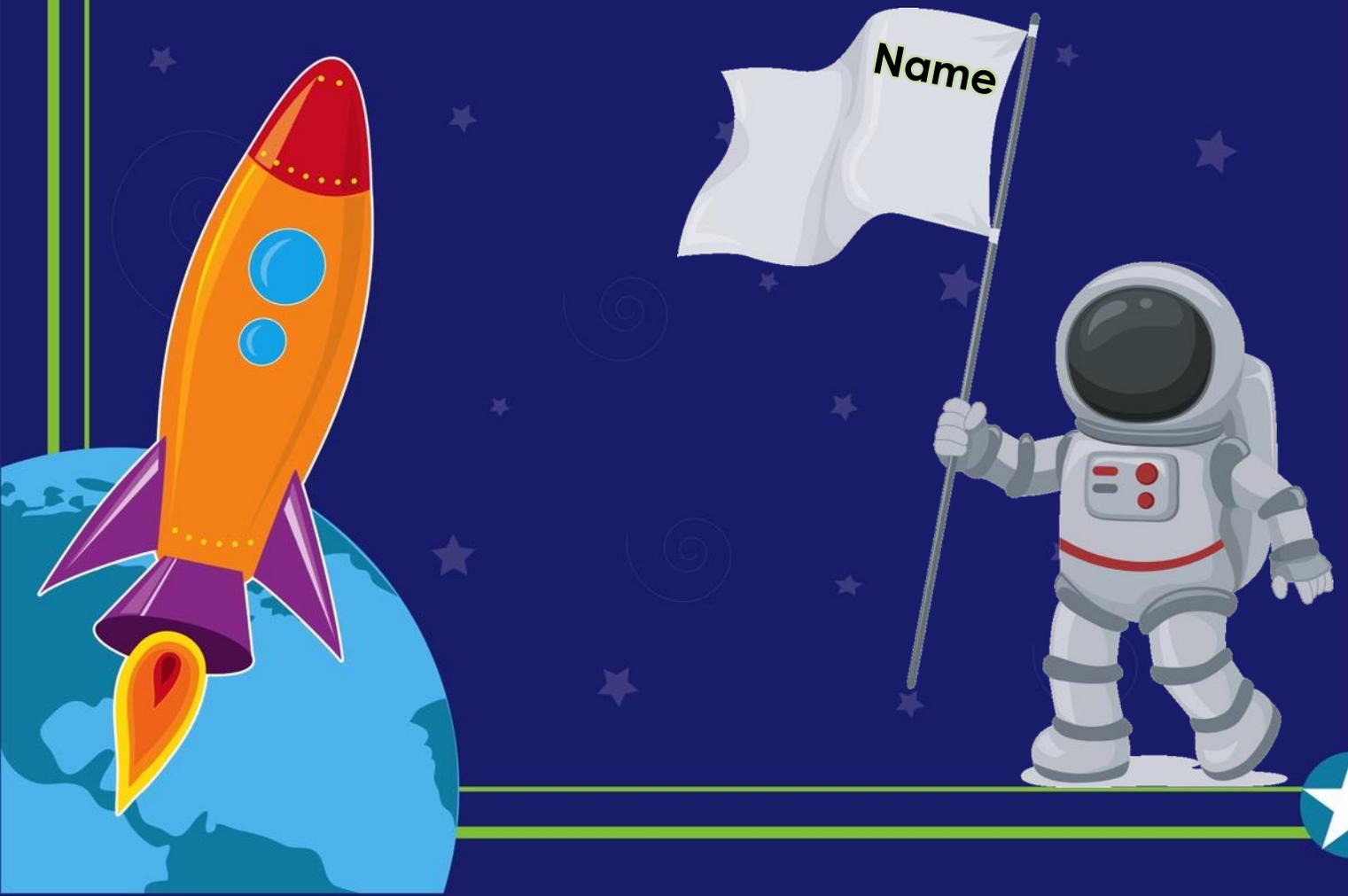


# My Science Journal

## All About the Solar System



# The Solar System



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Day/ Lesson Number

Lesson Title

1

What Makes Up the Solar System?

2

What is Astronomy?  
A Look at Space, Celestial Objects, and  
the Universe

3

Amazing Astronauts and  
Voyages into Space:  
A Look at Space Exploration

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Size and Scale of the Sun and Planets

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12

How Big is the Solar System?



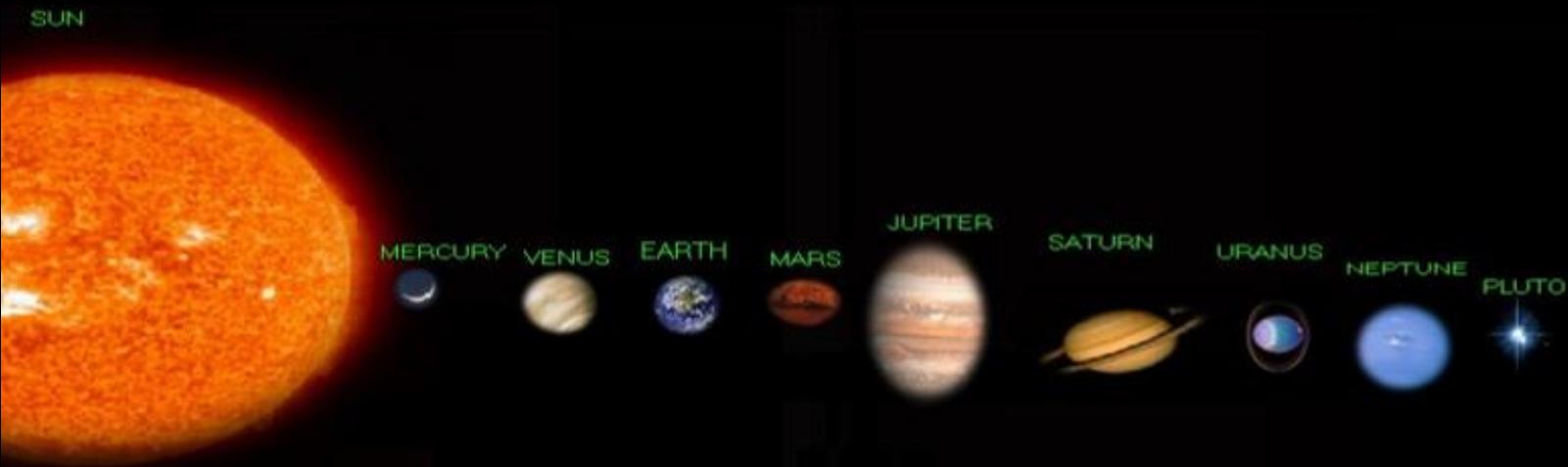
[Image by AL2TB on Wikimedia Commons](#)

