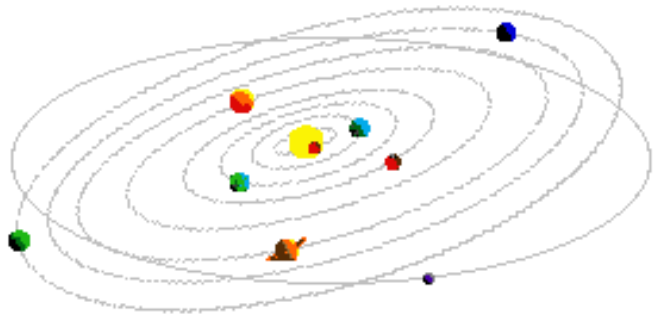
INTERMEDIATE SCIECNE 9

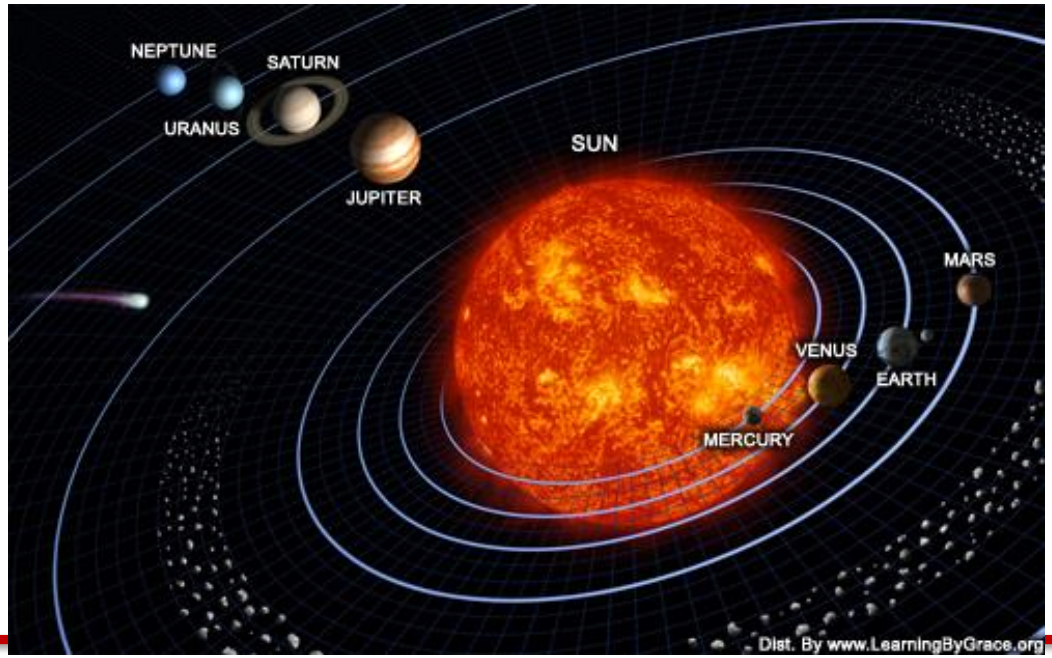
- **Unit 1: Space**

SECTION 7: SOLAR SYSTEM



What is a Solar System

- **Solar System** is everything that centers around the sun. That includes eight planets as well as some smaller objects such as asteroids, comets and meteoroids.



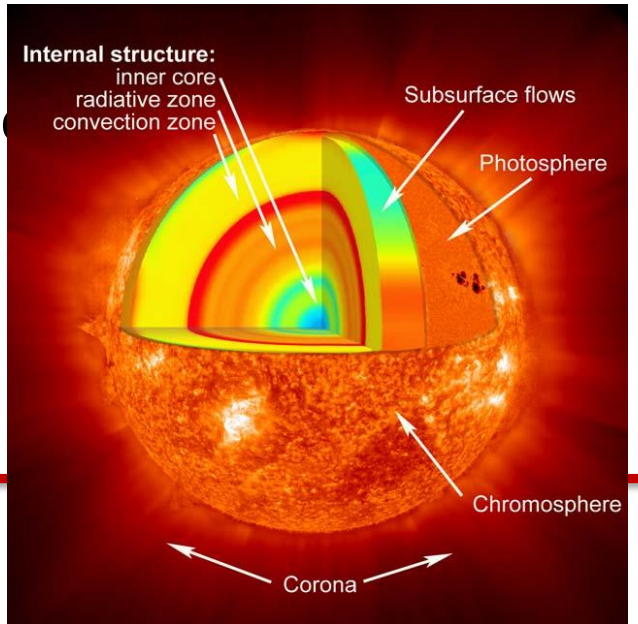
SUN

- is the star at the center of the Solar System and is by far the most important source of energy for life on Earth

- Most of the Sun's mass is hydrogen gas, the most common element in space.

- **thermonuclear reaction** the fusion of two or more atoms to create a different, larger atom, and a great deal of energy.

- thermonuclear reactions in the Sun's core
  to fuse to create helium.

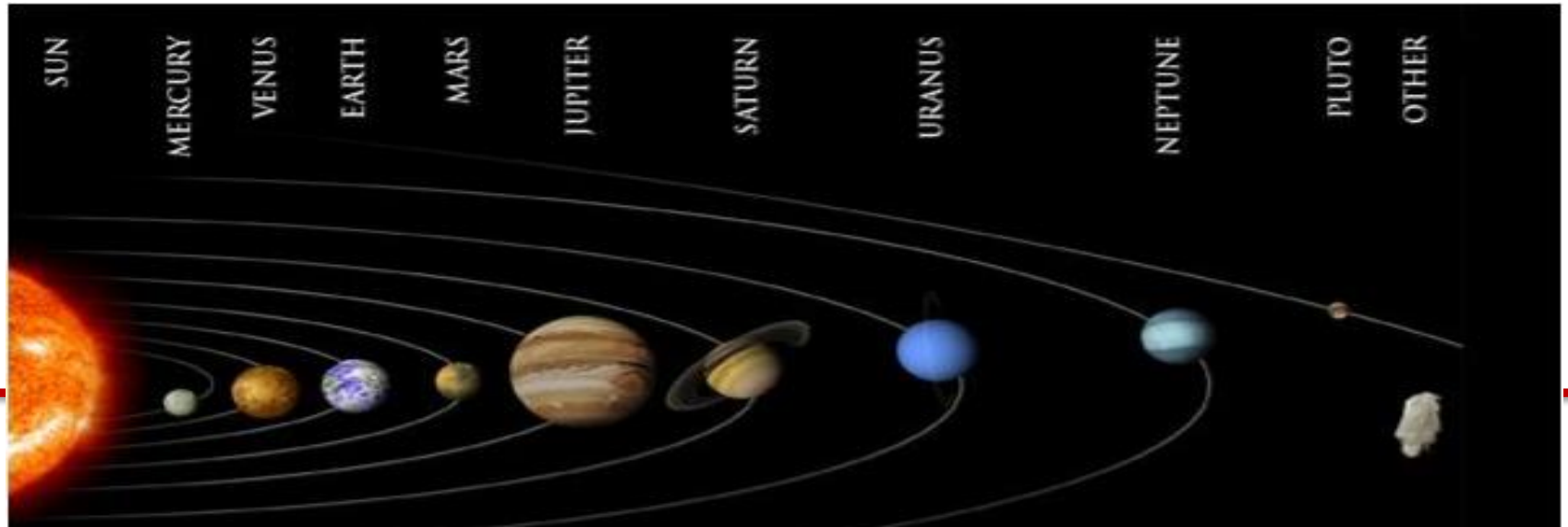


Components Of Our Solar System

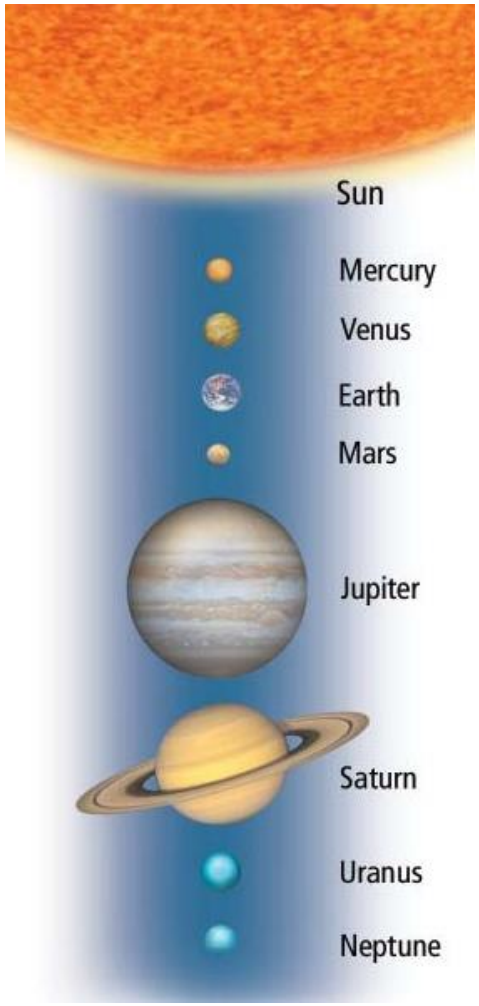
- i. the sun
- ii terrestrial and gas planets
- iii. dwarf planets (Pluto)
- iv. comets
- v. Asteroids
- vi meteors

CHARACTERISTICS OF A PLANET

- Celestial bodies that orbit one or more stars
- Massive enough for its gravity to hold a spherical shape
- Massive enough (i.e. has enough gravity) to clear its orbital path of debris
- Includes Mercury, Venus, Earth, Mars, Jupiter, Uranus and Neptune



Classifying Planets

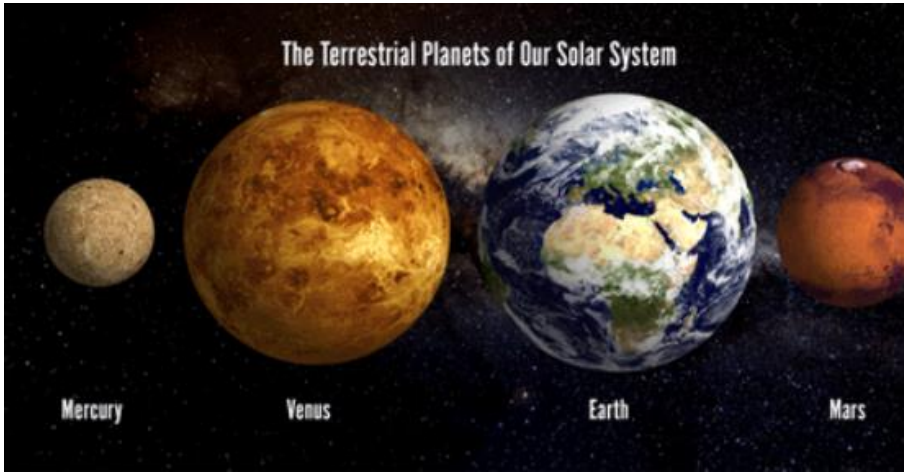


Terrestrial Planets (Inner Planets) **refer to** planets closest to the Sun Mercury, Venus, Earth, and Mars.

Jovian(Outer planets) refers to planets that are further away from the sun. Examples: Jupiter, Saturn, Uranus,and Neptune.

Terrestrial Planets

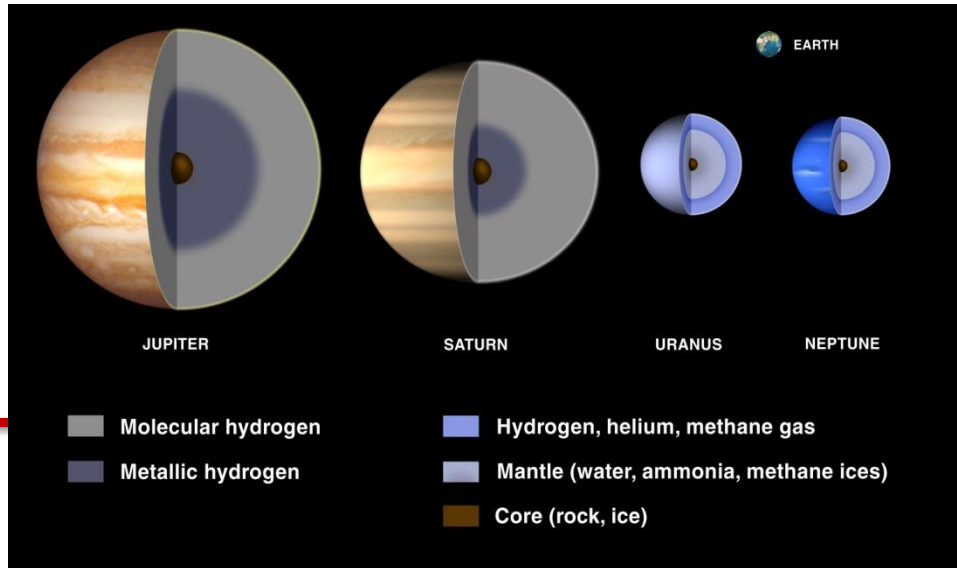
- **terrestrial planets** are the four innermost planets in the solar system, Mercury, Venus, Earth and Mars.



- Dense and rocky
- Closest to the sun
- Smaller orbits
- Warmer average surface temperatures (-63 C to 467 C

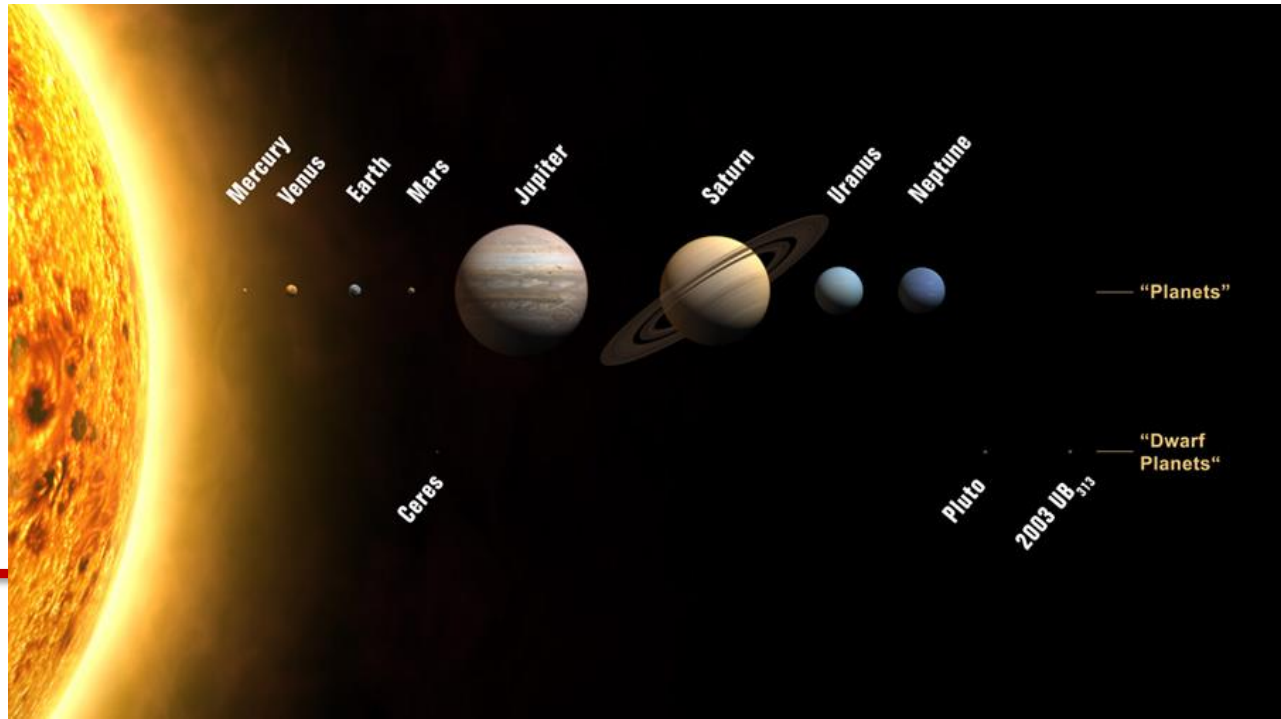
Gases Planets (Jovian)

- Jovian (Jupiter-like) planets, because they are all gigantic compared with Earth, and they have a gaseous nature.
- The Jovian planets are also referred to as the gas giants,
- Includes Jupiter, Saturn, Uranus and Neptune
- Larger orbits
- Cold surface temperature
- -215 C to -150 C



Dwarf Planets (Pluto)

- Celestial bodies that orbit the sun with enough gravity to hold its spherical shape, but...
- They are not massive enough to clear their orbit of debris
- Example Pluto

