
 - **Creator Designer**



Constellations

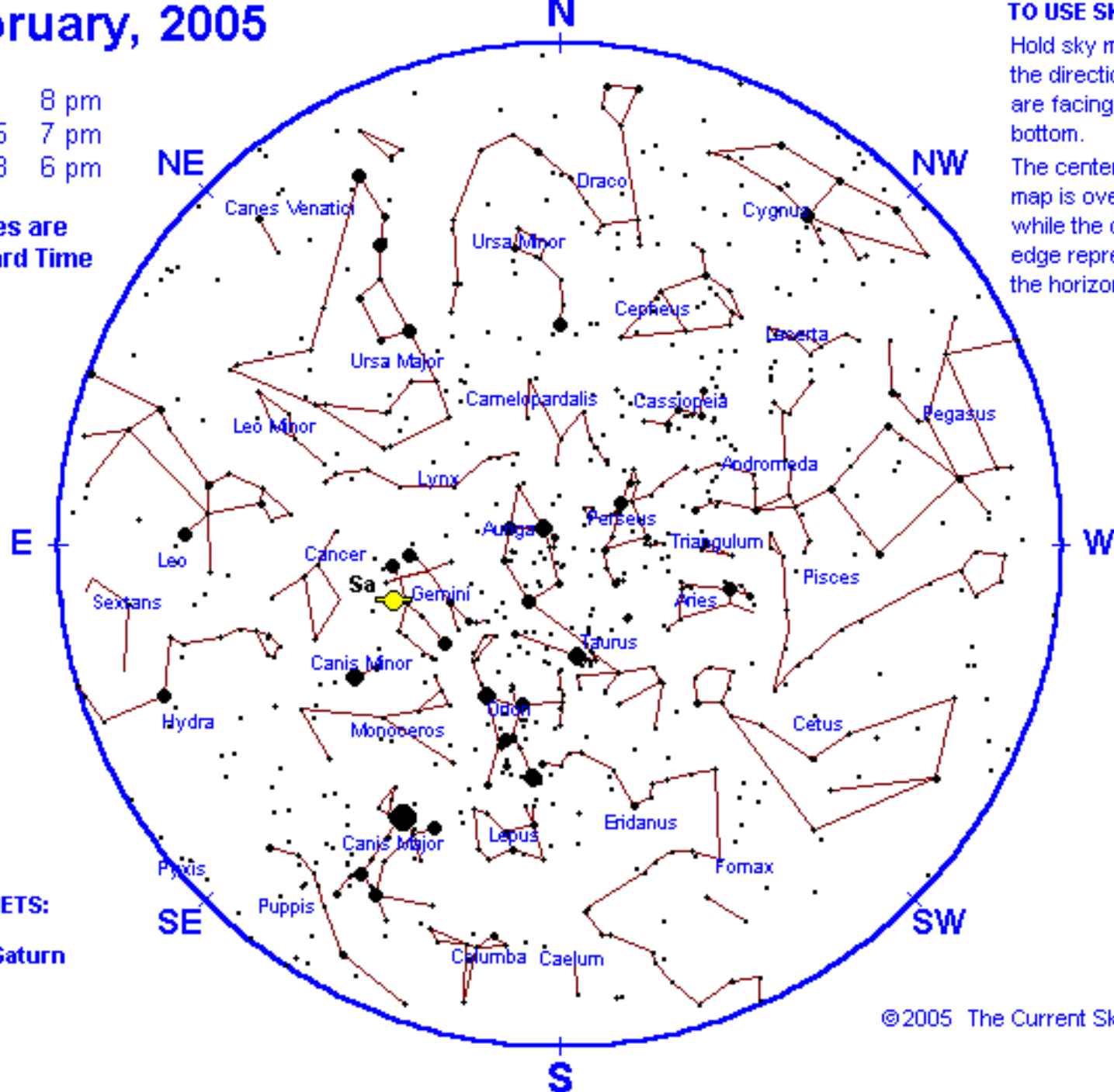
February, 2005

Feb 1 8 pm
Feb 15 7 pm
Feb 28 6 pm

All times are
Standard Time

TO USE SKY MAP:
Hold sky map with
the direction you
are facing at the
bottom.