# Vocabulary

<b>Asteroid</b>	A <b>small rocky body</b> orbiting the sun.
<b>Asteroid Belt</b>	The space <b>between Mars and Jupiter</b> where most asteroids orbit
<b>Astronaut</b>	A person who is <b>trained to travel in spacecraft</b>
<b>Astronomer</b>	An <b>expert in astronomy</b> / a person who studies astronomy
<b>Astronomy</b>	The branch of science that deals with <b>celestial objects, space, and the physical universe as a whole</b>
<b>Atmosphere</b>	The <b>envelope of gases</b> that surround a planet
<b>Comet</b>	A <b>celestial object</b> consisting of a <b>nucleus of ice and dust</b> and, when near the sun, a <b>"tail" of gas and dust particles</b> pointing away from the sun
<b>Constellation</b>	A <b>group of stars forming a recognizable pattern</b> that is traditionally named after its apparent form or identified with a mythological figure
<b>Core</b>	The <b>center</b> of an object
<b>Cosmonaut</b>	The <b>Russian</b> term for "astronaut"
<b>Crater</b>	A <b>hole in the ground</b> caused by an object from space
<b>Dwarf Planet</b>	A <b>celestial body resembling a small planet</b> but <b>lacking certain technical criteria</b> that are required for it to be classed as such
<b>Earth</b>	The <b>third planet</b> of the Solar System
<b>Galaxy</b>	A <b>system of billions of stars</b> , together with gas and dust, held together by gravitational attraction
<b>Gas Giant</b>	A <b>large planet of relatively low density consisting predominantly of hydrogen and helium</b> , such as Jupiter, Saturn, Uranus, or Neptune
<b>Gravity</b>	The <b>force that attracts a body toward the center of the Earth</b> , or toward any other physical body having mass
<b>Jupiter</b>	The <b>fifth and largest planet</b> in the Solar System

<b>Mars</b>	The <b>fourth planet</b> of the Solar System
<b>Mercury</b>	The planet that is <b>closest to the Sun</b>
<b>Meteorite</b>	A <b>meteor that survives its passage through the Earth's atmosphere</b> such that part of it strikes the
<b>Meteoroid</b>	A <b>small body moving in the Solar System</b> that would become a meteor if it entered the Earth's atmosphere
<b>Milky Way</b>	The galaxy where the <b>Solar System is located</b>
<b>Moon</b>	A <b>natural satellite</b> of any planet
<b>Neptune</b>	The <b>eighth planet</b> in the Solar System
<b>Orbit</b>	The <b>curved path of a celestial object</b> or spacecraft around a star, planet, or moon
<b>Pluto</b>	The <b>last and smallest planet</b> in the Solar System
<b>Revolution</b>	The <b>movement of an object in a circular or elliptical course</b> around another or about an axis or center
<b>Rotation</b>	The action of <b>rotating around an axis or center</b>
<b>Saturn</b>	The <b>sixth planet</b> in the Solar System
<b>Solar System</b>	The <b>collection of eight planets and their moons</b> in orbit around the Sun, together with smaller bodies in the form of asteroids, meteoroids, and comets
<b>Star</b>	A <b>body of hot gases</b> located in outer space
<b>Sun</b>	The <b>central body of the Solar System</b>
<b>Sunspot</b>	A <b>spot or patch</b> appearing from time to time on the <b>Sun's surface</b> , appearing dark by contrast with its surroundings
<b>Telescope</b>	An <b>optical instrument</b> used to <b>observe objects</b> that are far away.
<b>Terrestrial</b>	Of, on, or relating to <b>Earth</b>
<b>Uranus</b>	The <b>seventh planet</b> in the Solar System
<b>Venus</b>	The <b>second and brightest planet</b> in the Solar System

# Planets of the Solar System



[Image by tonynetone on Flickr](#)

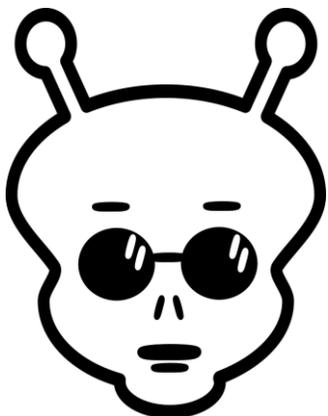
To remember the order of the planets, here's a mnemonic:

**My Very Easy Method Just Speeds Up Naming Planets**

(Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, Pluto)

# Introduction to the Solar System

- The Solar System is made up of **nine planets**.
- Each planet **circles (orbits) the Sun**.
- The **Sun has a lot of gravity**, which is why it tries to pull the planets towards it. This is why the Sun is the center of the universe.
- There are **180 moons** in the Solar System. **Moons do not orbit the Sun**; they **orbit the closest planet**.
- For many years, people were unaware of the Solar System; they believed Earth was the center of the universe.
- The Solar System **orbits around the Milky Way Galaxy**.
- In the Milky Way Galaxy, there are about **200 billion stars**.
- The **Sun** makes up **99.85% of the Solar System's mass**; **planets, asteroids, and other objects** make up **0.15%** of the remaining mass.
- The planets of the Solar System orbit in a **counterclockwise direction**.



## Think About It!

Do you think aliens exist? Why or why not?

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# How Did the Solar System Form: The Nebular Theory

- The Solar System began forming **5 billion years ago** from a giant spinning **cloud of gas and dust**.
- Main Gases: Hydrogen (**74%**) and Helium (**24%**)
- Remaining Gases: **Oxygen**; **Nitrogen**; **Carbon**.
- The cloud became denser and hotter under the **influence of gravity**.
- As material fell towards the core, the cloud **increased** in speed.
- Increasing temperature generated enough energy to trigger a **nuclear fusion**.
- The nuclear fusion marked the **birth of the Sun**.
- The Sun took **10 million years to form**.
- Near the Sun was **heavier**, **rocky material and metallic** with high melting points.
- **Mutual gravity** caused the **rocks** to **come together and form planets**.
- Rocky Planets: **Mercury**, **Venus**, **Earth**, and **Mars**.
- **Temperatures dropped** further from the Sun.
- Gas Giants: **Jupiter**, **Saturn**, **Uranus**, and **Neptune**.
- The Solar System is about **4.6 billion years old**.



# What Will You Find in the Solar System?

- The Solar System is made up of more than just planets!