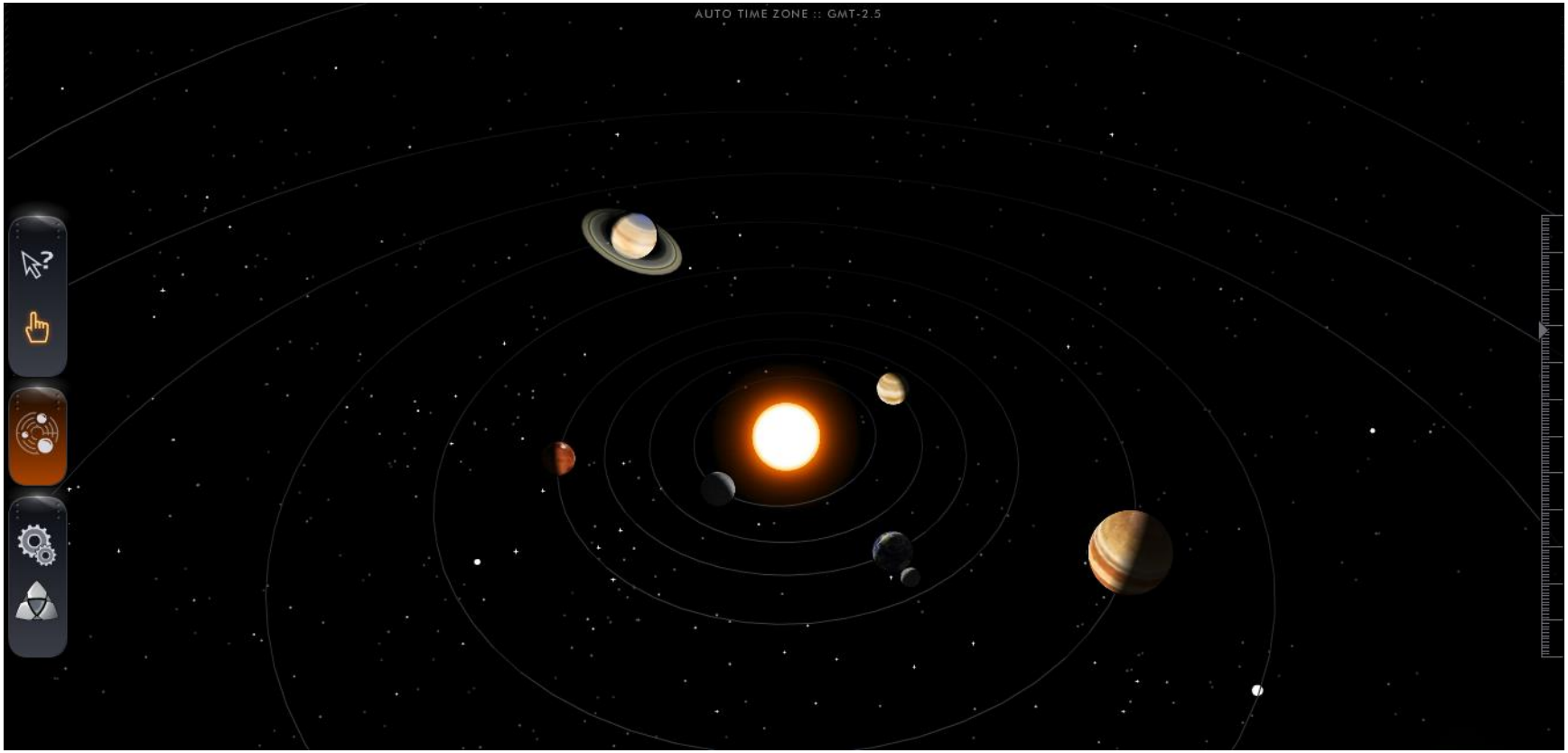


- For example, My Very Excellent Mother Just Served Us Nachos (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune).

Criteria	Terrestrial Planets (Inner)	Jovian Planets (Outer)
Size	Small (all Earth size or smaller)	Large (4 to 11 times larger than Earth)
Motion	Slow spinning, small orbits	Faster spinning, large orbits
Composition	Solid and rocky	Gaseous
Distance from Sun	Closer	Further awar
Temperature	Warmer, but temperatures vary	Colder, but temperatures vary
Density	Greater	Lesser

WEBSITE

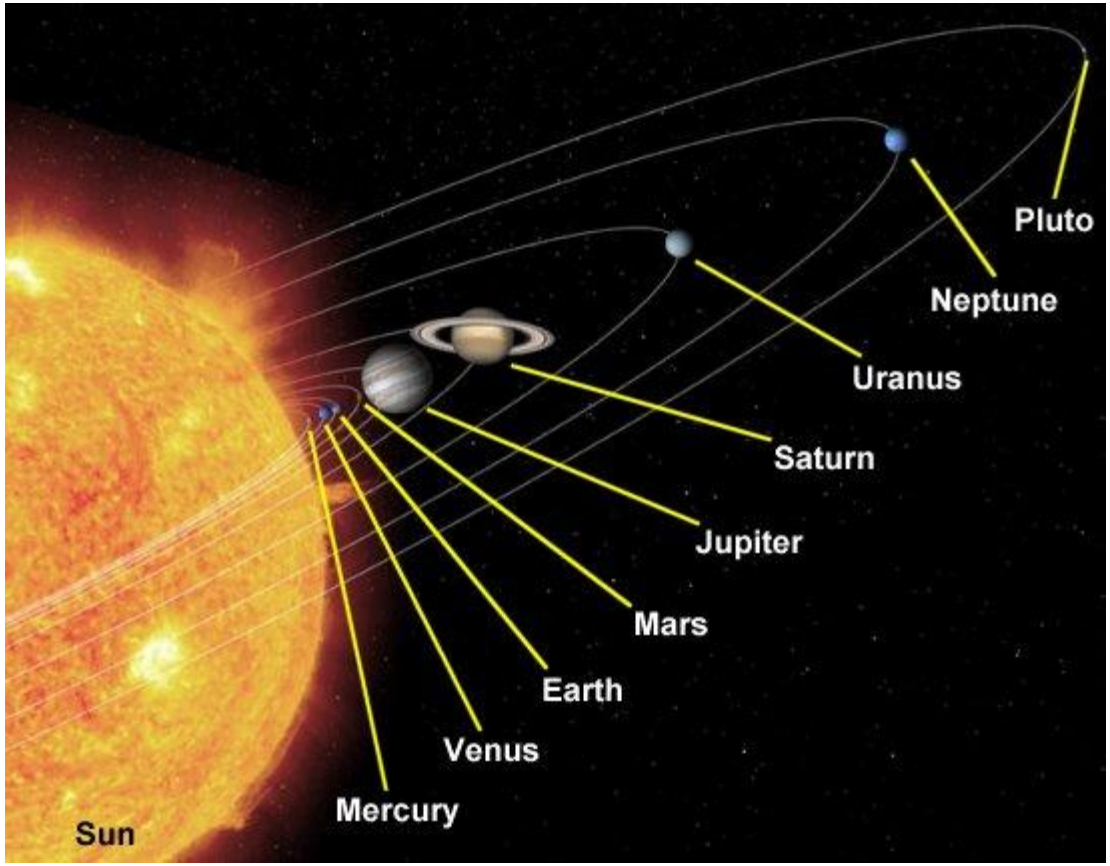
SOLAR SYSTEM SCOPE



EDUCATIONAL MOVIE

- **A Closer look at the planets**

CORE LAB: STROLLING THROUGH THE SOLAR SYSTEM



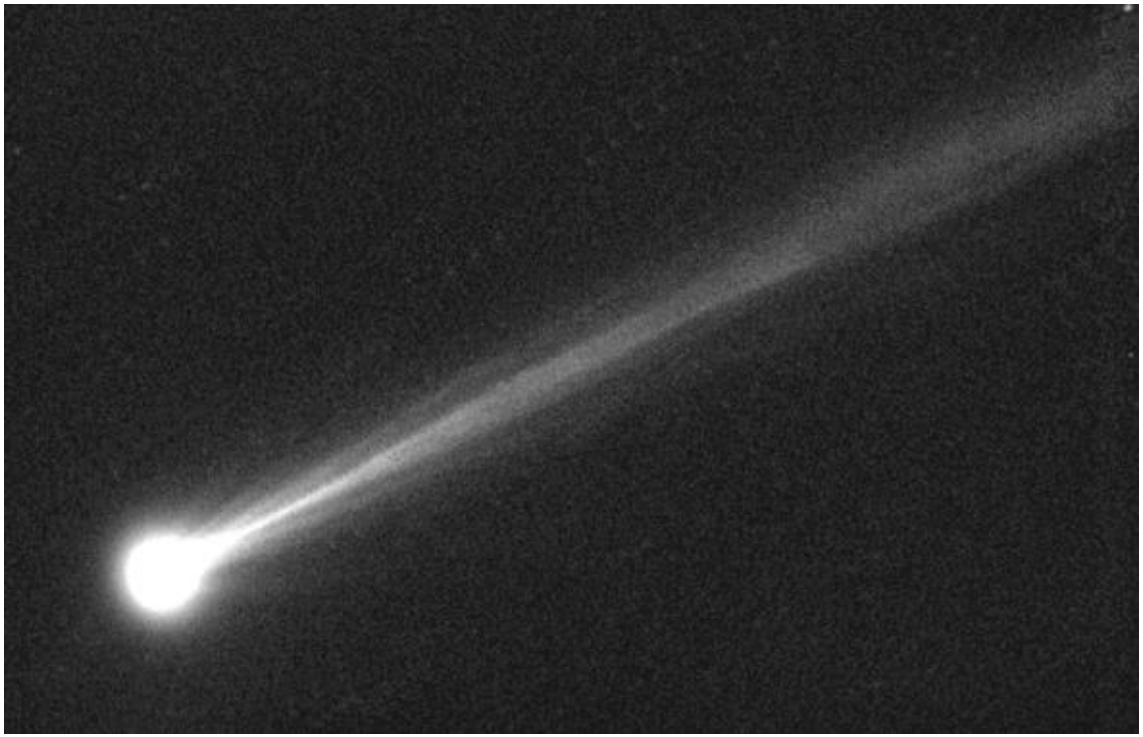
INTERMEDIATE SCIECNE 9

- **Unit 1: Space**

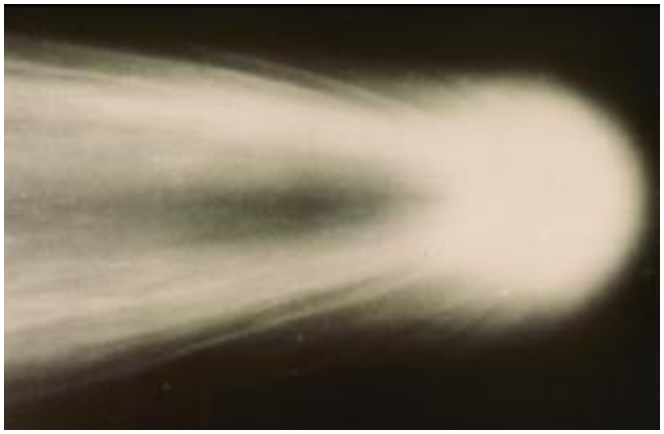
SECTION 8: NAME THAT SPACE ROCK

Comets

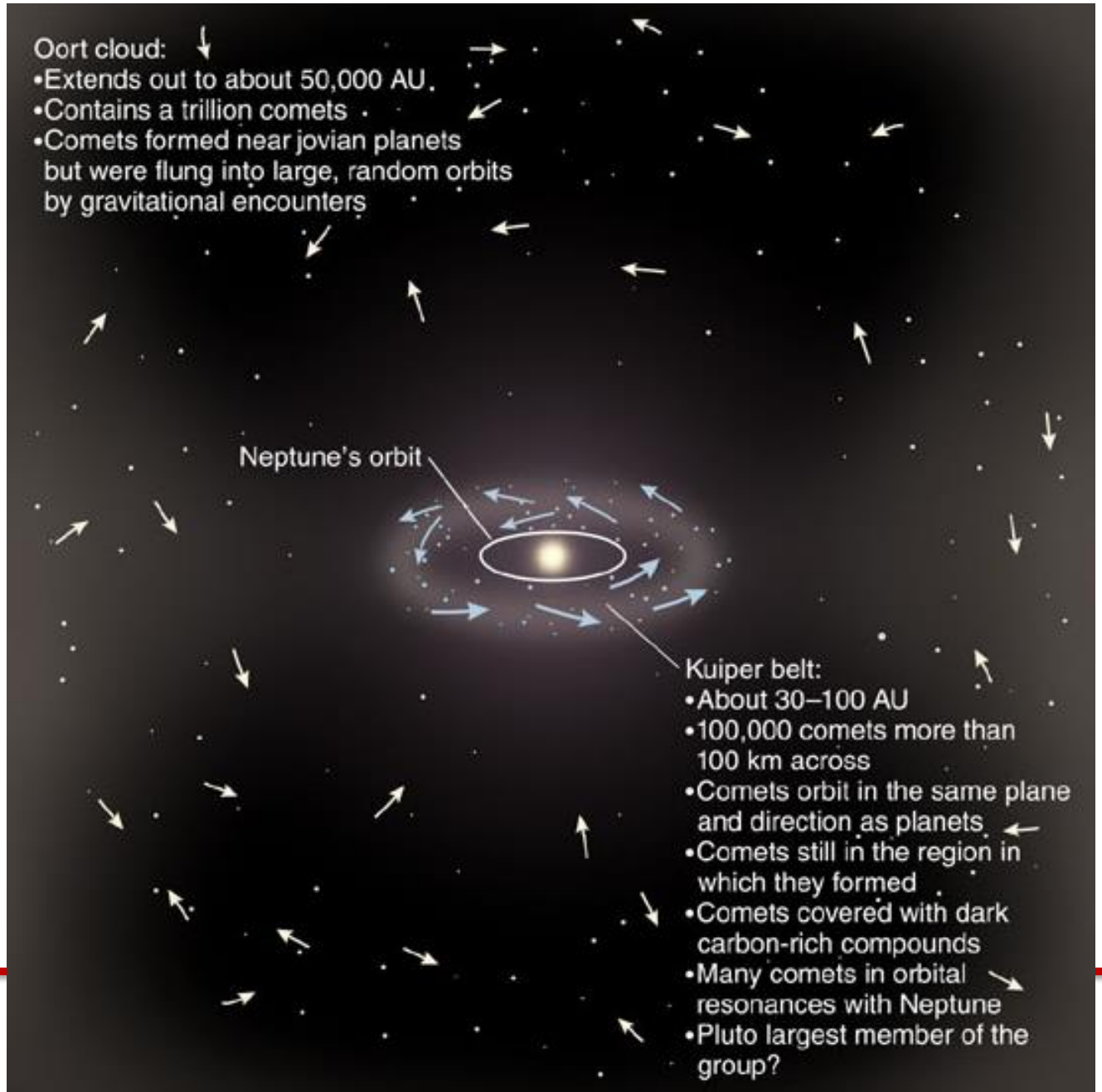
- Dirty snowballs" composed of ice, rock and gas



Comets



Origins of Comets

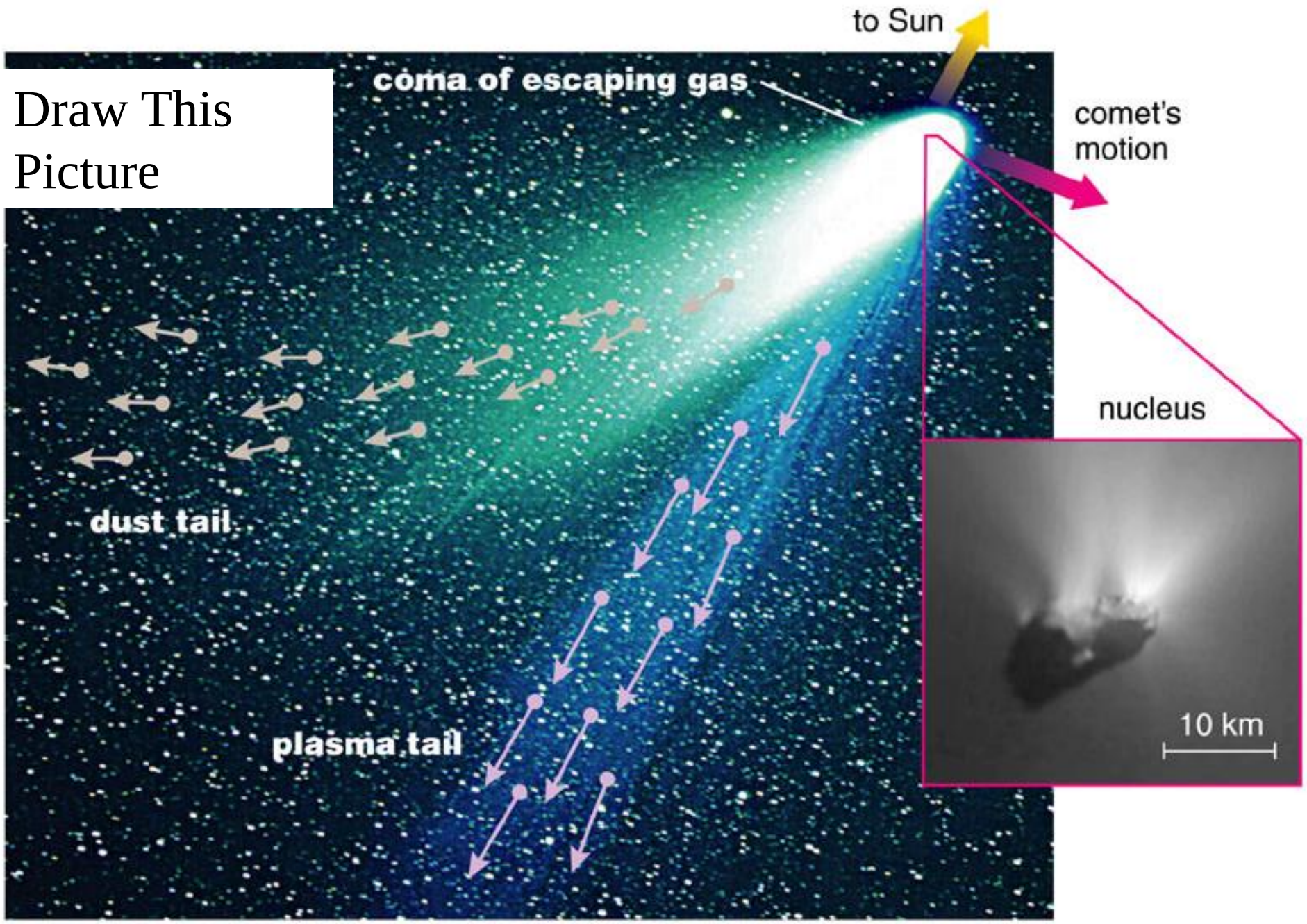


Only a tiny number of comets enter the inner solar system - most stay far from the Sun