The center of the
map is overhead
while the circular
edge represents
the horizon.

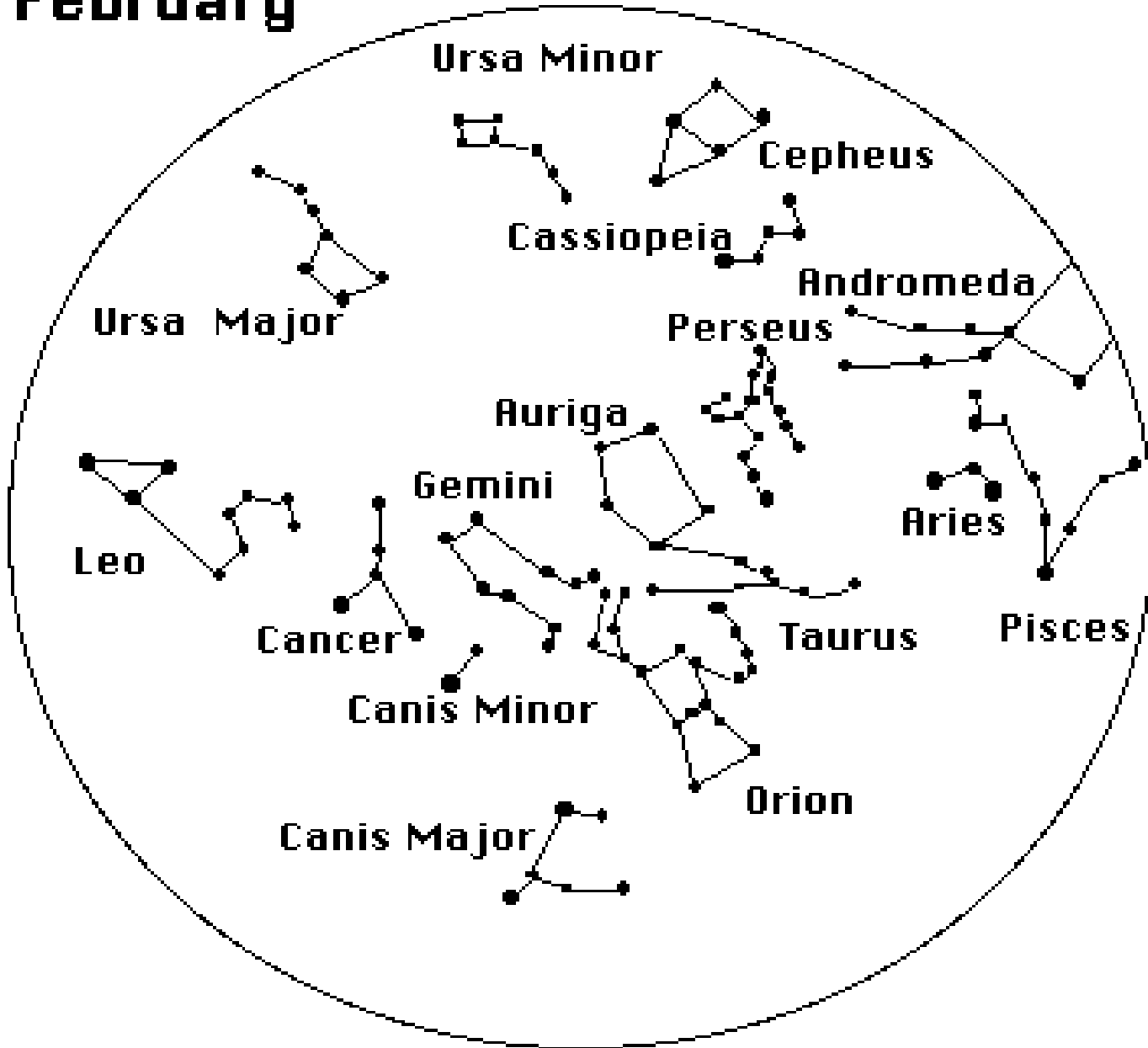


PLANETS:

Sa = Saturn

February

North



West

East

South

March

North

Cepheus

Ursa Minor

Andromeda

Cassiopeia

Ursa Minor

Perseus

Aries

Bootes

Auriga

Taurus

East

Gemini

West

Virgo

Leo

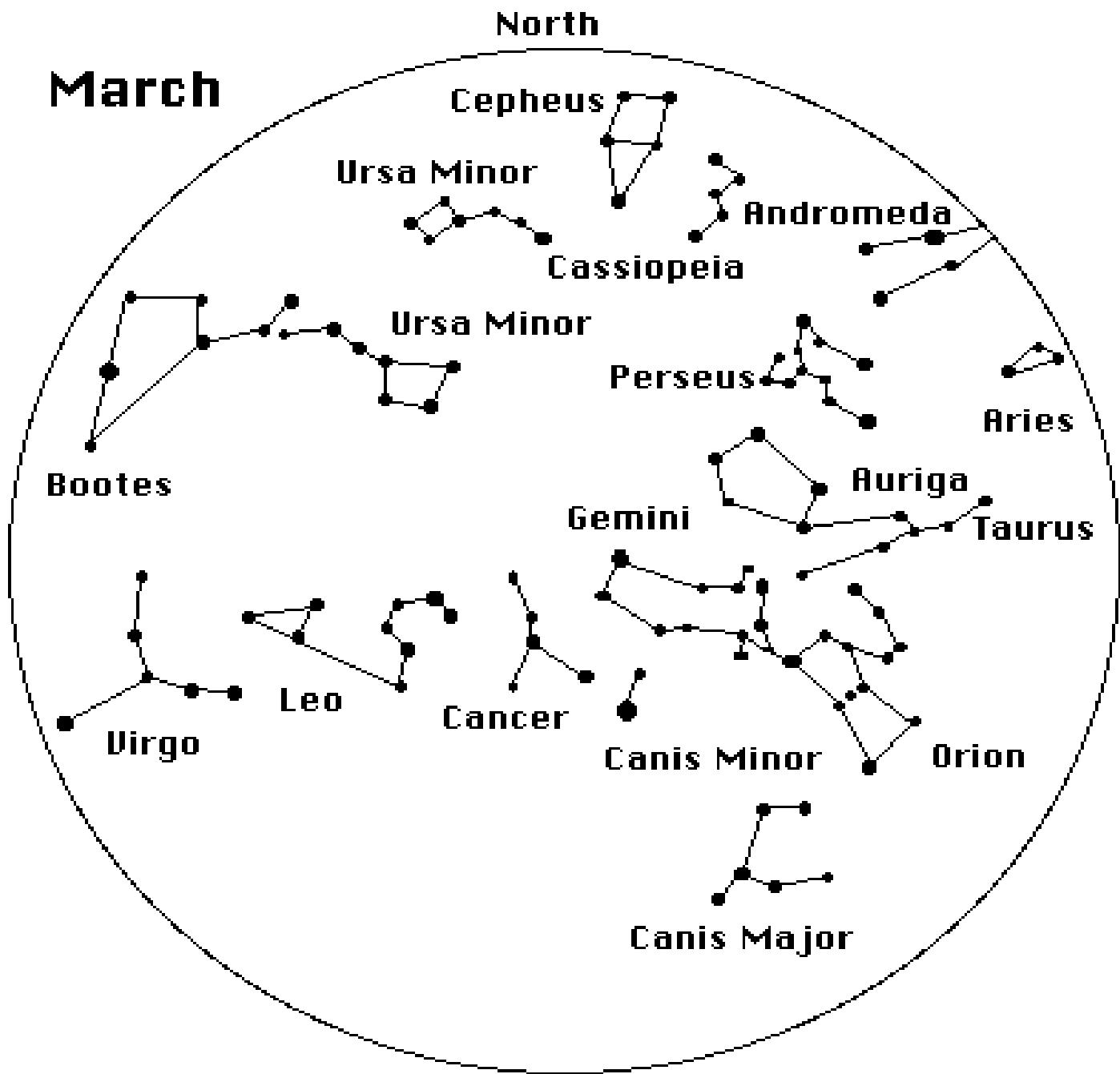
Cancer