Sun (A)	A <b>large star</b> ; the <b>center</b> of the Solar System.
Planet (B)	A celestial body moving in an <b>elliptical orbit around a star</b> .
Dwarf Planet (C)	A celestial body resembling a planet, but <b>lacking some required criteria</b> .
Satellite (D)	A celestial body <b>orbiting the Earth or another planet</b> .
Asteroid (E)	A <b>small rocky body orbiting the Sun</b> .
Comet (F)	A celestial object consisting of a <b>nucleus of ice and dust and, when near the Sun, a "tail" of gas and dust particles</b> pointing away from the Sun.
Meteor (G)	A <b>small body of matter from outer space</b> that enters the earth's atmosphere.

## Which One Is It?

Label the pictures with correct letters above.



D

[Image by geralt on Pixabay](#)



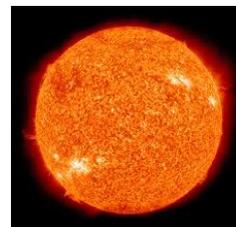
F

[Image on Max Pixel](#)



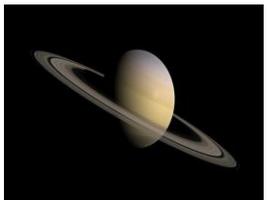
E

[Image by ESO on Wikimedia Commons](#)



A

[Image by NASA/SDO \(AIA\) on Wikimedia Commons](#)



B

[Image by bark on Flickr](#)



C

[Image by gnokii on Openclipart](#)



G

[Image by State Farm on Flickr](#)

# History of Astronomy

- Astronomy is one of the **oldest types of science**.
- Someone who studies astronomy is called an **astronomer**.
- Astronomy is the study of **outer space** and **celestial bodies**, including **stars, comets, planets,** and **galaxies**.
- Astronomy has been traced back to the **Ancient Mesopotamia**.
- **Ancient Greeks, Romans,** and **Mayans** also studied astronomy.
- In ancient times, space was **observed only by the eyes**.
- In the **early 1600s**, the **telescope was invented**. The invention of the telescope helped scientists get a better view of the sky, stars, the moon, and planets.
- Major discoveries in astronomy are still being made today. The **20<sup>th</sup> Century** saw the discoveries of **new galaxies, black holes, neutron stars,** and **quasars**.



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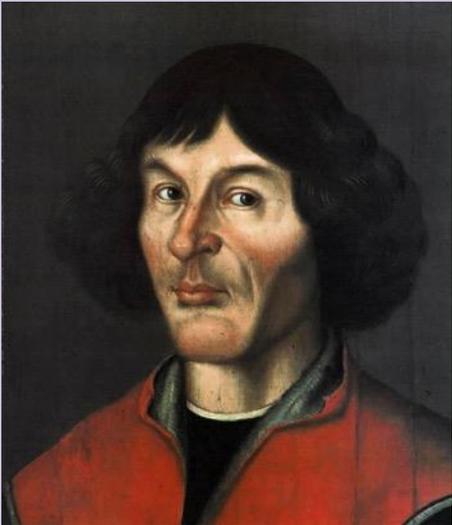
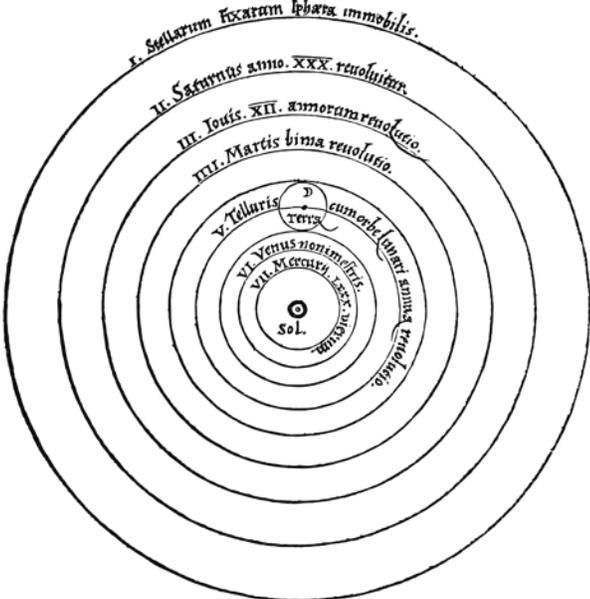


[Image by ktos on Pixabay](#)

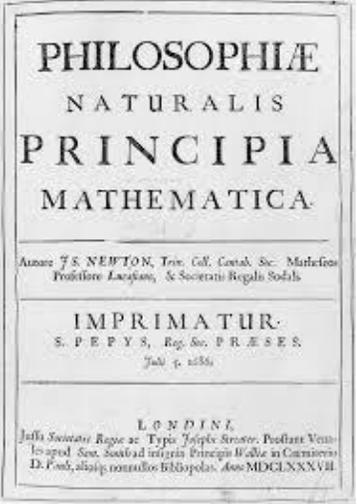
# Galileo Galilei

<b>Born</b>	February 25, 1564 Pisa, Italy
<b>Died</b>	January 8, 1642 Arcetri, Italy
<b>Contributions to Science</b>	<ul style="list-style-type: none"><li>▪ Proved that the <b>Solar System revolved around the Sun</b>. He called this the "Heliocentric Model."</li><li>▪ <b>Improved the telescope</b>, changing the magnification from 3x to 30x!</li><li>▪ In <b>1610</b>, he discovered Jupiter had four moons.</li><li>▪ Discovered <b>Earth's moon has phases and craters</b>.</li><li>▪ Experimented a lot—developed the <b>"Scientific Method"</b>.</li><li>▪ Developed the <b>pendulum design</b>, a time keeping method.</li></ul>
 <p><a href="#">Image by Justus Sustermans on Wikimedia Commons</a></p> <p><b>Galileo Galilei</b></p>	 <p><a href="#">Image by Sailko on Wikimedia Commons</a></p> <p><b>Galileo's Telescopes</b></p>