Oort cloud:
On random orbits extending to about 50,000 AU

Kuiper belt:
On orderly orbits from 30-100 AU in disk of solar system

Draw This Picture

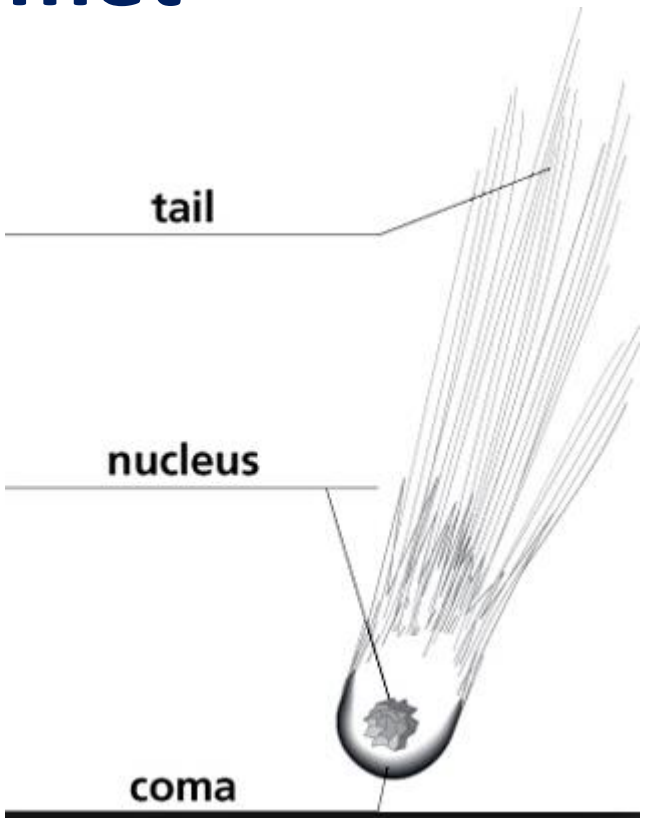


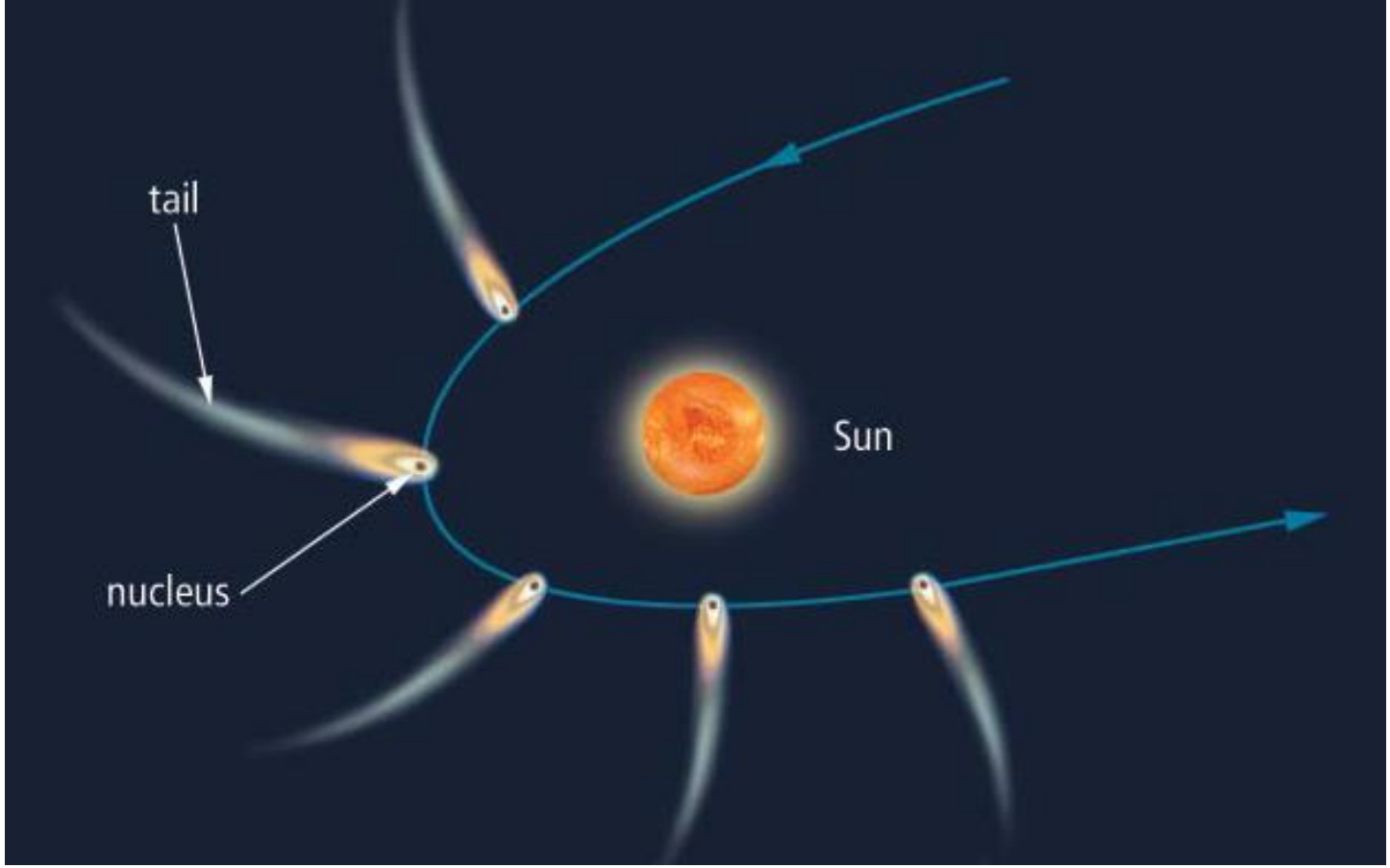
Parts of a Comet

Tail is composed of gas and dust emitted from the nucleus

Nucleus is the solid, central part of a comet. it is a combination of ice, dust and rock

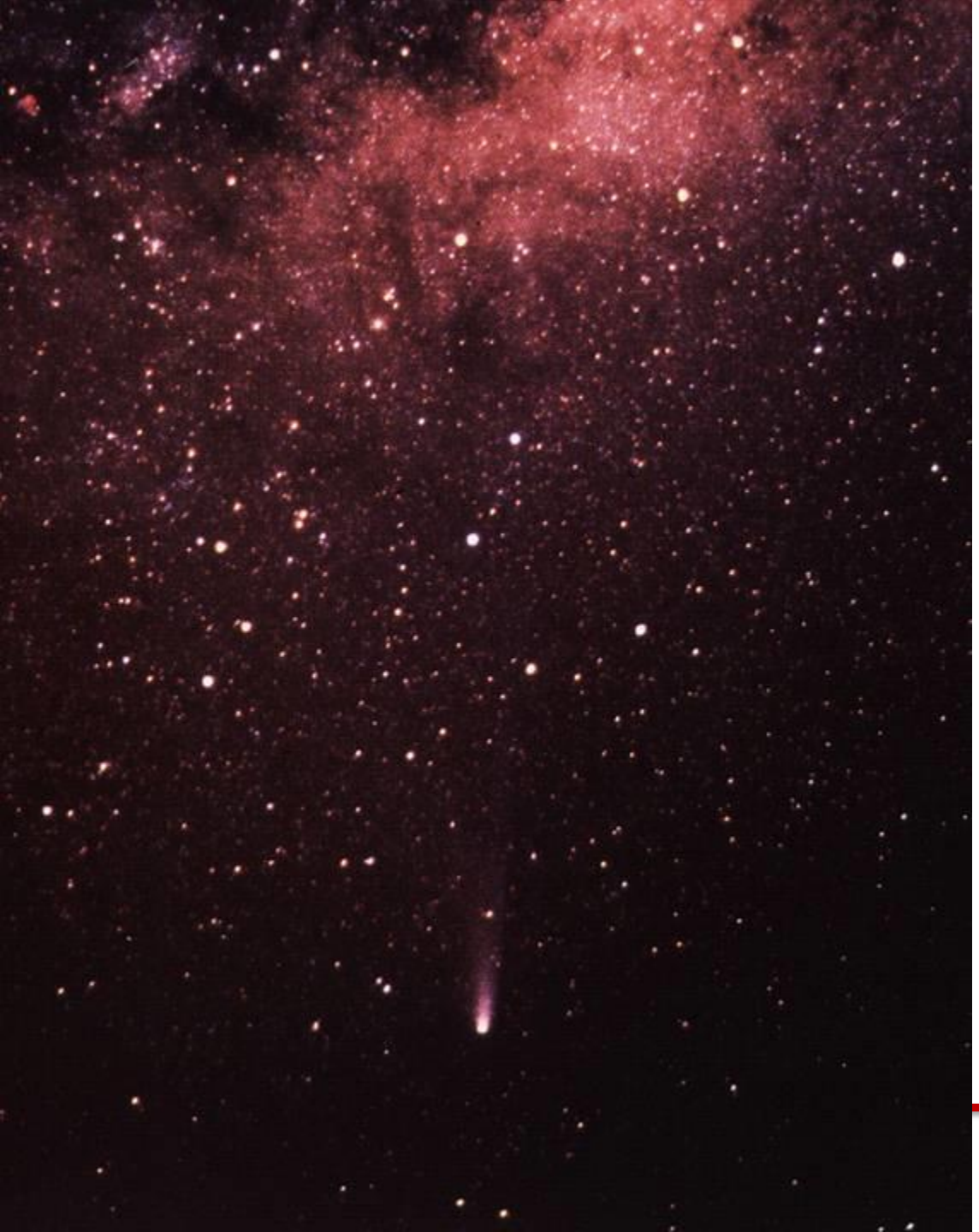
Coma is a large, dusty atmosphere surrounding the nucleus, made up of sublimated gas mixed with dust.



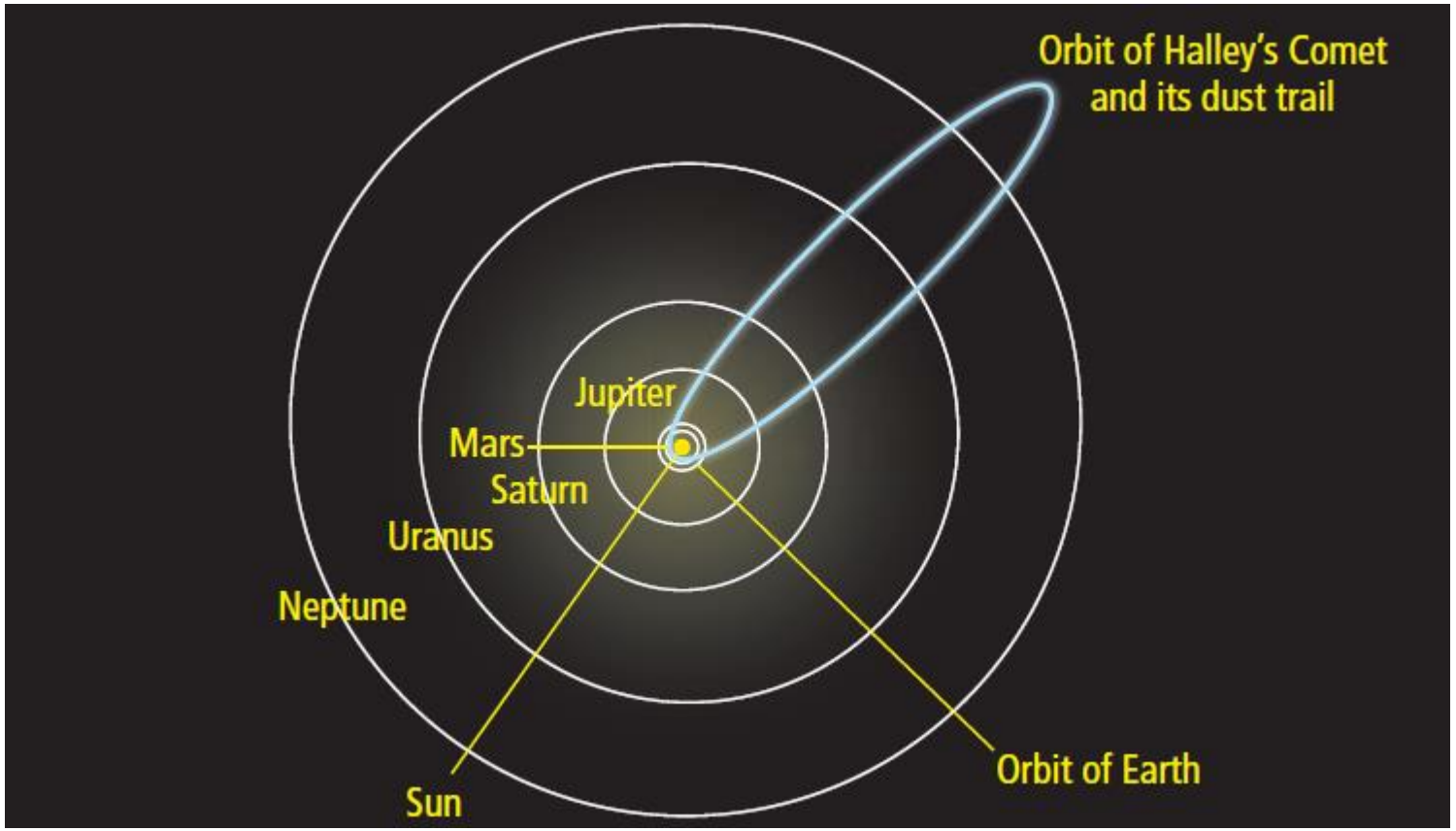


- Travel in long elliptical orbits around the sun that change due to the gravitational pull of planets

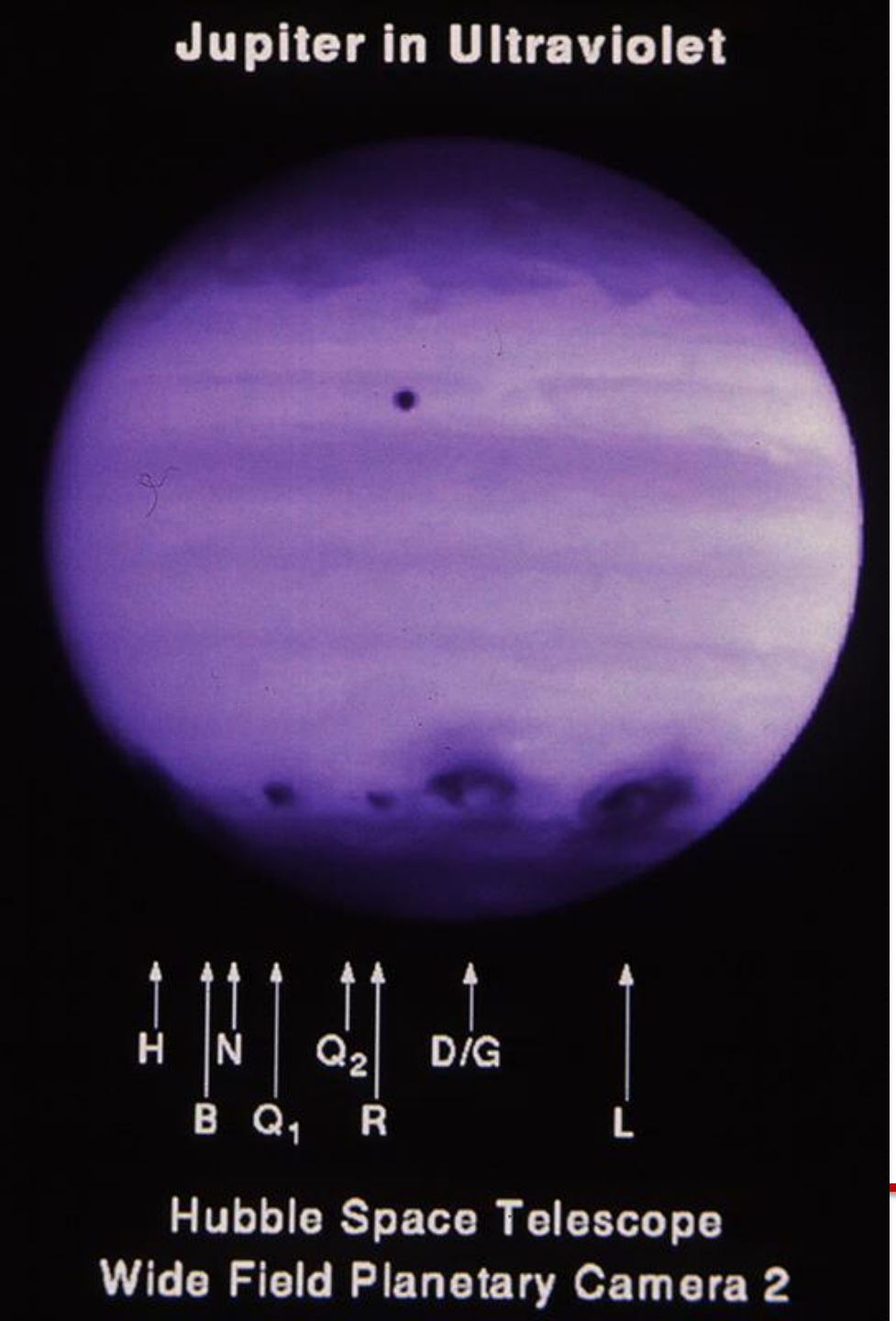
- Their long dust tail can stretch for millions of kilometres



Comet Halley on March 21, 1986, after having rounded the Sun, and on its way out of the inner Solar System



Halley's Comet is in an elliptical orbit that takes it out beyond Neptune's orbit and in past Earth orbit.