Canis Minor

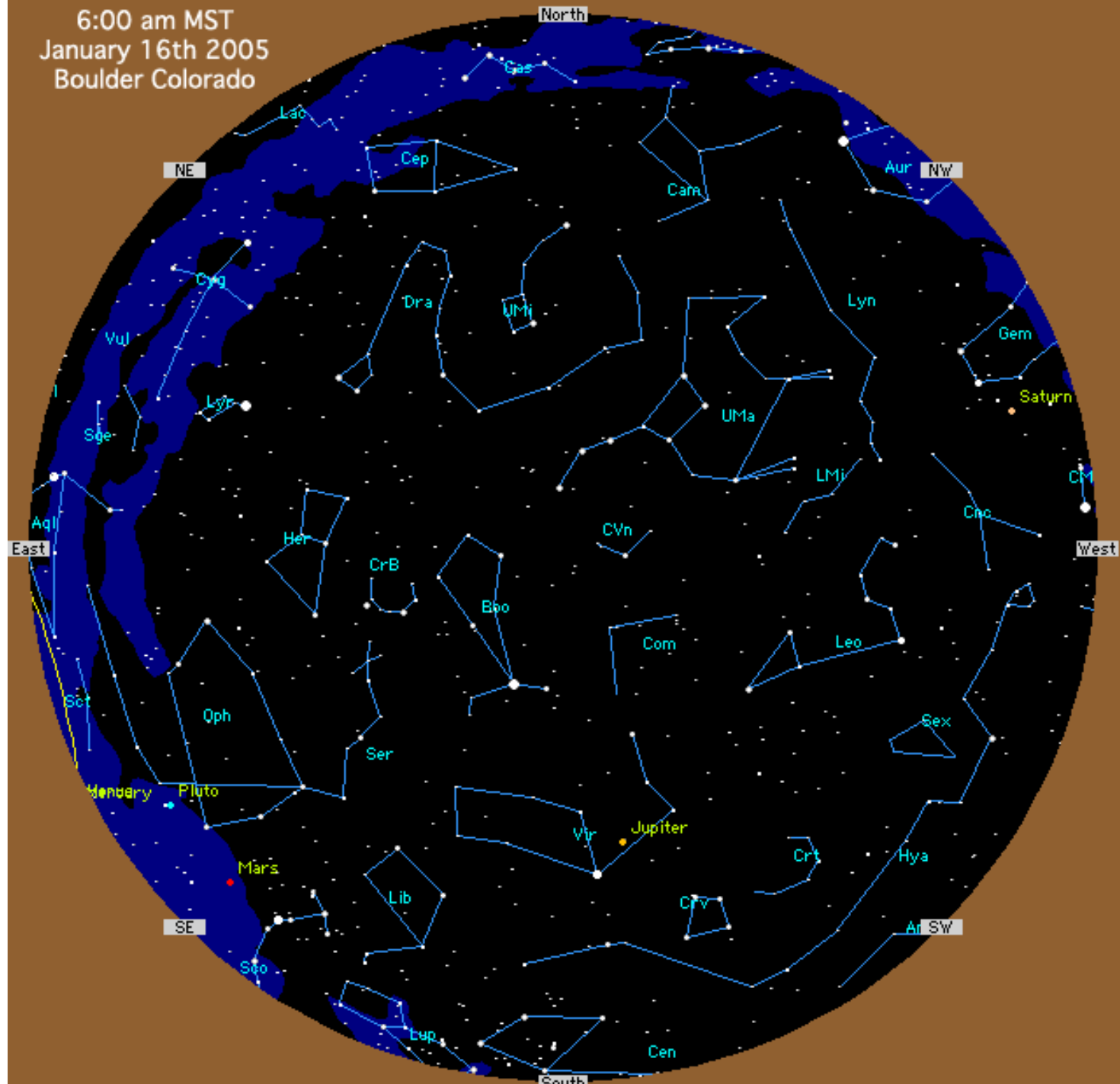
Orion

Canis Major

South

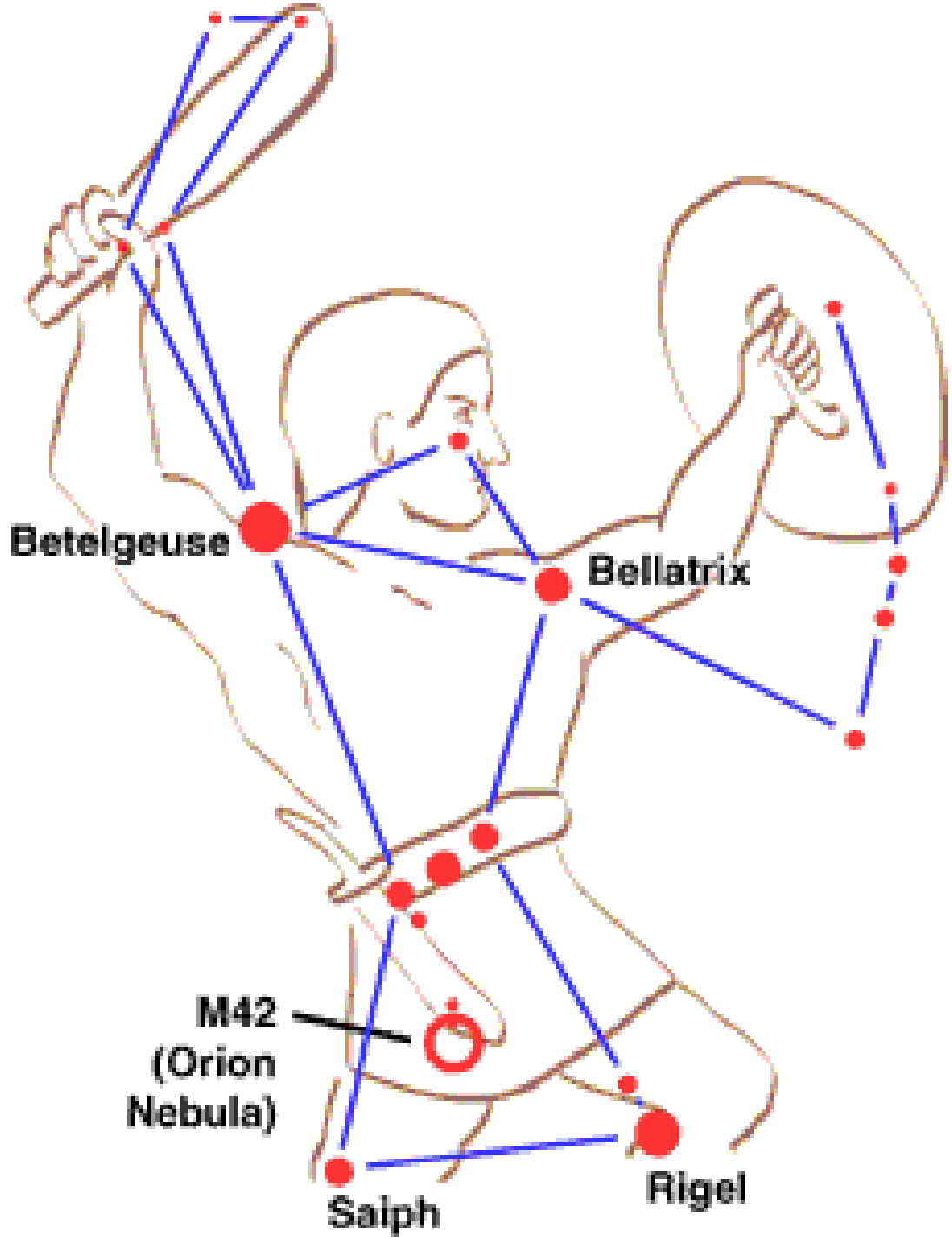