# Nicolaus Copernicus

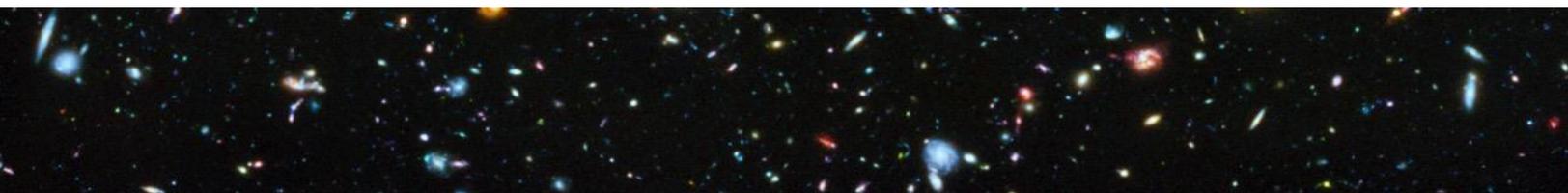
<b>Born</b>	February 19, 1473 Torun, Royal Prussia (now Poland)
<b>Died</b>	May 24, 1543 Frauenberg, East Prussia (now Poland)
<b>Contributions to Science</b>	<ul style="list-style-type: none"><li>▪ Developed the <b>"Heliocentric Theory"—the Sun is the center of the universe.</b></li><li>▪ Stated that <b>Earth revolves around the Sun in a year</b> and turns on its <b>axis once a day.</b></li><li>▪ Discovered the correct order of the planets.</li><li>▪ Explained that <b>stars move because of the Earth</b>, not because of themselves.</li><li>▪ Also explained that the <b>Sun moves</b> because of the <b>movement of the Earth.</b></li><li>▪ Known as the <b>"Father of Modern Astronomy."</b></li></ul>
 <p><a href="#">Image on Wikimedia Commons {{PD-old-100}}</a></p> <p><b>Nicolaus Copernicus</b></p>	 <p><i>i. Stellarium fixarum sphaera immobilis.</i> <i>ii. Saturnus anno. xxx. revolvitur.</i> <i>iii. Iovis. xii. annorum revolutio.</i> <i>iiii. Martis bima revolutio.</i> <i>v. Telluris terra cum orbibus lunari annis 365. diurnis.</i> <i>vi. Venus non mensuris.</i> <i>vii. Mercurii. sex. mensuris.</i> <i>Sol.</i></p> <p><a href="#">Image by Nicolai Copernici on Wikimedia Commons</a></p> <p><b>Copernicus' Model of the Solar System</b></p>

# Sir Isaac Newton

<p><b>Born</b></p>	<p>January 4, 1643 Woolsthorpe, England</p>
<p><b>Died</b></p>	<p>March 31, 1727 London, England</p>
<p><b>Contributions to Science</b></p>	<ul style="list-style-type: none"> <li>▪ Defined the <b>three laws of motion and universal gravitation</b>, which is described <i>Philosophiae Naturalis Principia Mathematica</i> (<u><i>Mathematical Principles of Natural Philosophy</i></u>) published in 1687.</li> <li>▪ <b>Discovered gravity</b>; today that theory is called “Newton’s Law of Universal Gravitation.”</li> <li>▪ Stated: <b>“An object in motion wants to stay in motion, and an object at rest wants to stay at rest.”</b> (<a href="http://www.coolkidfacts.com/isaac-newton-for-kids/">http://www.coolkidfacts.com/isaac-newton-for-kids/</a>)</li> <li>▪ Invented the <b>reflecting telescope in 1668</b>. Today, mostly all telescopes used by astronomers are reflecting telescopes.</li> <li>▪ Considered to be one of the <b>most influential scientists of all time</b>.</li> </ul>
 <p><small>SIR ISAAC NEWTON Painted by Sir Godfrey Kneller 1689</small></p> <p><a href="#">Image by Godfrey Kneller on Wikimedia Commons</a></p> <p><b>Sir Isaac Newton</b></p>	 <p><b>Sir Isaac Newton’s Book,</b> <b><u><i>Philosophiæ Naturalis Principia Mathematica</i></u></b></p> <p><a href="#">Image by Wellcome Images on Wikimedia Commons</a></p>

# Fields of Astronomy

<h2>Observational Astronomy</h2>	<p>the study of <b>celestial objects</b>, such as stars and planets. There are types of observational astronomy that focus on how to observe objects: basic light; radio; infrared; C-ray; Gamma Ray; ultraviolet observations</p>
<h2>Theoretical Astronomy</h2>	<p>the use of <b>mathematical models to describe observations</b> we can see and even those we cannot see</p>
<h2>Solar Astronomy</h2>	<p>the <b>study of the Sun</b> and how it impacts the Earth</p>

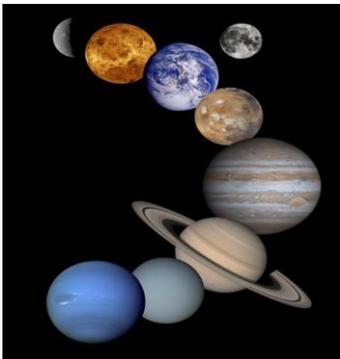


## Planetary Astronomy

the study of the **planets, moons, asteroids, and comets**

## Stellar Astronomy

the **study of the stars**. This includes the formation of stars, **different types** of stars, **red giants, black holes, supernovas,** and **neutron stars**



[Image by skeeze on Pixabay](#)

# Think About It!

If you had to choose one of the five fields of astronomy, which one would you choose and why?

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# History of Space Exploration

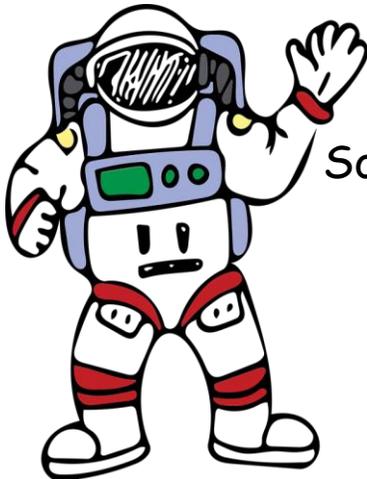
- For hundreds of years, outer space has been somewhat unknown.
- **Prior to 17<sup>th</sup> Century**, astronomers viewed the sky only with their eyes.
- In **1608**, **Hans Lippershey invented the telescope**. The telescope allowed astronomers to get a better view of the sky.
- The **original telescope only had a 3x magnification**—it was enough to see the sky, but a better magnification would be needed.
- **Galileo Galilei** improved the telescope—creating a telescope with a magnification of **30x**!
- In the **1950s**, **science and technology began improving**. The interest in outer space increased.
- The **“Space Race”** began in **1957**.
- From the 1950s on, people have **landed on the Moon**, **orbited other planets**, and have even **taken pictures of Mars**!

# Do You Have What it Takes?

Being an astronaut can be a really awesome job! However, it takes a lot of work! Do you have what it takes?

To be an astronaut, you need to love school! Astronauts spend a lot of time in school studying astronomy, medicine, engineering, and math. Many astronauts also know how to speak more than one language. Usually astronauts can speak English and Russian.

In order to be an astronaut, you must be very healthy! Traveling into outer space can be very stressful on the body and can also make you very tired. Prior to every space trip, astronauts undergo extensive physical examinations. When astronauts get into outer space, they work and live in a tiny space and spend a lot of time together. You need to be able to get along with your fellow astronauts!