Hubble Space Telescope image of the impacts of a number of the fragments of comet Shoemaker-Levy with the planet Jupiter, causing the greatest explosions ever witnessed by mankind!

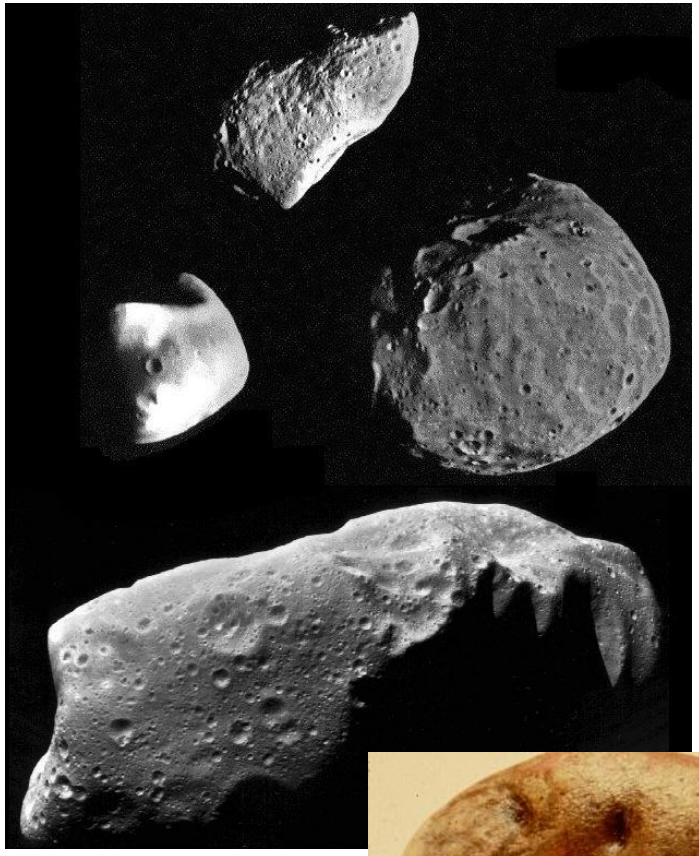
Deep Impact Video

Asteroids

Asteroids are rocky-metallic objects which range in size from about the size of pebbles to around 1,000 km across.

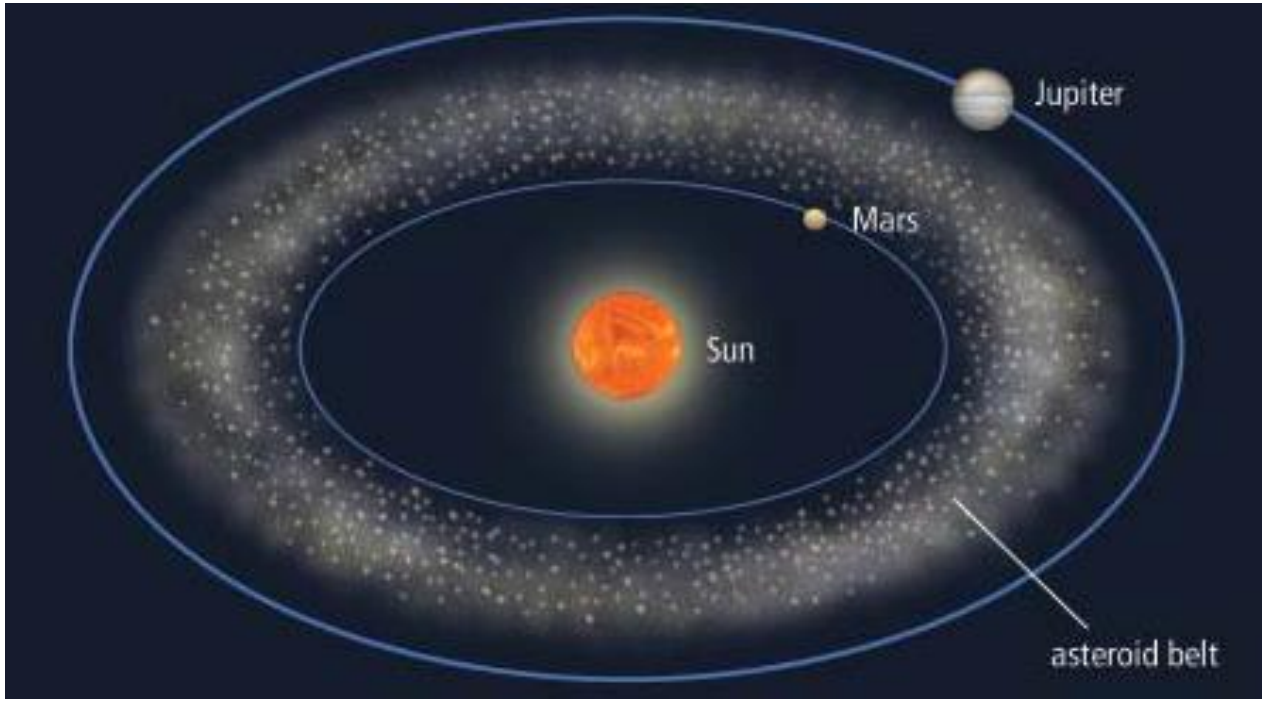
An irregularly shaped rocky object in space (like a space potato)

May be the shattered remains of objects left over from the time when the planets were formed



Asteroids

- Most asteroids in our solar system are in the Asteroid Belt located between Mars and Jupiter



Civilization Threatening Impact

Mass Extinction Impact

Earth Sterilizing Impact

Meteoroid

- **Meteoroids** are pieces of rock (i.e. chunks of asteroids or planets) floating through space

Meteors

- **Meteors** are “shooting stars” or meteoroids that are burning up through the earth’s atmosphere

What's a "Meteor Shower"?

- Usual rate = six meteors per hour
- During a Meteor Shower = rate may be as high as 60 meteors per hour
- Occur when Earth passes through the tail or debris of a comet

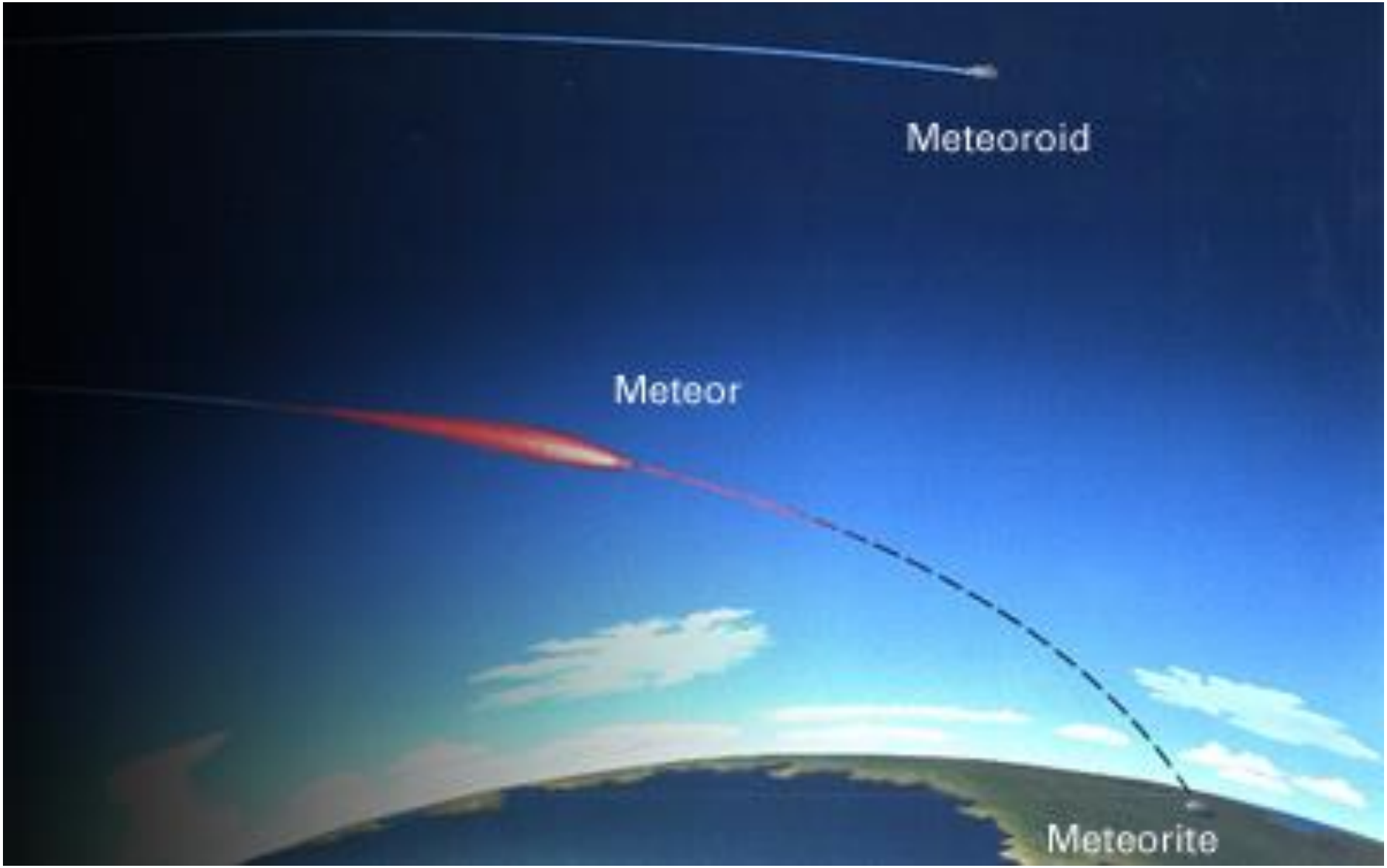
For 2015

- Oct. 21-22, 2015
- Nov. 17-18, 2015
- Dec. 13-14, 2015

Meteorites

- Meteorites are meteors that actually reach the earth's surface (must have been large meteors to survive)

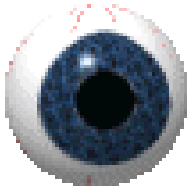

WHAT'S THE
DIFFERENCE?
METEOROIDS, METEORS AND METEORITES, OH MY!
It's no coincidence that meteoroids, meteors and meteorites all sound like the same thing; they practically are. In fact, the only real difference among them is their location. Meteoroids – which are debris from asteroids and comets – live in the space outside Earth's atmosphere. As soon as a meteoroid enters into Earth's atmosphere, it becomes a meteor. (Meteor is also just a fancy name for what you might call a "shooting star." When lots of meteors fly by Earth all at once, it creates what's called a "meteor shower.") And finally, if the debris makes it all the way to Earth's surface, it's called a meteorite. Easy as that!
METEOROID
METEOR
METEOR SHOWER
METEORITE
space
Earth's atmosphere
Earth's surface


Meteoroid
Meteor
Meteorite

Impact sites is the place where a relatively small object (meteorite) has collided with a larger object (planet) to produce a fairly circular depression on the surface of the larger object. The impact site is often referred to as an impact crater due to the circular depression that was formed.

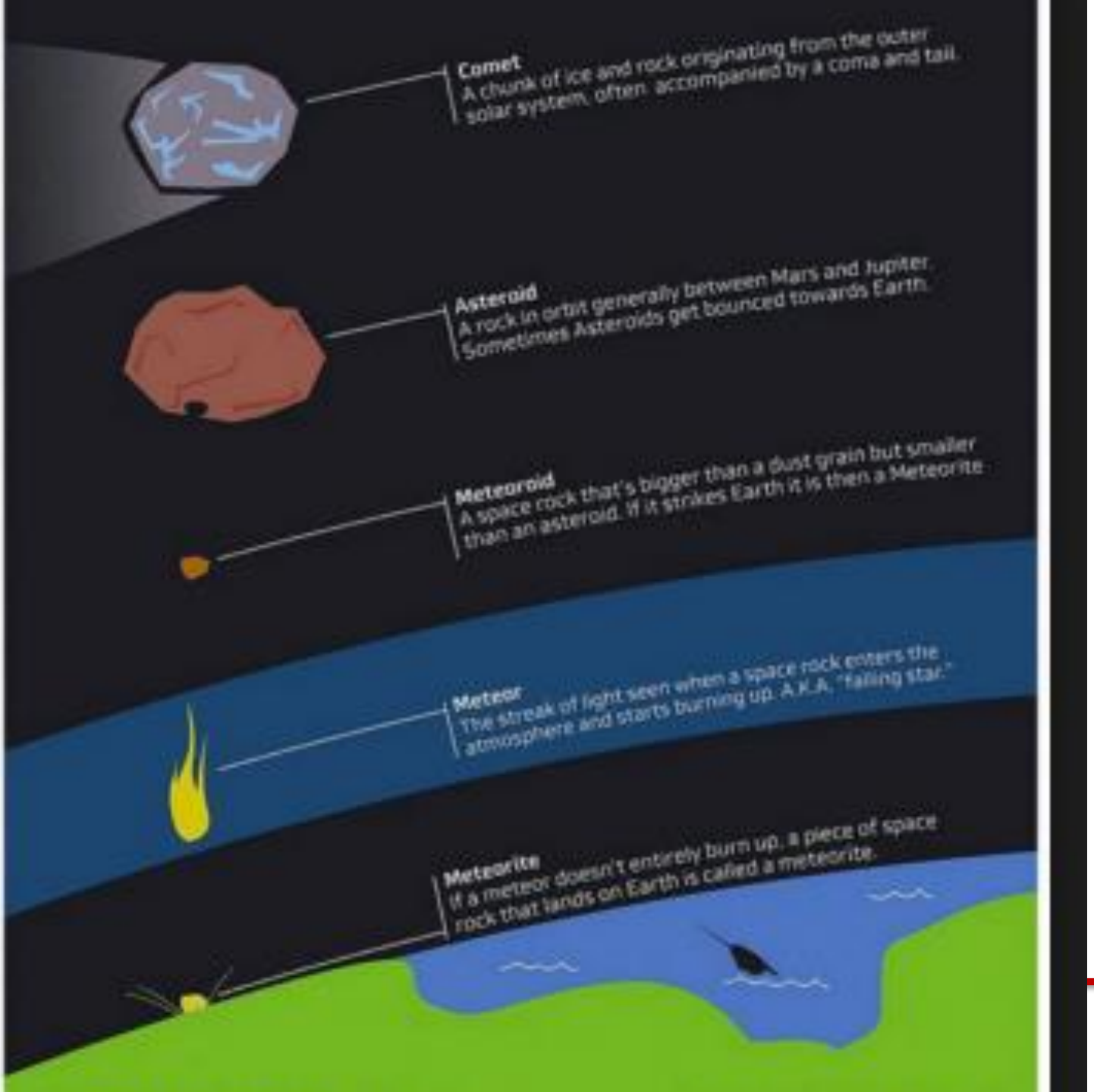
The Manicouagan crater in Quebec (A) shows what can happen when a meteorite reaches Earth's surface. The Manicouagan crater is 70 km wide and is extremely old. Compare it to a more recent impact: The Barringer meteor crater in Arizona (B) was formed only 50 000 years ago when a 50 m diameter meteor hit Earth.

Near-**E**arth **O**bjects (NEOs)



Near-**E**arth **O**bjects (NEOs) are comets and asteroids that have been nudged by the gravitational attraction of nearby planets into orbits that allow them to enter the Earth's neighborhood

This map shows sites in North America where meteorites are known to have landed.


Comet
A chunk of ice and rock originating from the outer solar system, often accompanied by a coma and tail.
Asteroid
A rock in orbit generally between Mars and Jupiter. Sometimes Asteroids get bounced towards Earth.
Meteoroid
A space rock that's bigger than a dust grain but smaller than an asteroid. If it strikes Earth it is then a Meteorite
Meteor
The streak of light seen when a space rock enters the atmosphere and starts burning up. A.K.A. "falling star."
Meteorite
If a meteor doesn't entirely burn up, a piece of space rock that lands on Earth is called a meteorite.