6:00 am MST
January 16th 2005
Boulder Colorado

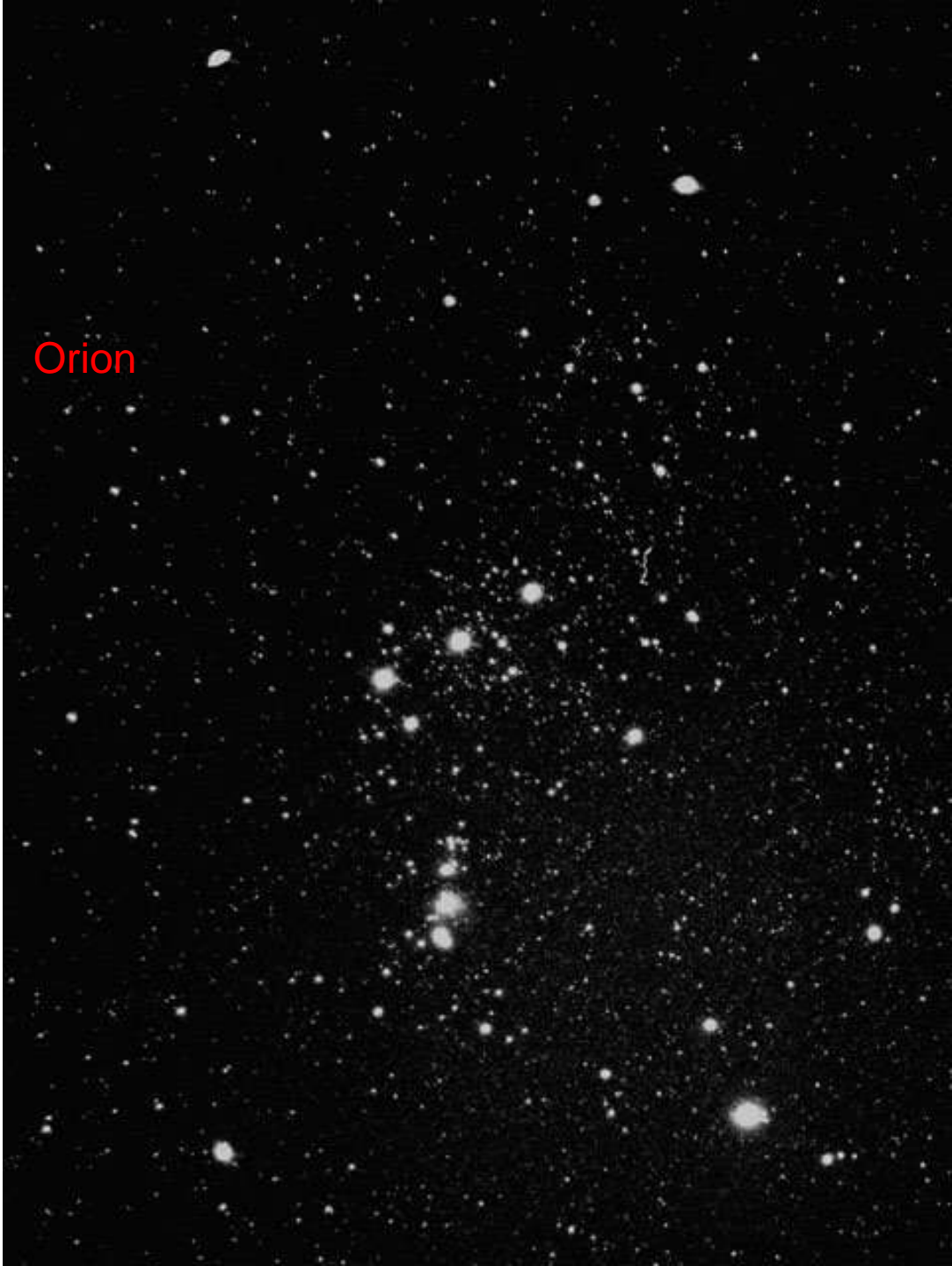


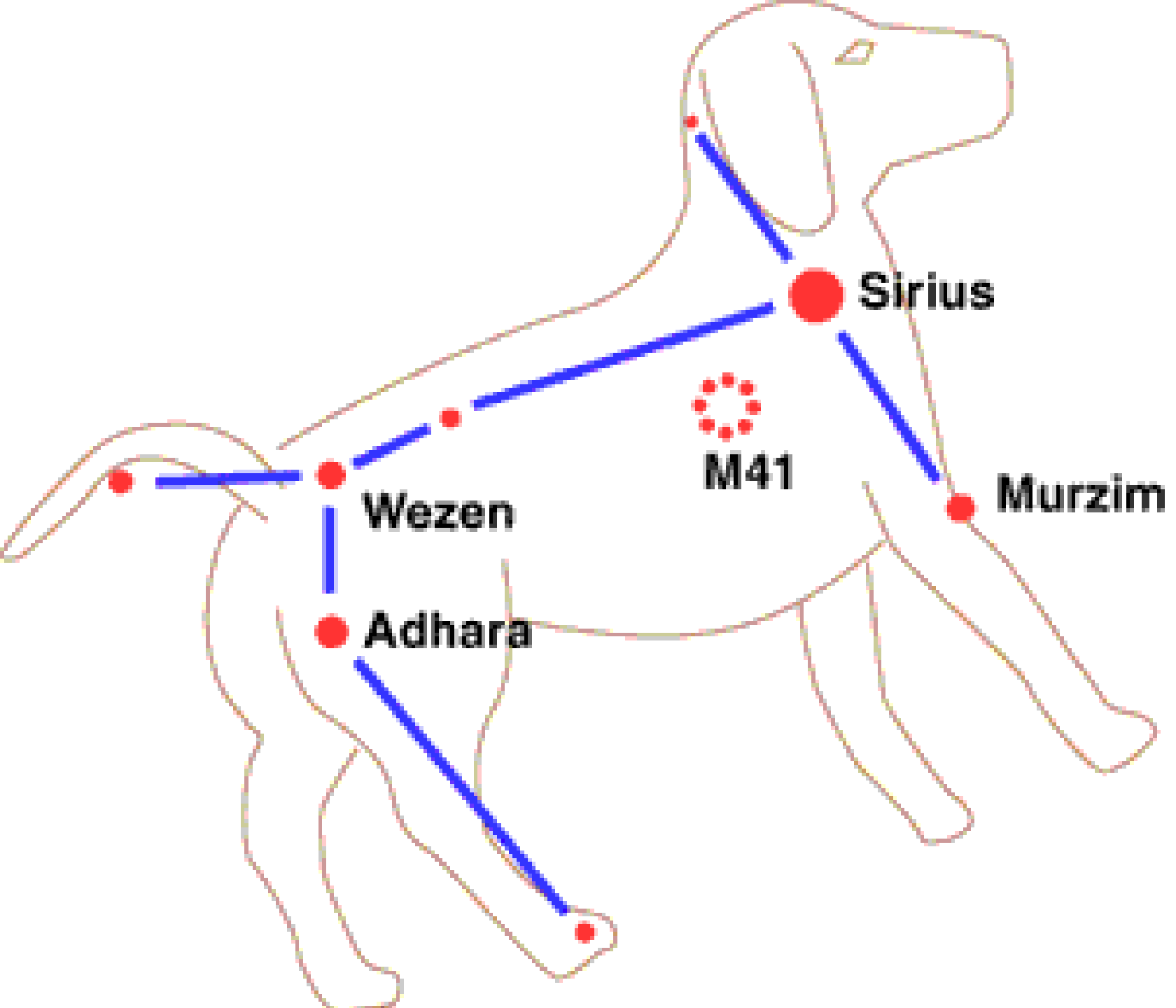


Taurus



Orion







Pleiades

Ursa Minor

polaris



Leo the lion

Denebola

Algieba

Regulus





Auriga