[Image by one life on Pixabay](#)

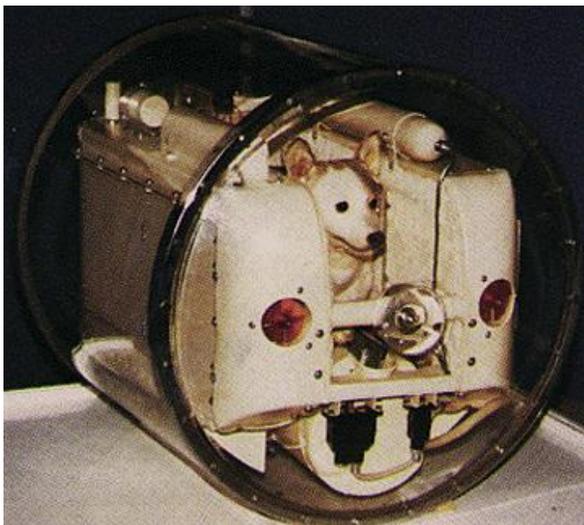
So, do you think you have what it takes to be an astronaut?

Astronaut	Information	Picture
Buzz Aldrin	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1930</li> <li>▪ <b>Died:</b> N   A</li> <li>▪ <b>Famous For...</b> being the second person to walk on the Moon.</li> </ul>	 <p data-bbox="1114 422 1482 445"><a href="#">Image by NASA on Wikimedia Commons</a></p>
Neil Armstrong	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1930</li> <li>▪ <b>Died:</b> 2012</li> <li>▪ <b>Famous For...</b> being the first person to walk on the Moon.  <b>“One small step for man, one giant step for mankind.”</b></li> </ul>	 <p data-bbox="1102 871 1471 894"><a href="#">Image by NASA on Wikimedia Commons</a></p>
Guion Bluford	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1922</li> <li>▪ <b>Died:</b> N   A</li> <li>▪ <b>Famous For...</b> being the first African American to go into outer space. He was also the mission specialist for the Challenger.</li> </ul>	 <p data-bbox="1094 1276 1463 1299"><a href="#">Image by NASA on Wikimedia Commons</a></p>
Yuri Gagarin	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1934</li> <li>▪ <b>Died:</b> 1968</li> <li>▪ <b>Famous For...</b>being the first Russian astronaut (cosmonaut) to orbit the Earth.</li> </ul>	 <p data-bbox="1114 1583 1466 1631"><a href="#">Image by SAS Scandinavian Airlines on Wikimedia Commons</a></p>
Gus Grissom	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1926</li> <li>▪ <b>Died:</b> 1967</li> <li>▪ <b>Famous For...</b>being the second American to go into outer space. He was also the commander of the Gemini II</li> </ul>	 <p data-bbox="1079 1955 1520 1982"><a href="#">Image by U.S. Air Force on Wikimedia Commons</a></p>

Astronaut	Information	Picture
John Glenn	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1921</li> <li>▪ <b>Died:</b> 2016</li> <li>▪ <b>Famous For...</b>being the first American to orbit the Earth. He was also the oldest person to go into space—at age 77 he again traveled to outer space.</li> </ul>	 <p data-bbox="1094 506 1463 531"><a href="#">Image by NASA on Wikimedia Commons</a></p>
Mae Jemison	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1956</li> <li>▪ <b>Died:</b> N   A</li> <li>▪ <b>Famous For...</b> being the first African American woman to orbit outer space.</li> </ul>	 <p data-bbox="1094 827 1463 852"><a href="#">Image by NASA on Wikimedia Commons</a></p>
Sally Ride	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1951</li> <li>▪ <b>Died:</b> 2012</li> <li>▪ <b>Famous For...</b>being the first American woman to orbit outer space. She was also the youngest astronaut to orbit outer space.</li> </ul>	 <p data-bbox="1094 1241 1463 1266"><a href="#">Image by NASA on Wikimedia Commons</a></p>
Alan Shepherd	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1923</li> <li>▪ <b>Died:</b> 1998</li> <li>▪ <b>Famous For...</b>being the second person, but first American to travel to outer space. He was also the fifth person to walk on the Moon.</li> </ul>	 <p data-bbox="1066 1646 1497 1671"><a href="#">Image by NASA/MSFC on Wikimedia Commons</a></p>
Valentina Tereshkova	<ul style="list-style-type: none"> <li>▪ <b>Born:</b> 1947</li> <li>▪ <b>Died:</b> N   A</li> <li>▪ <b>Famous For...</b>being the first female Russian cosmonaut to orbit outer space.</li> </ul>	 <p data-bbox="1070 1948 1484 1995"><a href="#">Image by Alexander Mokletsov on Wikimedia Commons</a></p>

# “Space Race”

- The “Space Race” occurred in the **1960s**.
- During the Cold War, the United States and Soviet Union (present day Russia) began a competition to see **which country would get to outer space first**. This included putting a man on the moon and sending out a spaceship with astronauts.
- The “Space Race” was very important because it showed which country had **better technology, more access to science information, and smarter astronauts and engineers**.
- In **1955**, the United States and Soviet Union announced that they would be putting a **satellite into outer space**.
- On **October 4, 1957**, **Sputnik I was placed into orbit by the Soviet Union**. The United States placed **Explorer I** into orbit in **February 1958**.
- The Russians were also the first country to launch an animal into space. On **November 3, 1957**, **Sputnik 2** was launched with **Soviet space dog, Laika**, on board.
- On **April 12, 1961**, Russian cosmonaut (astronaut), **Yuri Gagarin** became the first man to orbit Earth. He orbited on the space craft known as **Vostok I**.
- In early **May 1961**, **Alan Shepherd** became the first American to go into outer space. Shepherd, however, **did not orbit the Earth**.



[Image by NASA on Wikimedia Commons](#)

- **John Glenn**, an American Astronaut, **orbited the Earth on February 20, 1962** on the space craft known as **Friendship 7 space craft**.
- In **1961**, **the Apollo Moon Project was launched by President Kennedy** (United States). The goal was to be the first country to put a man on the Moon.
- On **July 16, 1969**, three astronauts, **Neil Armstrong, Buzz Aldrin**, and **Michael Collins**, left for the Moon on **Apollo 11**. It took three days to get to the Moon.
- On **July 20, 1969**, **Neil Armstrong** became the **first man to walk on the Moon**.
- Armstrong's first words on the Moon we: "That's one small step for man, one giant leap for mankind."
- In 1975, the United States and the Soviet Union were beginning to mend their relationship.
- The United States and the Soviet Union created the **Apollo-Soyez Project in 1975**; this officially **ended the "Space Race."**

# Think About It!

Imagine you are one of the astronauts or cosmonauts that is going into space for the first time.  
Write about your experience.