EDUCATIONAL MOVIE

- **Bill Nye Comets and Meteors**

INTERMEDIATE SCIECNE 9

- **Unit 1: Space**

SECTION 9: CANADA AND SPACE EXPLORATION

Canada Role In Space Research And Exploration

1. the Canadarm 1

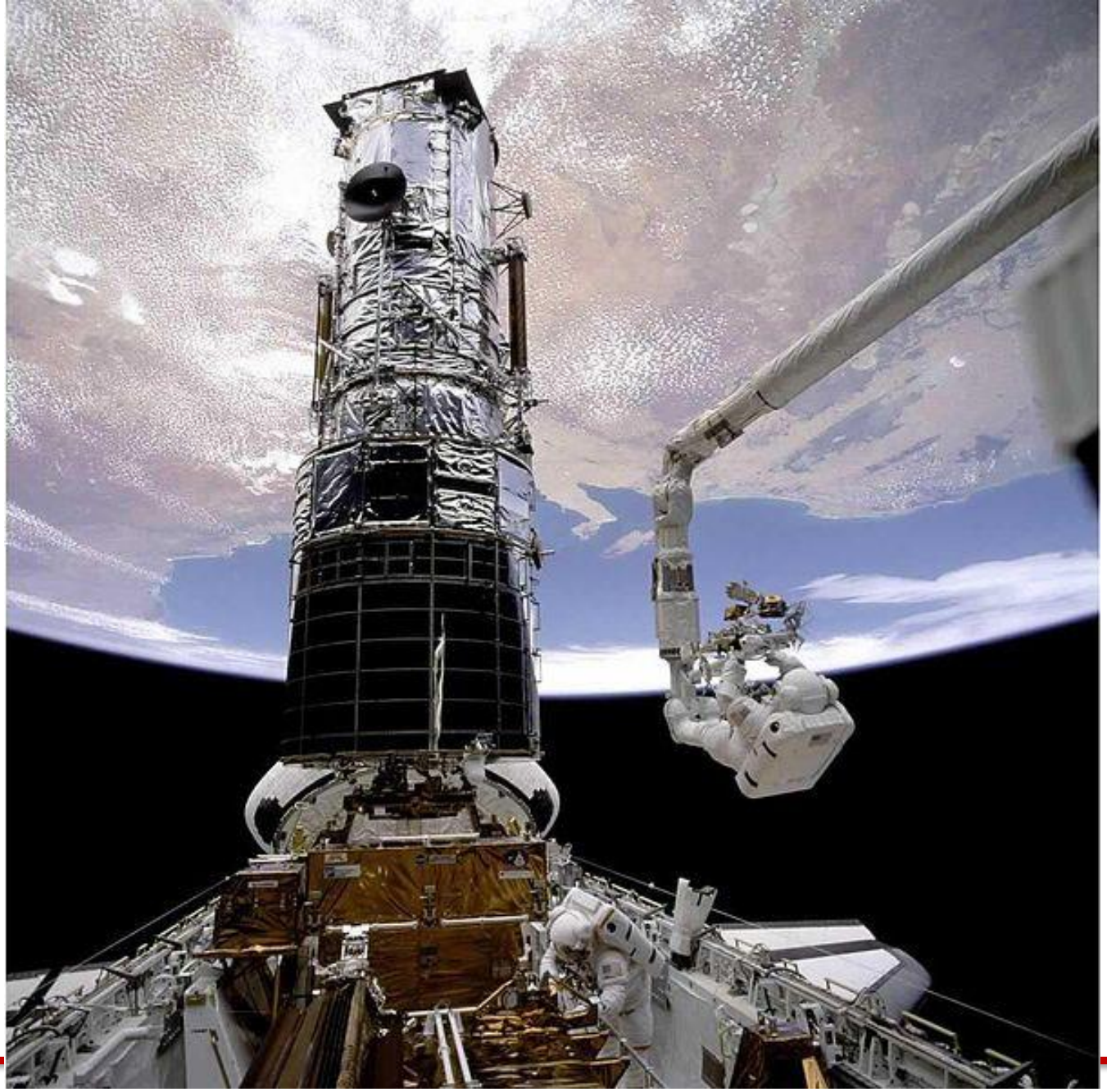
CANADARM 1was a mechanical arm used on the Space Shuttle to manoeuvre a payload from the payload bay of the orbiter to its deployment position and then release it.

The Canadarm is 15.2 metres (50 ft 3 in) long

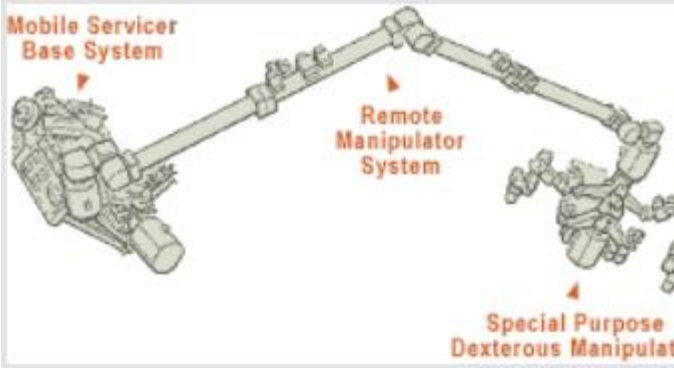
38 centimetres (15 inches) in diameter.

It weighs 410 kg (905 pounds), and the total system weighs 450 kg (994 lb).

It has six joints that correspond roughly to the joints of the human arm, with shoulder yaw and pitch joints; an elbow pitch joint; and wrist pitch, yaw, and roll joints



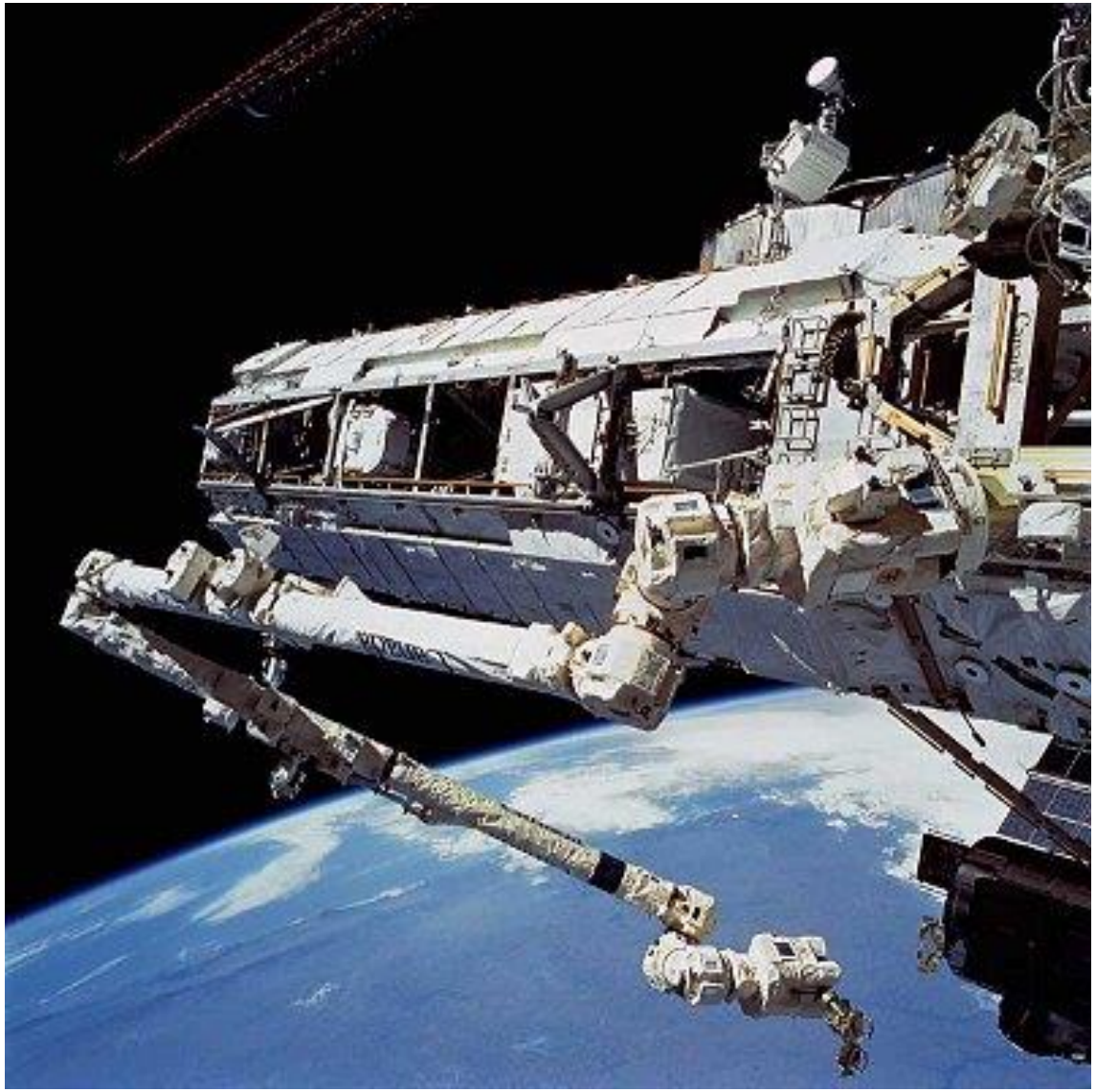
2. Canadarm 2



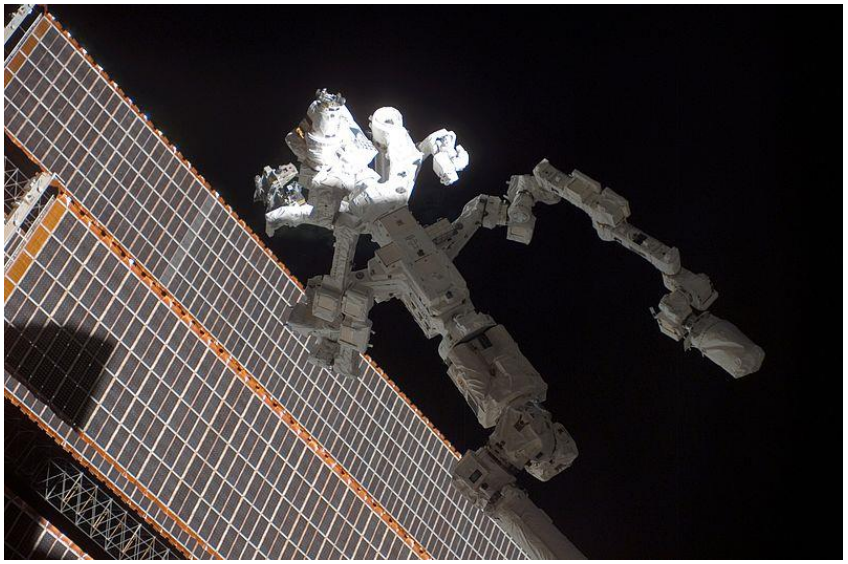
Canadian Space Station Remote Manipulator system (SSRMS) or Canadarm 2

This robotic system plays a key role in space station assembly and maintenance: moving equipment and supplies around the station, supporting astronauts working in space, and servicing instruments and other payloads attached to the space station. Astronauts receive robotics training to enable them to perform these functions with the arm.

It is 17.6 meters (57.7 feet) long when fully extended and has seven motorized joints. This arm is capable of handling large payloads and assisting with docking the space shuttle.



3. Dextre (CanadaHand), also known as the Special Purpose Dexterous Manipulator (SPDM), is a two armed robot,, which is part of the Mobile Servicing System on the International Space Station (ISS), and extends the function of this system to replace some activities otherwise requiring spacewalks. It was launched March 11, 2008.



Dextre on the end of Canadarm2


Where are the 9 cameras
on Canadarm2, Dextre
and the mobile base?
Canada

4. International Space Station

Along with the United States, Russia, Europe and Japan, Canada is a partner in the International Space Station (ISS),

The first module of the Station was launched in 1998, the Station has circled the globe 16 times per day at 28 000 km/h at an altitude of about 370 km, covering a distance equivalent to the Moon and back daily. Once complete, the Station will be as long as a Canadian football field, and will have as much living space as a five-bedroom house.

5. Canadian Astronauts

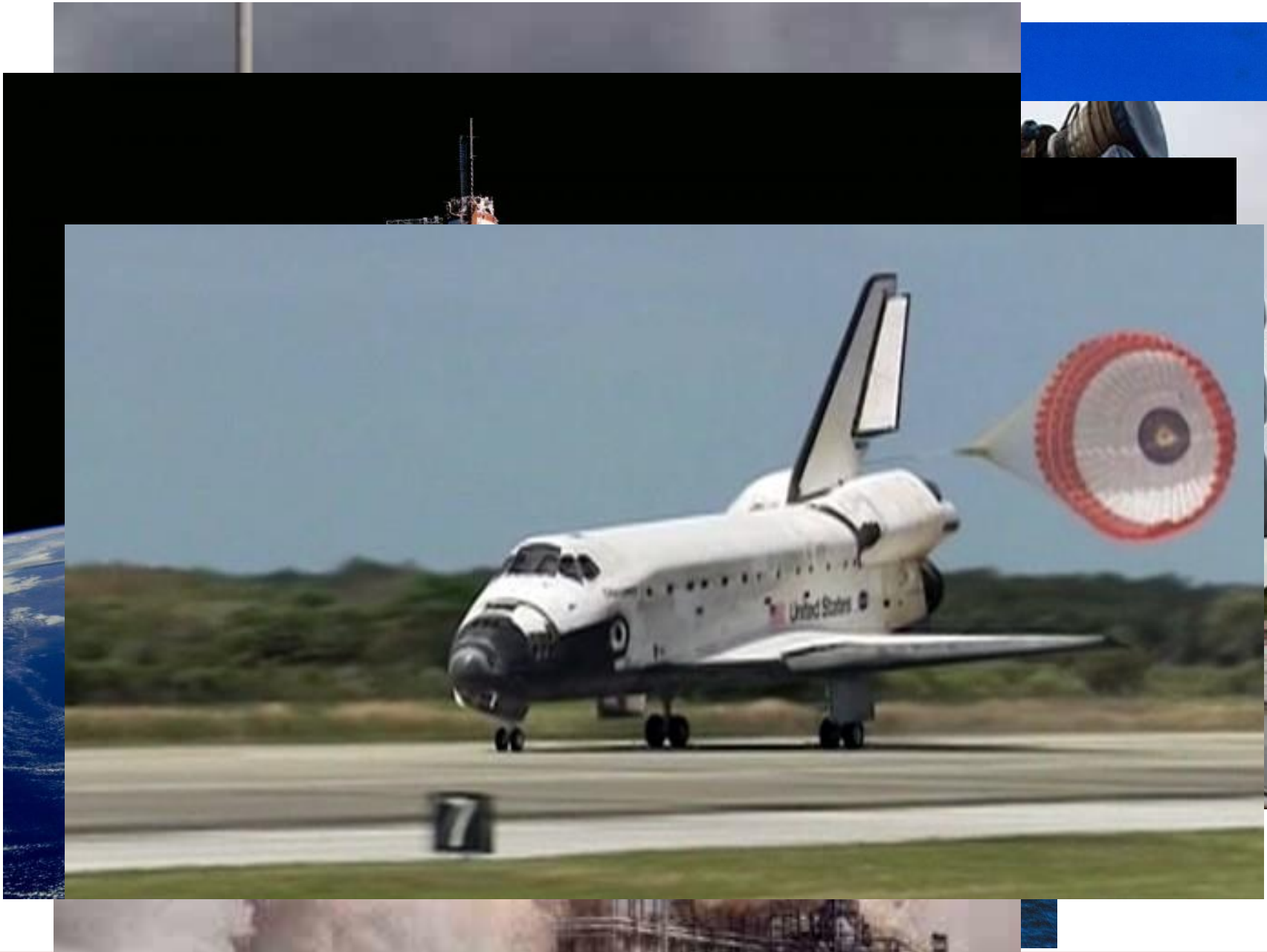
Marc Garneau	Roberta Bondar	Chris Hadfield
		
Canada's first female astronaut and the first neurologist in space. She was launched in January 1992 aboard NASA's space shuttle Discovery	The first Canadian astronaut in space during the STS-41G mission of the American space shuttle Challenger, 5-13 October 1984.	First Canadian Astronaut to walk in space, operate Canadarm, and command the International Space Station Hadfield was the first and only Canadian to board the Russian space station Mir Hadfield has spent a total of 166 days in space, including 14 hours 53 minutes and 38 seconds of time "outside"

Technologies Designed To Explore Space

- 1. rocket propulsion

Thrust is the force which moves any aircraft through the air.
Thrust is generated by the propulsion system of the aircraft

spacecraft today are propelled by forcing a gas from the back/rear of the vehicle at very high speed through a supersonic de Laval nozzle. This sort of engine is called a rocket engine.


United States
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United States
NASA
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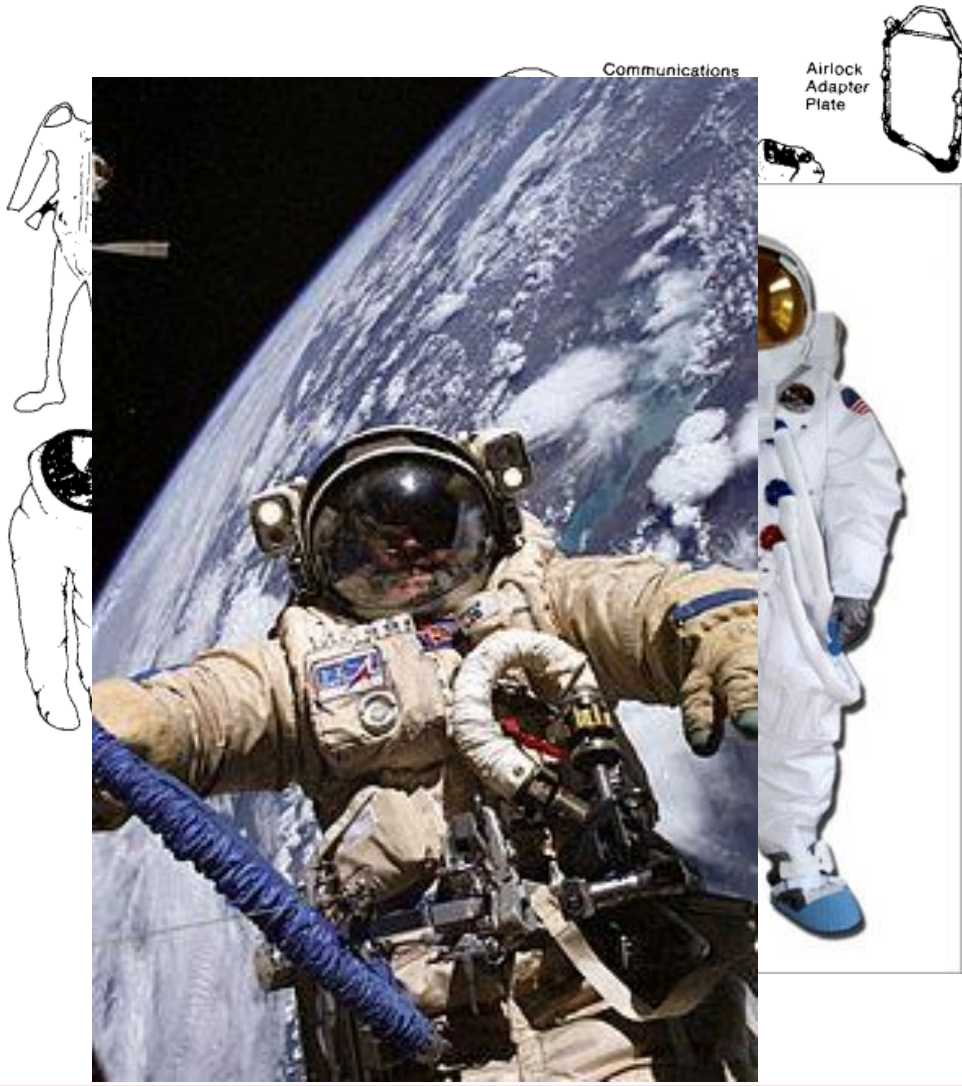
2. Space Suits

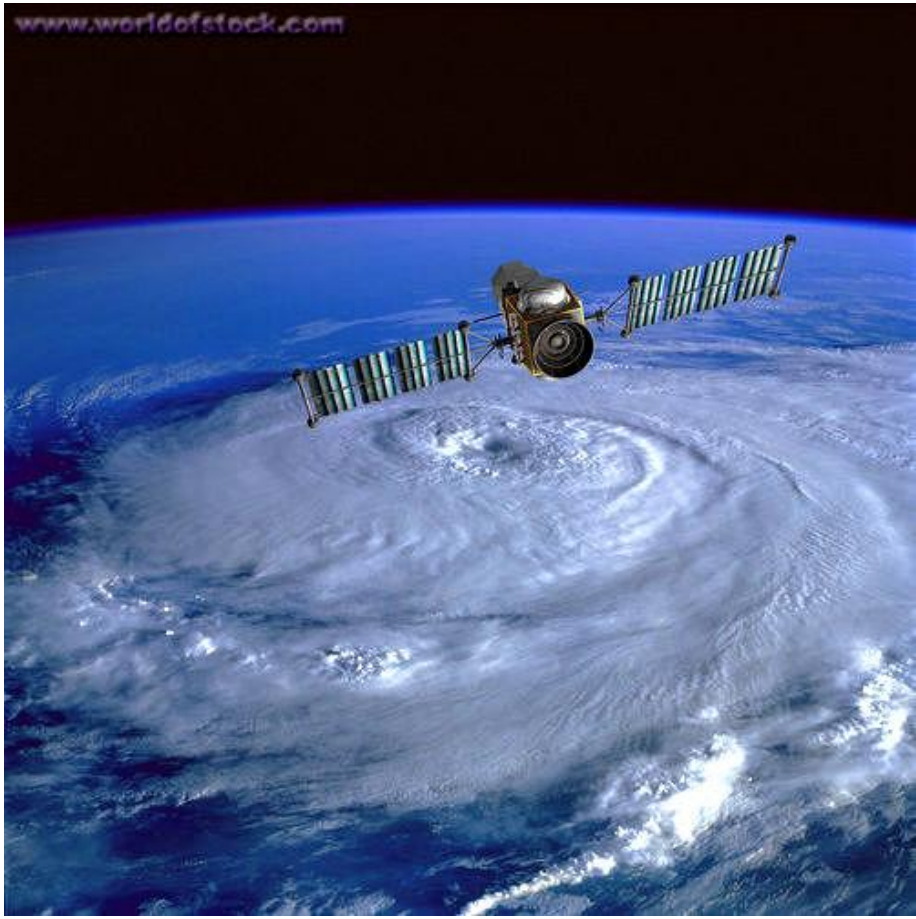
space suit is a garment worn to keep an astronaut alive in the harsh environment (vacuum and temperature extremes) of outer space.



- Outer space is an extremely hostile place. If you were to step outside a spacecraftand you weren't wearing a space suit, the following things could happen:
- You could become unconscious within 15 seconds because there's no oxygen.
- Your blood and body fluids could "boil" and then freeze because there is little or no air pressure.
- Your tissues (skin, heart, other internal organs) could expand because of the boiling fluids.
- You could face extreme changes in temperature. For example, in the sunlight temperatures might reach 248 degrees F (120 degrees C) and plummet to -148 F (-100 C) in the shade.
- You would be exposed to various types of radiation, such as cosmic rays, and charged particles emitted from the sun (solar wind).
- You could be hit by small particles of dust or rock that move at high speeds (micrometeoroids) or orbiting debris from satellites or spacecraft.

- So, to protect you from these dangers, a space suit must:
- Have a pressurized atmosphere
- Give you oxygen and remove carbon dioxide
- Maintain a comfortable temperature despite strenuous work and movement into and out of sunlit areas
- Protect you from micrometeoroids and from radiation to some degree
- Allow you to see clearly, move easily inside the space suit and outside of the spacecraft, and communicate with others (ground controllers, fellow astronauts)

3. satellite orbiting a satellite is an object which has been placed into orbit by human endeavour.



4. Probes

A space probe is an unmanned craft which is sent into space to do research. When we want to get close up pictures and information about the planets, moons, comets and asteroids in our solar system, we send out space probes. Space probes can carry special cameras and instruments far out into the solar system. Some space probes study many planets and moons while flying past them. Others go into orbit around a planet or moon to study it more closely.

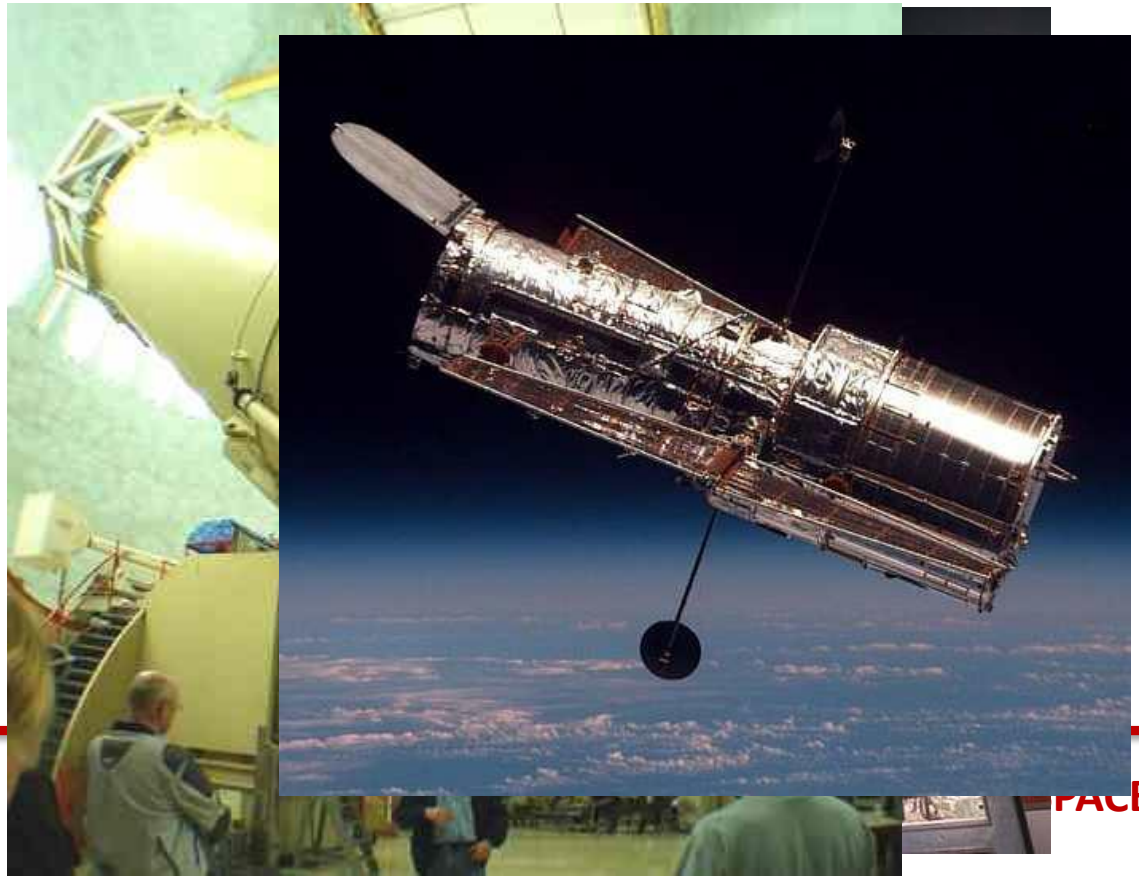
rovers

5. Rovers

A **rover** is a space exploration vehicle designed to move across the surface of a planet or other astronomical body

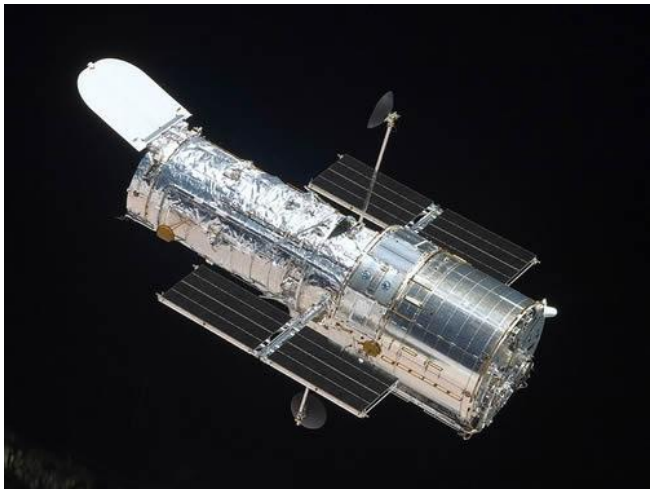
6. Optical telescopes

is a telescope which is used to gather and focus light mainly from the visible part of the electromagnetic spectrum for directly viewing a magnified image for making a photograph, or collecting data through electronic image sensors.



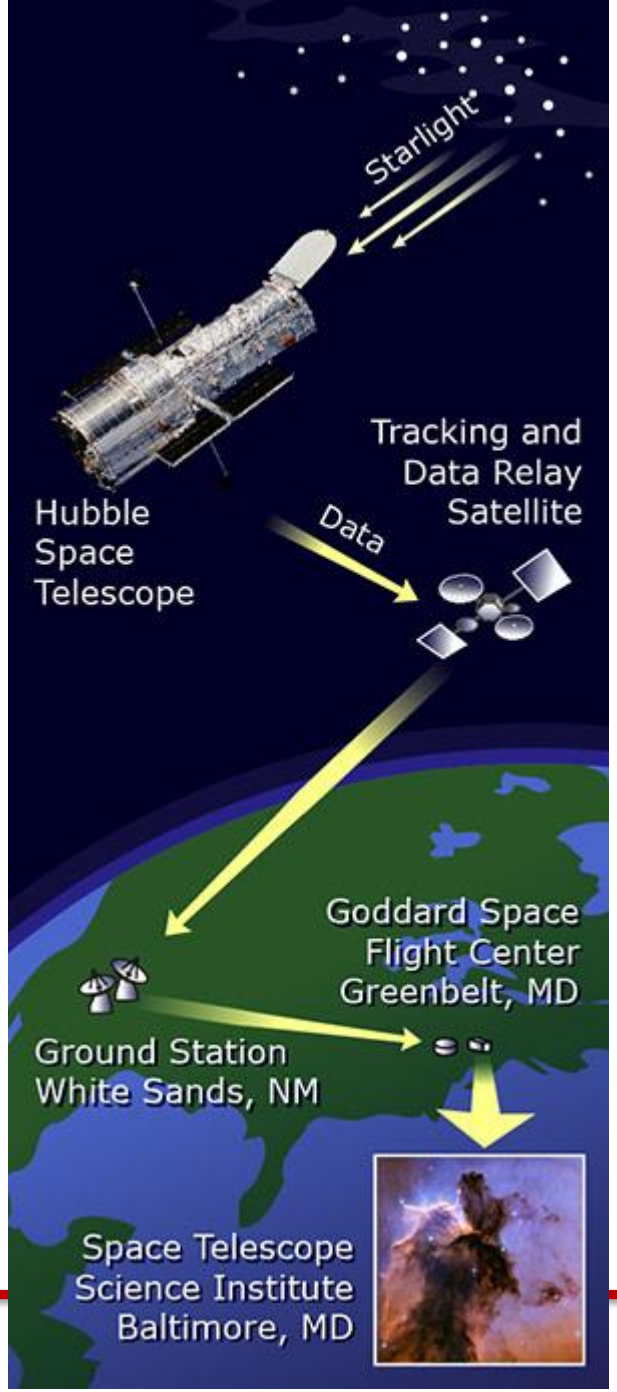
• Hubble space telescope

The Hubble Space Telescope's launch in 1990 sped humanity to one of its greatest advances in that journey.



Its position above the atmosphere, which distorts and blocks the light that reaches our planet, gives it a view of the universe that typically far surpasses that of ground-based telescopes.

Every 97 minutes, Hubble completes a spin around Earth, moving at the speed of about five miles per second (8 km per second) — fast enough to travel across the United States in about 10 minutes.


Starlight
Hubble
Space
Telescope
Data
Tracking and
Data Relay
Satellite
Goddard Space
Flight Center
Greenbelt, MD
Ground Station
White Sands, NM
Space Telescope
Science Institute
Baltimore, MD

- the Canada-France-Hawaii Telescope,

The Canada–France–Hawaii Telescope is located near the summit of Mauna Kea mountain on Hawaii's Big Island at an altitude of 4,204 meters (13,793 feet),


CFH

7. Radio Telescopes

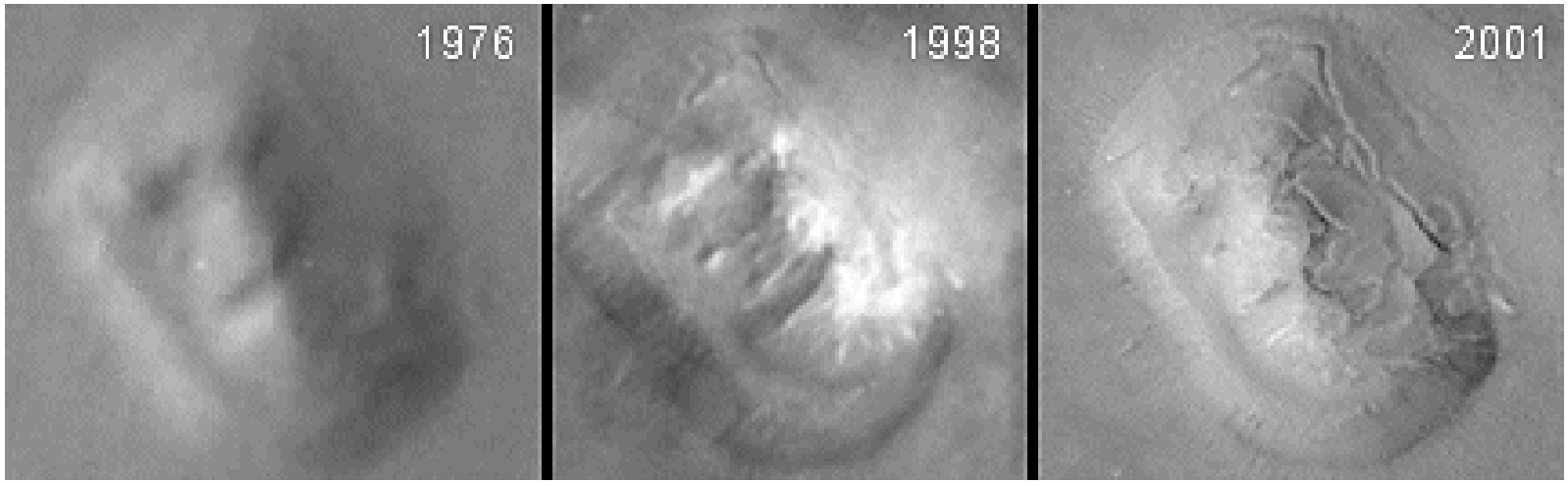
Radio telescopes are directional radio antennae that often have a parabolic shape.