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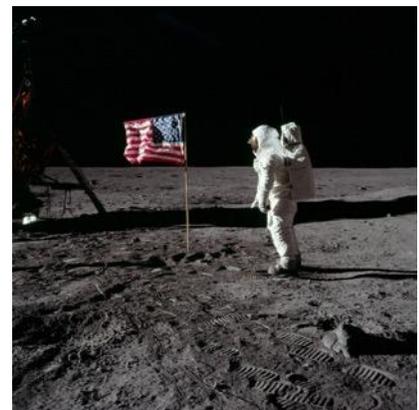
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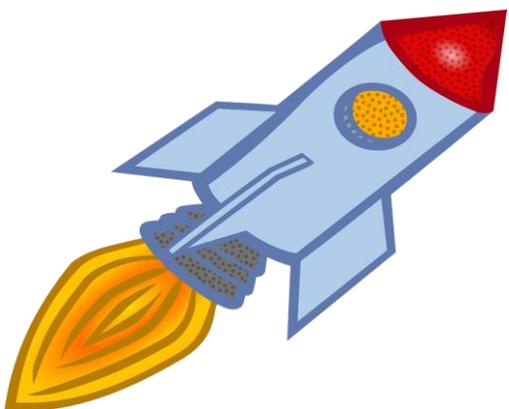


[Image by NASA / Neil A. Armstrong on Wikimedia Commons](#)

# Notable Space Explorations

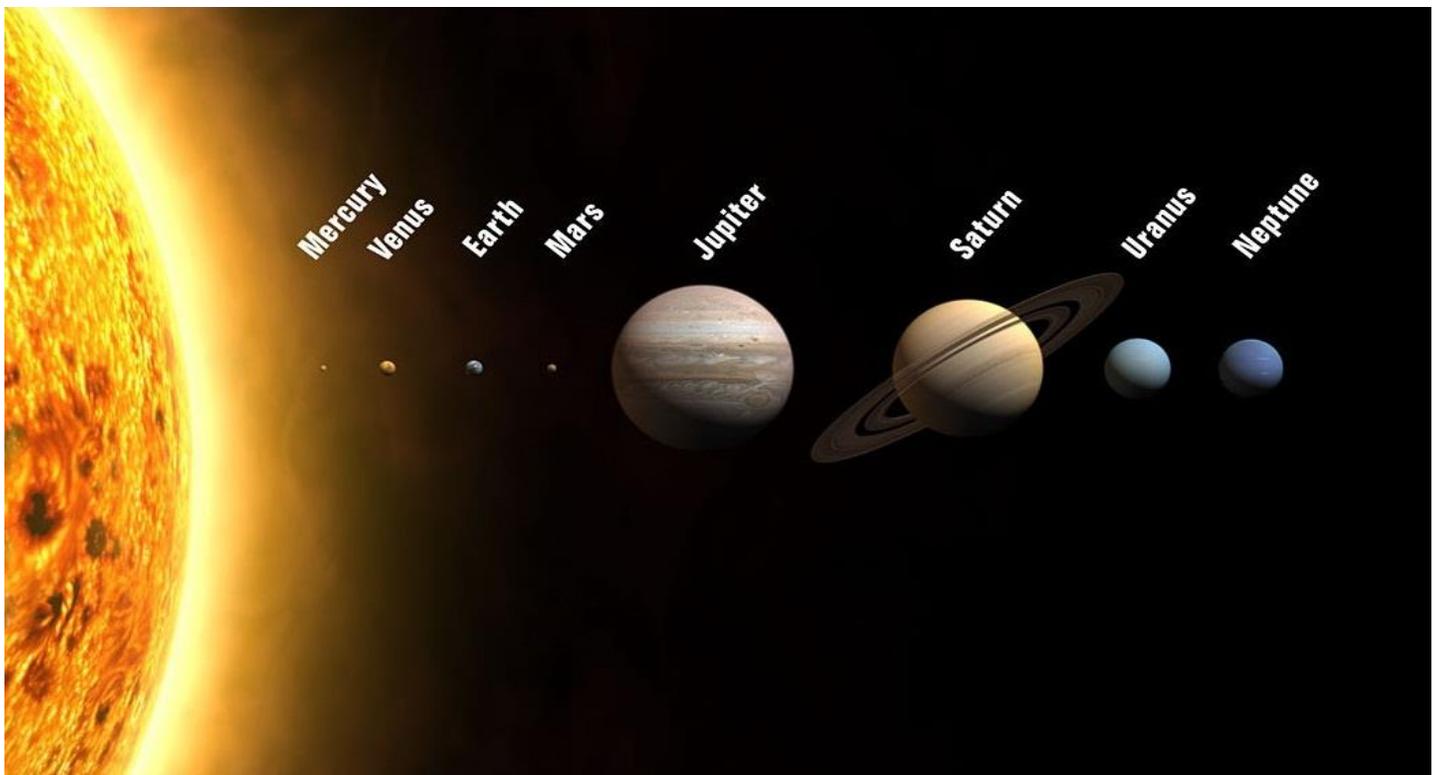
Year	Event
1543	Nicolaus Copernicus claims the Earth and planets orbit the Sun.
1609	Galiei Galileo is the first astronomer to use a telescope to view stars.
1668	Invention of the revolving telescope by Sir Isaac Newton.
1686	Sir Isaac Newton published the famous, <i>Mathematici Principles of Natural Philosophy</i> , explaining universal gravitation and the motion of the Sun and planets.
1801	Giuseppe Piazzi discovers the first asteroid, Ceres.
1926	The first liquid-fueled rocket is launched by Robert Goddard. This helped to pave the way for future explorations into space.
1942	Germany sends to first vehicle into outer space, the V-2 rocket.
1947	Fruit flies become the first animals to go into outer space.
August 21, 1957	"Space Race" begins
November 3, 1957	Laika, the Soviet space dog, becomes the first animal to go into orbit.
1961	Yuri Gagrain becomes the first human to go into outer space and the first human to orbit the Earth.
1965	Alexei Leneov is the first man to walk in space.
1965	Mariner 4 (United States) becomes the first space craft to fly passed Mars.

Year	Event
1969	Neil Armstrong becomes the first man to walk on the Moon.
1971	Salyut I, a Russian space station, is launched.
1971	Mariner 9 orbits Mars.
1973	Pioneer 10 becomes the first space craft to fly passed Jupiter.
1975	"Space Race" ends with the formation of the Apollo-Soyuz Test Project.
1976	Viking I lands on mars and sends back pictures.
1981	Columbia, the first space shuttle, is launched by the United States.
1986	Mir becomes the first inhabited space station. It would remain inhabited until 2001.
1990	Space Shuttle carries the Hubble Telescope into orbit.
1998	The first international space station is sent into orbit.
2001	NEAR Shoemaker lands on 433 Eros, an asteroid.