They are used to study naturally occurring radio emission from stars, galaxies, quasars, and other astronomical objects

- (iii) the Very Large Array Radio Telescope

The Very Large Array, one of the world's premier astronomical radio observatories, consists of 27 radio antennas in a Y-shaped configuration on the Plains of San Agustin fifty miles west of Socorro, New Mexico.

Unmasking the Face on Mars



Core Lab

- **“Designing a Space Station”**

- **Page (422)**

FOLDABLE

Hadfield served as NASA's chief of International Space Station operations from 2006 to 2008. Include:

i. Roberta Bondar

- ii. Marc Garneau
- iii. Chris Hadfield

movie

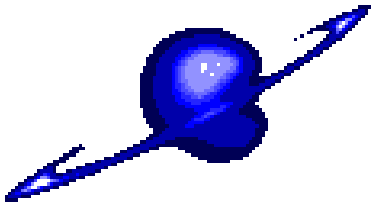
- Space!

- Canada has the "right stuff" to make significant contributions to space exploration. Canada's second arm in space has four cameras and can lift 100,000 kg; it became an important part of the International Space Station. Canadian astronauts describe their lengthy training for space missions in simulators and in labs. Their space suits must be flawlessly leak proof, or their blood would boil! Canadian astronaut Bjarni Tryggvason invented MIM, a micro gravity vibration isolation mount. Chris Hadfield and Marc Garneau have been CAPCOMS, the only person allowed to communicate directly with the shuttle crew in orbit.

INTERMEDIATE SCIECNE 9

- **Unit 1: Space**

SECTION 10: HOW IT BEGAN!



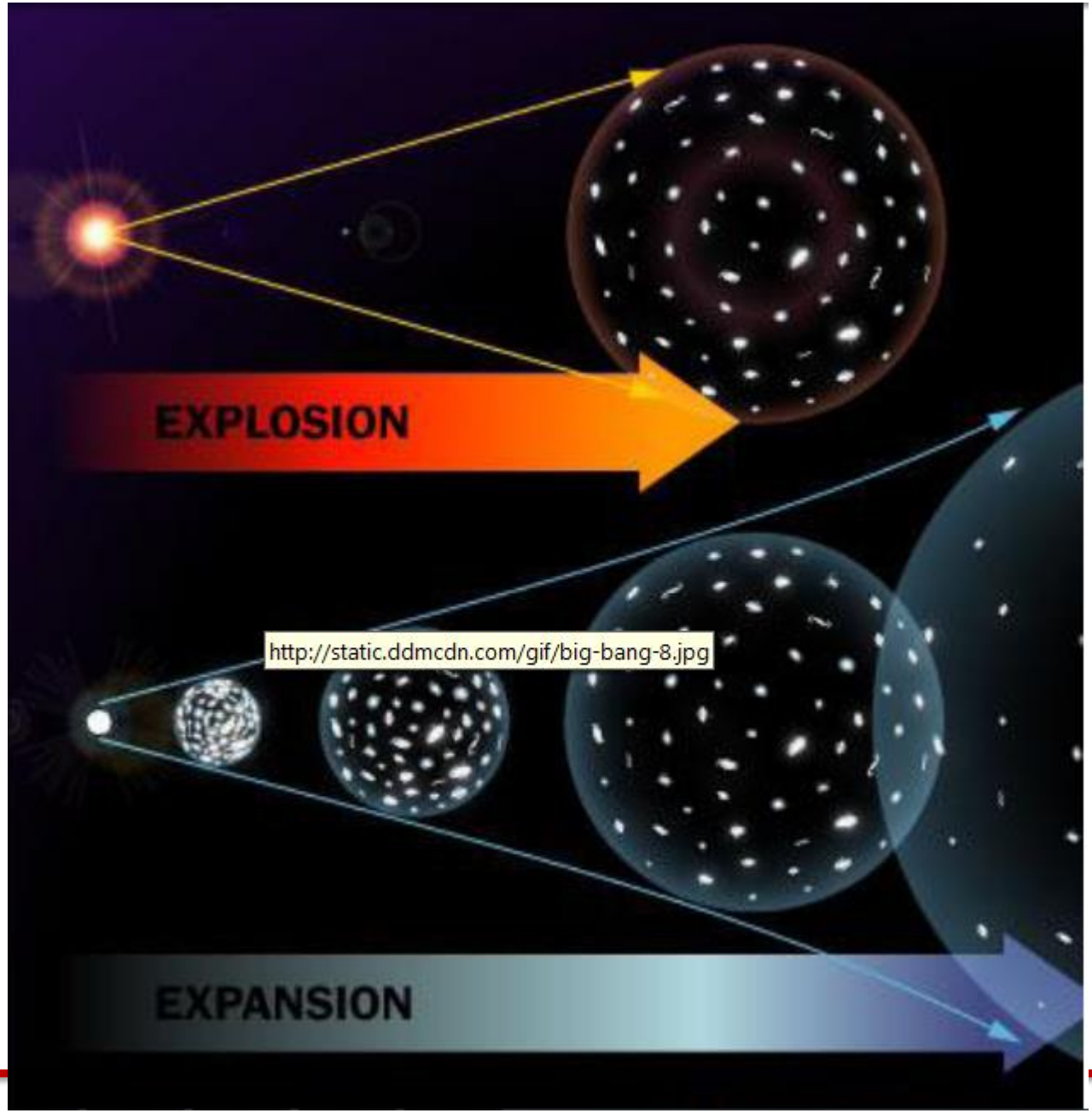
Big Bang Theory

The big bang theory is an effort to explain what happened at the very beginning of our universe**.**

It believes that 13. 7 billion years ago, that all the matter in the universe, was compacted together into a hot and dense point of matter.

This matter began to move outward after a massive explosion.

- The Big Bang Theory in supported by the fact that the universe is still expanding.


EXPLOSION
http://static.ddmcdn.com/gif/big-bang-8.jpg
EXPANSION

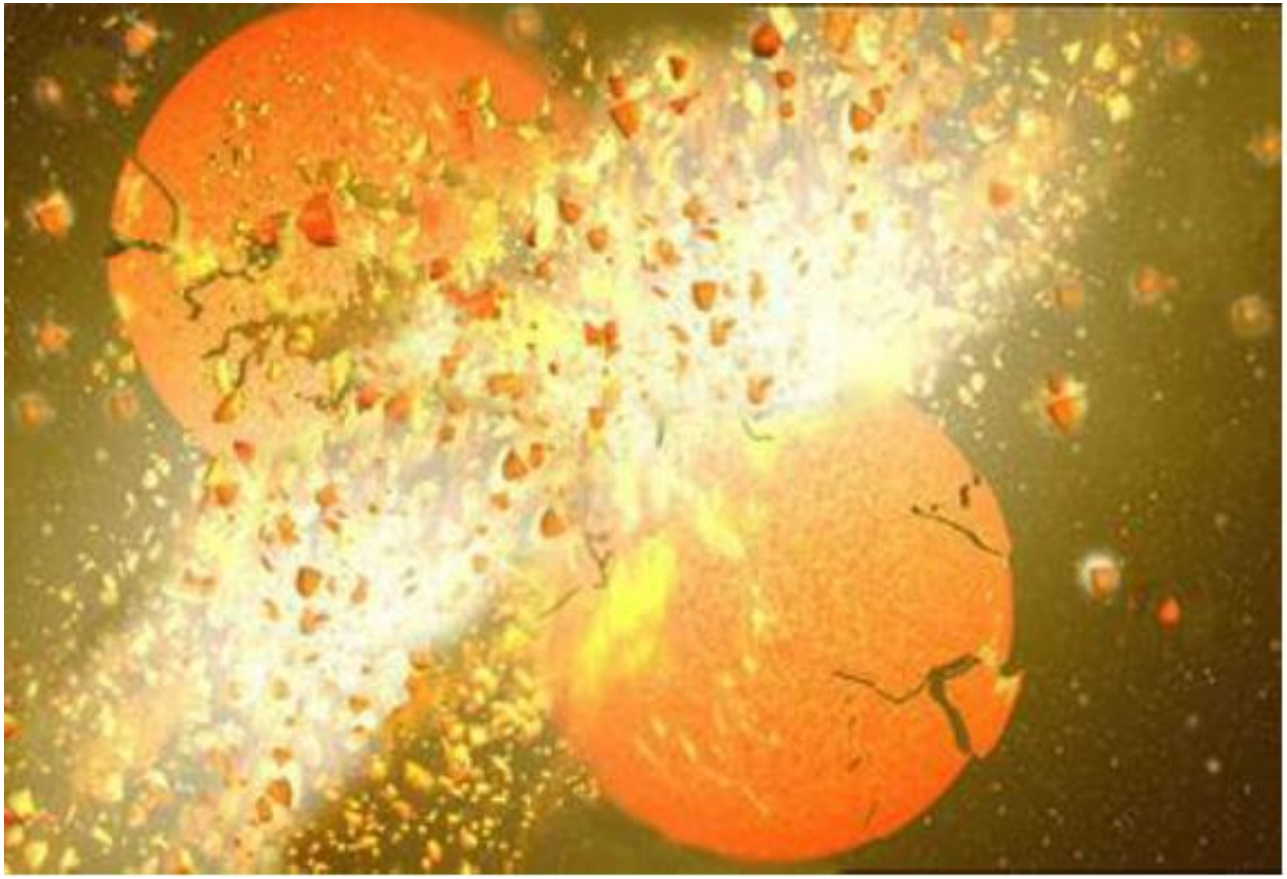
Oscillating Theory

- **Oscillating Theory** suggests that the universe will expand to a certain point in time and then, due to the forces of gravitation among the stars and galaxies, contract

Some scientists believe that this will result in a "Big Crunch" followed by another Big Bang.

Formation of the Solar System

1. **Stellar Collision Theory :** **Our planets, moons, and suns spun off from the collision between stars**



2. **Nebular hypothesis**: Hydrogen and other gases swirled around and condensed into our sun and its planets.

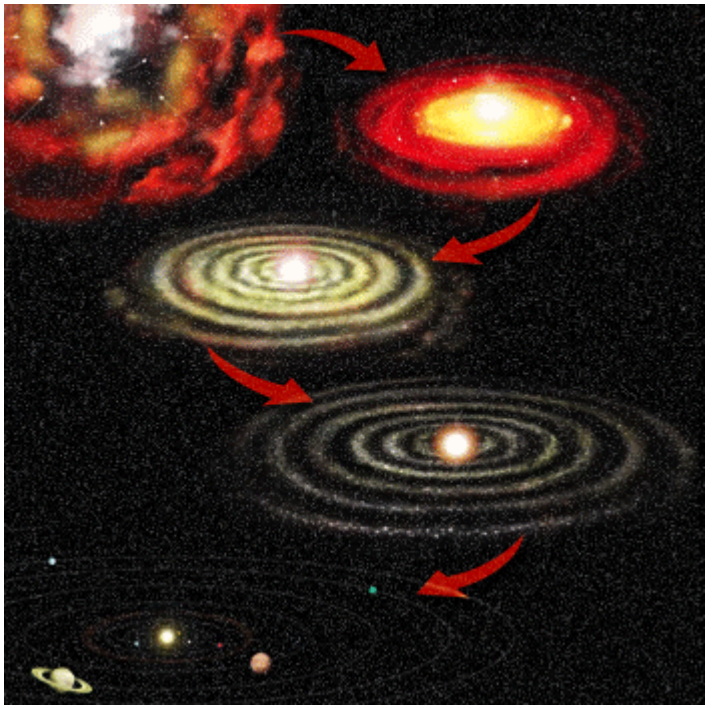


Figure 12.8 The Great Nebula in Orion is an example of an area where new stars and solar systems are being formed.

How did our solar system come to be?

National Aeronautics and Space Administration

NASA

It all began about 4.6 billion years ago in a wispy cloud of gas and dust.

At some point, part of the cloud collapsed in on itself—possibly because the shockwave of a nearby supernova explosion caused it to compress.

The result: a flat spinning disk of dust and gas.

4.6 Billion Years Ago

When enough material collected at this disk's center, nuclear fusion began. Our sun was born. It gobbled up 99.8% of all the material.

These clumps became planets, dwarf planets, asteroids, comets, and moons.

This cloud was a small part of a much bigger cloud.

Nuclear fusion occurs when hydrogen atoms fuse into helium.

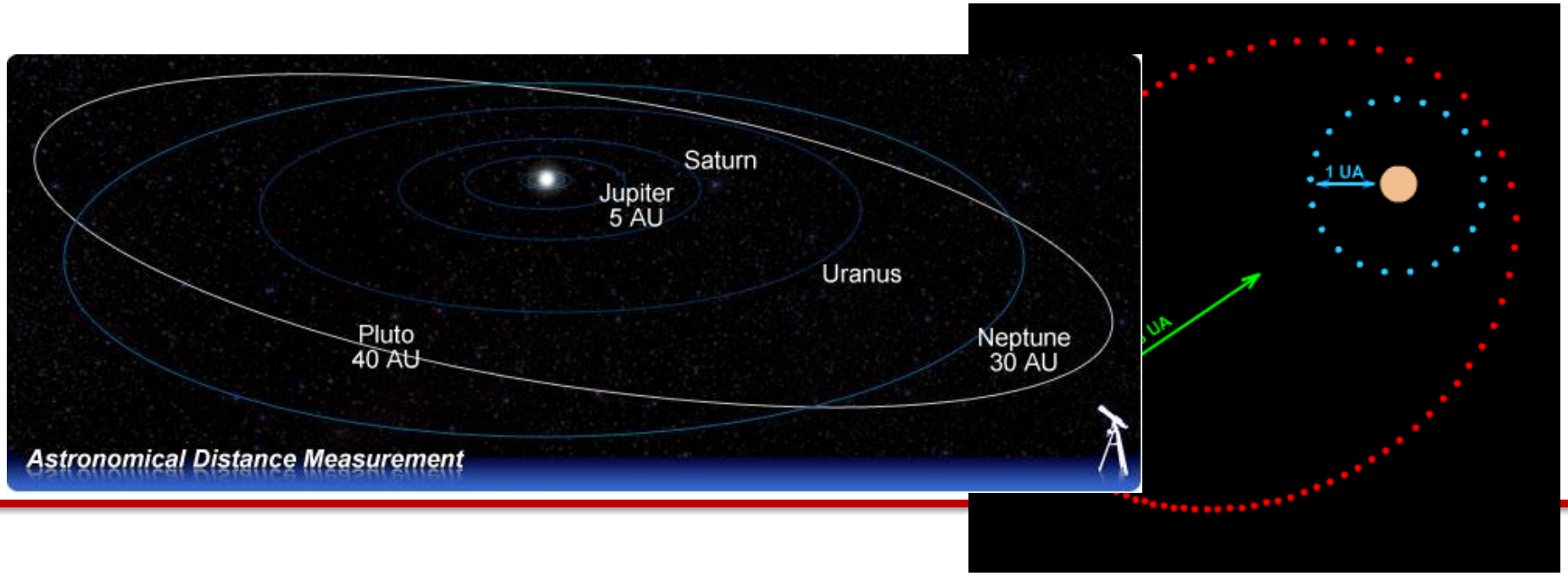
The material left behind by the sun clumped together into bigger and bigger pieces.

Present

Only rocky things could survive close to the sun, so gaseous and icy material collected further away. That's how our solar system came to be the place it is today!

Astronomical Units

- Astronomical Units (AU): Measurement equal to the average distance between the Sun and the Earth, about 150 million kilometers.



Light Year

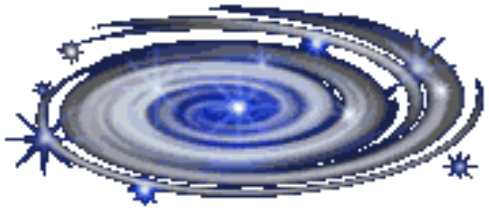
- **Light Year:** The distance light can travel in one year, which is 9,500,000,000,000 kilometers

- Bill nye **Outer Space**

INTERMEDIATE SCIECNE 9

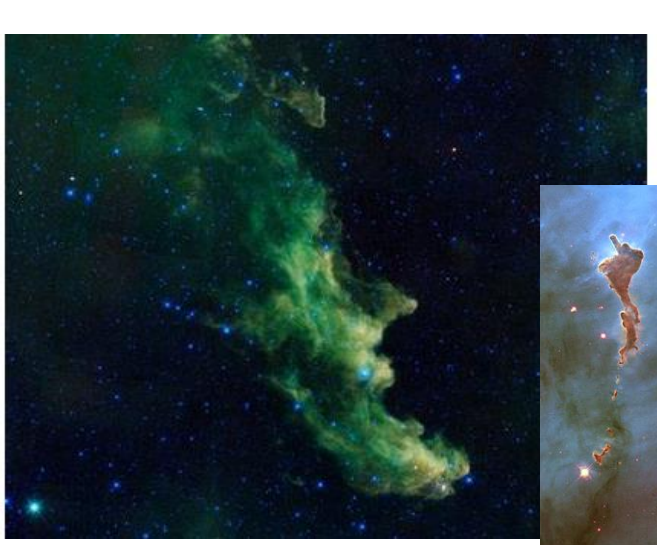
- **Unit 1: Space**

SECTION 11: Major Components of the Universe



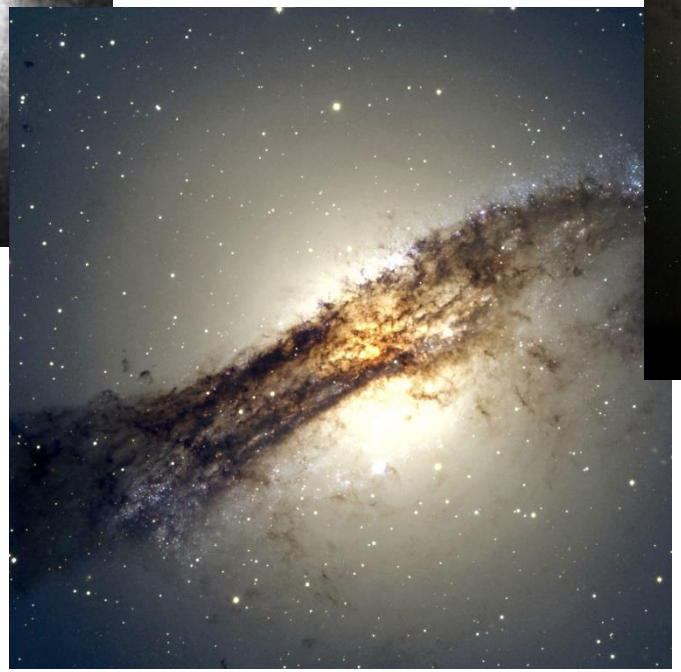
Major Components of the Universe

- 1) Nebula refers to a cloud of gas and dust in space.

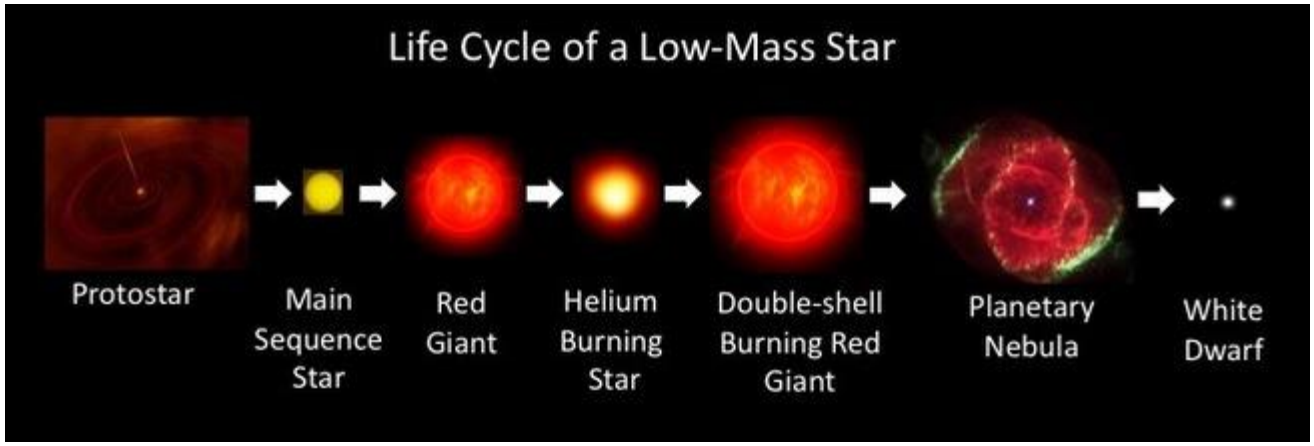


2) Spiral galaxies: a galaxy with long arms spiralling out from a centre core made up of stars that formed long ago

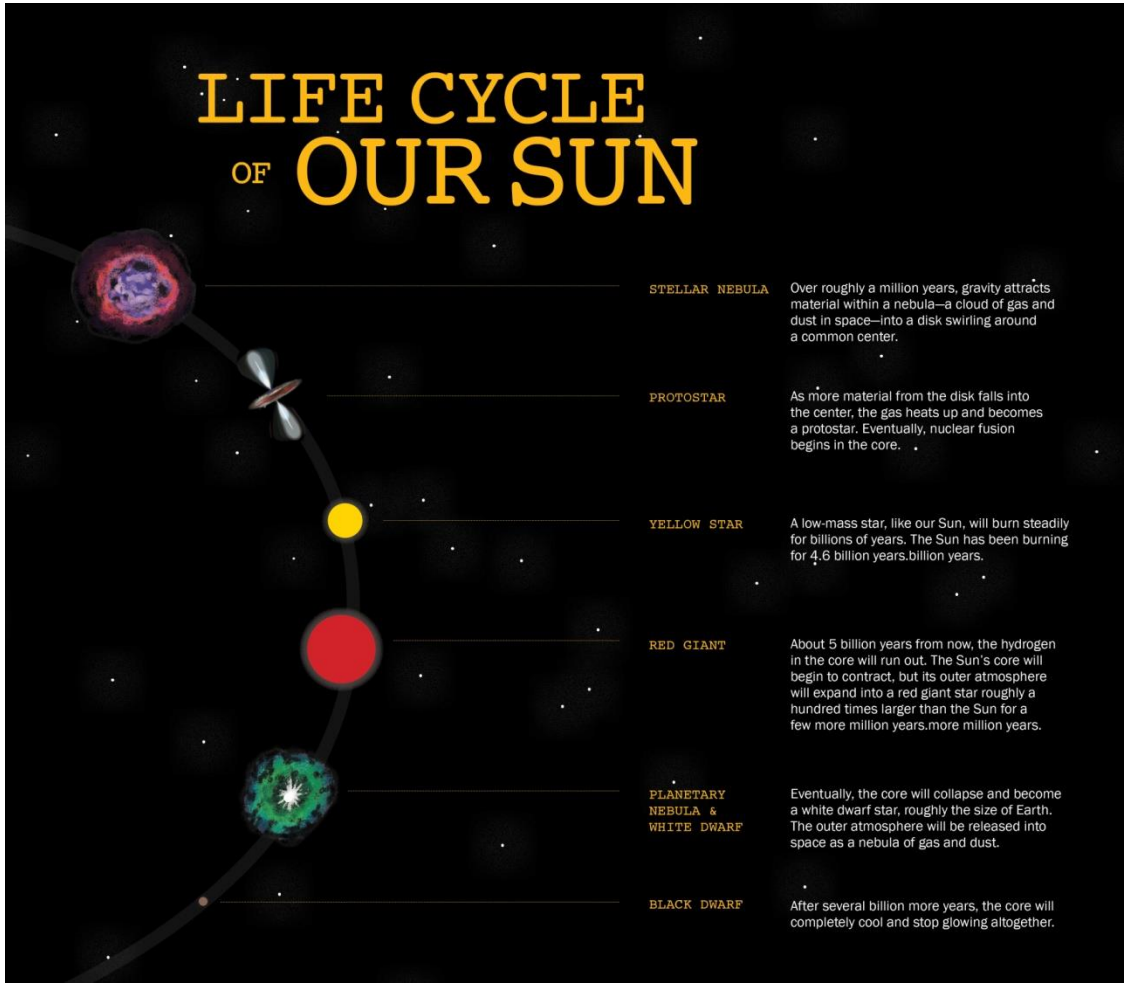
Elliptical galaxies : a galaxy that ranges in shape from a perfect sphere to a stretched but flattened ellipse and contains some of the oldest stars in the universe.



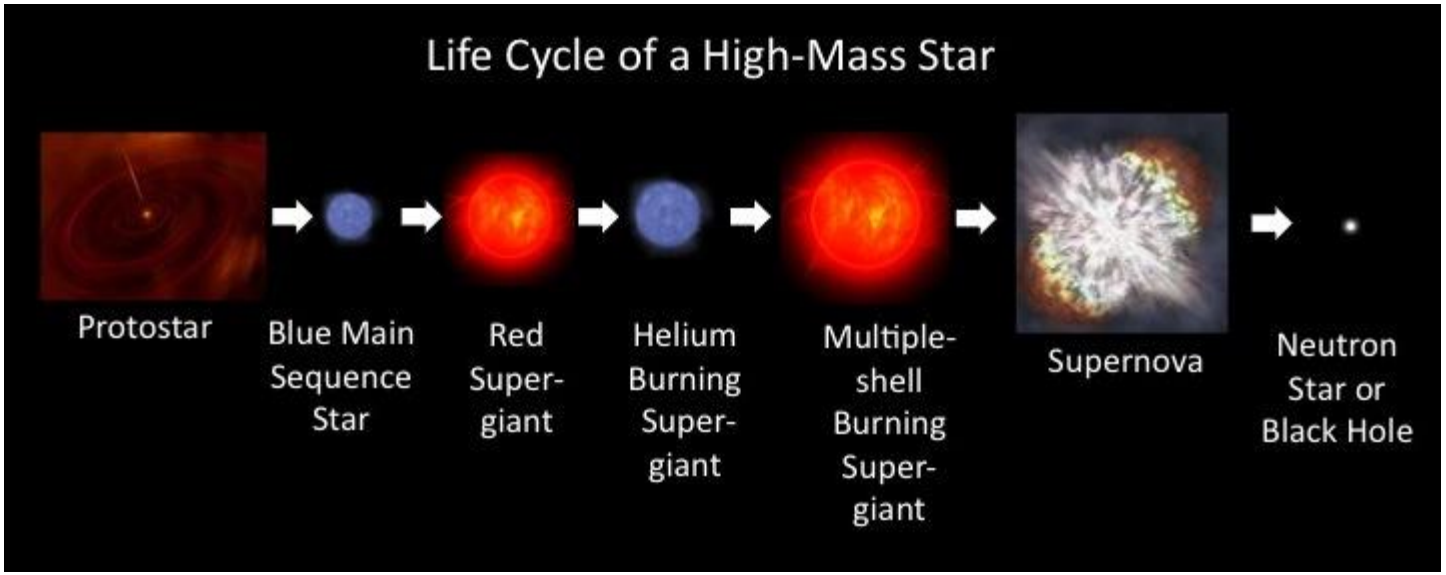
Low mass stars (red dwarf stars) use up their hydrogen slowly and can last as long as 100 billion years.

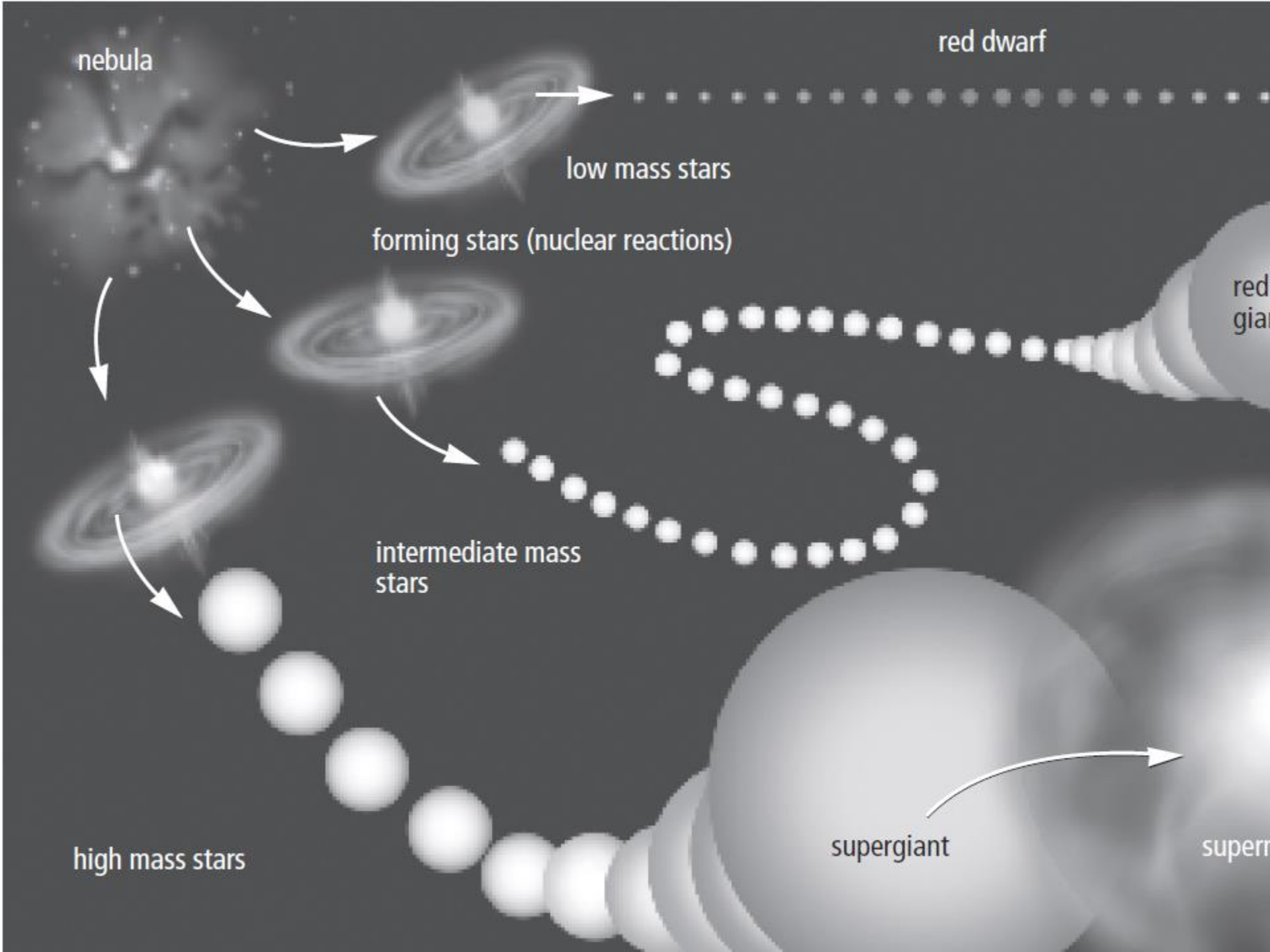


Intermediate mass stars like our Sun use up their hydrogen more quickly—over about 10 billion years.

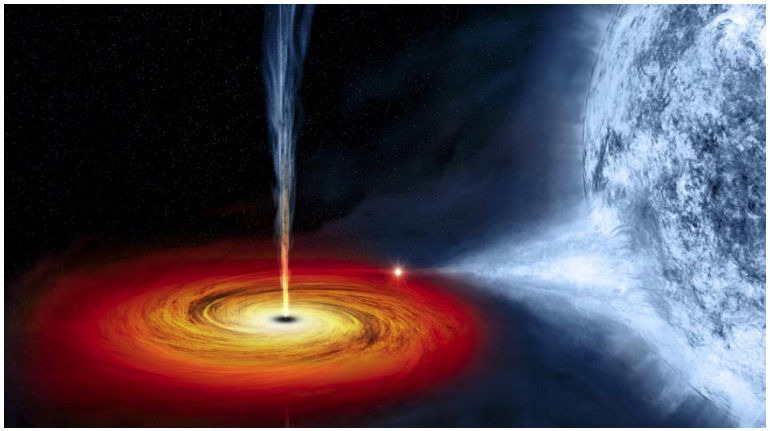


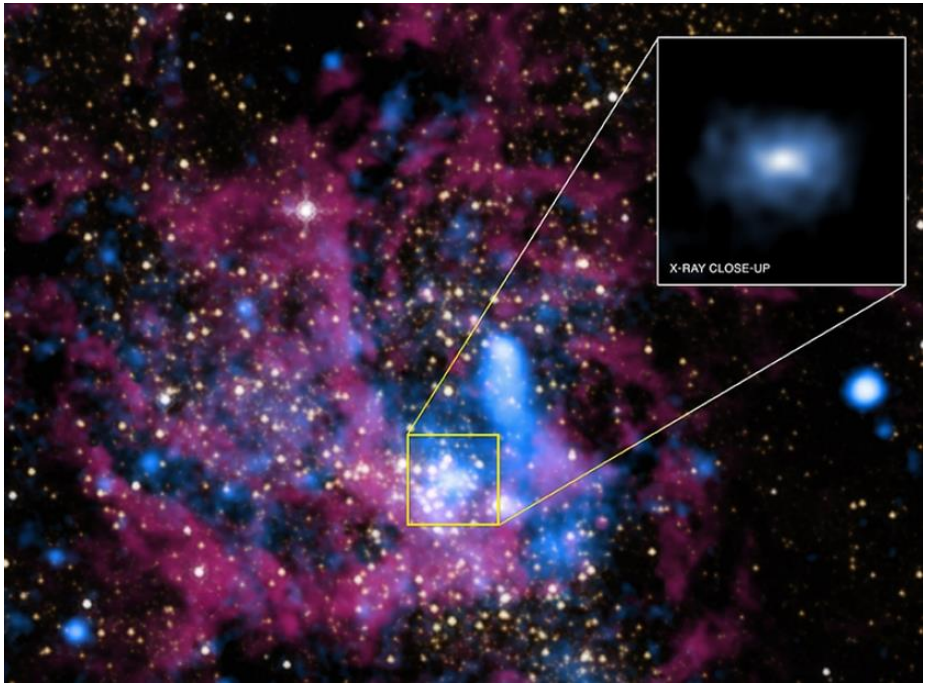
High mass stars use up their hydrogen relatively quickly, and may only last millions of years




nebula
red dwarf
low mass stars
forming stars (nuclear reactions)
red
gia
intermediate mass
stars
high mass stars
supergiant
superr

Black Hole: A sphere of incredibly tightly packed material with an extraordinary gravitational pull created when a star collapses into itself It is called a black hole because nothing, not even light can escape the powerful gravitational field.





Quasar: a region of extremely high energy that develops as the supermassive black hole in the center of a galaxy attracts more matter into itself