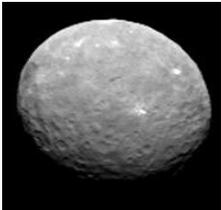
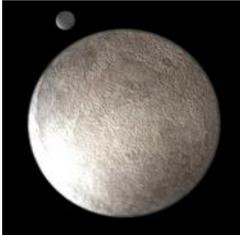
# Planets of the Solar System

- The Solar System is really amazing! Currently, scientists say that, in the Solar System, there are:
  - **566,000 asteroids**
  - **3,100 comets**
  - **181 moons**
  - **8 planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune**
  - **5 dwarf planets: Pluto, Ceres, Haumea, Makemake, and Eris**
  - **1 big star (Sun)**
- The diameter of the Solar System is **11.65 trillion miles** [**18.75 trillion kilometers**]



# Dwarf Planets

- The term “dwarf planet” was adopted by the International Astronomical Union in **2006**.
- Dwarf planets are **bigger than comets and asteroids, but smaller than planets**.
- The Solar System has 5 **dwarf planets**: Pluto, Ceres, Eris, Makemake, and Haumea.

Planet	Year of Discovery	Distance from the Sun	Picture
Pluto	<b>1930</b>	5,874,000,000 kilometers	 <a href="#">Image by NASA on Wikimedia Commons</a>
Ceres	<b>1801</b>	413,700,000 kilometers	 <a href="#">Image by NASA/ IPL-Caltech/ UCLA/ MPS/ DLR/ IDA on Wikimedia Commons</a>
Eris	<b>2005</b>	10,120,000,000 kilometers	 <a href="#">Image by NASA on Wikimedia Commons</a>
Makemake	<b>2005</b>	6,850,000,000 kilometers	 <a href="#">Image by Ann Feild (Space Telescope Science Institute) on Wikimedia Commons</a>
Haumea	<b>2004</b>	6,452,000,000 kilometers	 <a href="#">Image by Jcpag2012 on Wikimedia Commons</a>

# Mercury

**Order from the Sun:** First

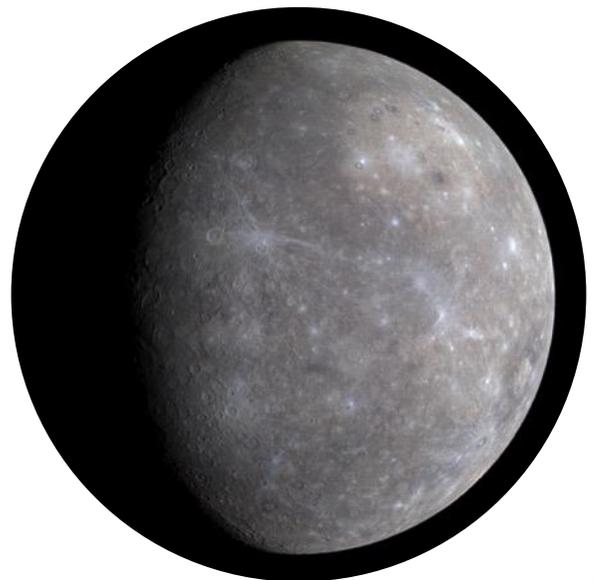
**Distance from the Sun:** 35.98 million miles

**Number of Moons:** 0

**Time it Takes to Orbit the Sun:** 88 days

**Time it Takes to Rotate:** 59 Earth days

**One Cool Fact About This Planet:** Mercury does not have an atmosphere to protect it from the Sun.



[Image by NASA/Johns Hopkins University Applied Physics Laboratory/Carnegie Institution of Washington on Wikimedia Commons](#)

# Venus

**Order from the Sun:** Second

**Distance from the Sun:** 67.24 million miles

**Number of Moons:** 0

**Time it Takes to Orbit the Sun:** 225 days

**Time it Takes to Rotate:** 243 Earth days

**One Cool Fact About This Planet:** Venus is the brightest planet in the Solar System. Venus rises before the Sun and is often called “Morning Star”.



[Image by NASA on Wikimedia Commons](#)

# Earth

**Order from the Sun:** Third

**Distance from the Sun:** 92.96 million miles

**Number of Moons:** 1

**Time it Takes to Orbit the Sun:** 365 days

**Time it Takes to Rotate:** 23 hours; 56 minutes; 4.1 seconds

**One Cool Fact About This Planet:** Earth is the only planet with life



[Image by NASA/ GSCF/ NOAA/ USGS on Wikimedia Commons](#)

# Mars

**Order from the Sun:** Fourth

**Distance from the Sun:** 141.6 million miles

**Number of Moons:** 2

**Time it Takes to Orbit the Sun:** 687 days

**Time it Takes to Rotate:** 24 hours; 37 minutes; 22 seconds

**One Cool Fact About This Planet:** Mars has polar ice caps (just like Earth), which leads scientists to believe that at one time life existed on Mars.



[Image by NASA, ESA, and The Hubble Heritage Team \(STScI/AURA\) on Wikimedia Commons](#)

# Jupiter

**Order from the Sun:** Fifth

**Distance from the Sun:** 483.8 million miles

**Number of Moons:** 67

**Time it Takes to Orbit the Sun:** 12 years

**Time it Takes to Rotate:** 9 hours; 55 minutes; 30 seconds

**One Cool Fact About This Planet:** Jupiter is the stormiest planet in the Solar System.



[Image by NASA, ESA, and A. Simon \(Goddard Space Flight Center\) on Wikimedia Commons](#)

# Saturn

**Order from the Sun:** Sixth

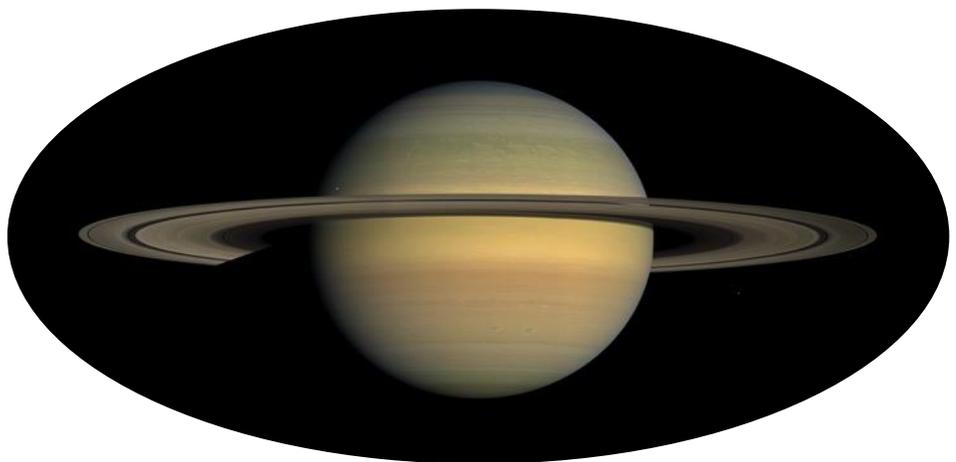
**Distance from the Sun:** 888.2 million miles

**Number of Moons:** 62

**Time it Takes to Orbit the Sun:** 29 years

**Time it Takes to Rotate:** 10 hours; 32 minutes; 35 seconds

**One Cool Fact About This Planet:** Saturn is the only planet with rings; the rings can only be viewed by telescope.



[Image by NASA / JPL / Space Science Institute on Wikimedia Commons](#)

# Uranus

**Order from the Sun:** Seventh

**Distance from the Sun:** 1.784 billion miles

**Number of Moons:** 27

**Time it Takes to Orbit the Sun:** 84 years

**Time it Takes to Rotate:** 17 hours; 14 minutes; 24 seconds

**One Cool Fact About This Planet:** Uranus' blue-green color comes from ammonia and methane, which is located as a frozen mass in the center of the planet



[Image by NASA/IPL/Voyager mission on Wikimedia Commons](#)

# Neptune

**Order from the Sun:** Eighth

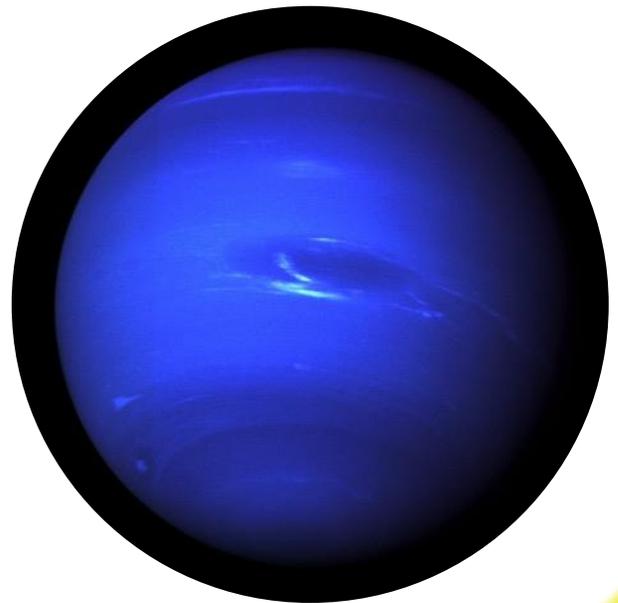
**Distance from the Sun:** 2.795 billion miles

**Number of Moons:** 14

**Time it Takes to Orbit the Sun:** 165 years

**Time it Takes to Rotate:** 16 hours; 6.6 minutes

**One Cool Fact About This Planet:** 2011 marked the completion of Neptune's first orbit since its discovery in 1846.



[Image by NASA on Wikimedia Commons](#)

# Pluto

**Order from the Sun:** Ninth

**Distance from the Sun:** 3.67 billion miles

**Number of Moons:** 5

**Time it Takes to Orbit the Sun:** 248 years

**Time it Takes to Rotate:** 6 days; 9 hours; 17.6 minutes

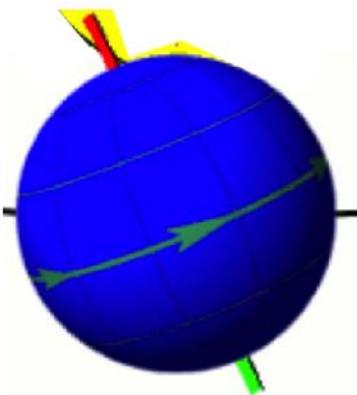
**One Cool Fact About This Planet:** It took NASA's spacecraft, New Horizons, 10 years to reach Pluto. New Horizons left in 2005 and arrived at Pluto in 2015.



[Image by NASA / Johns Hopkins University Applied Physics Laboratory / Southwest Research Institute on Wikimedia Commons](#)

# Rotate

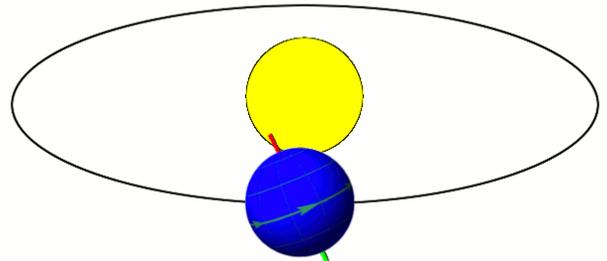
- Rotate means to **spin or turn**.
- The Earth rotates on its **axis**.
- The rotation takes **24 hours or 1 day**.
- The result of Earth's rotation is **night and day**.



[Image by Tfr000 on Wikimedia Commons](#)

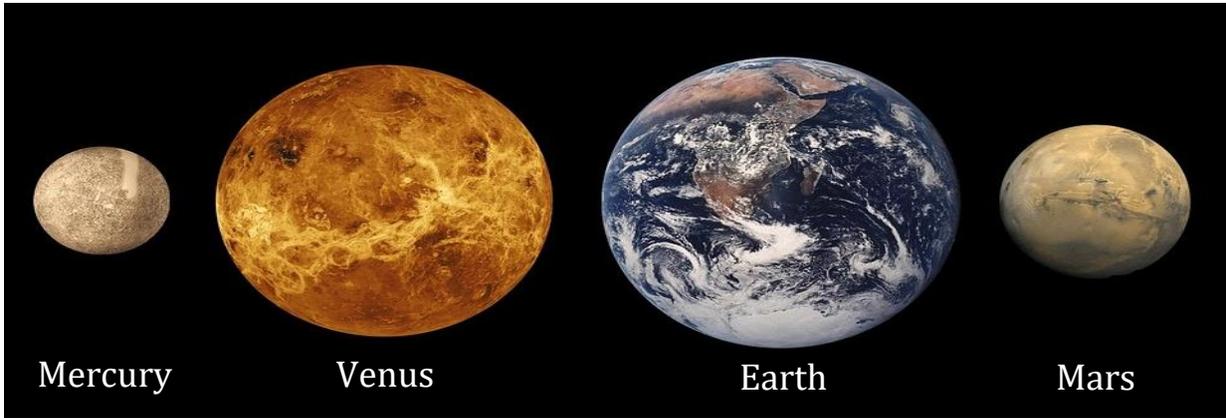
# Revolve

- Revolve means to **go around**.
- The Earth revolves around the **Sun**.
- It takes **365 days or 1 year** for the Earth to revolve around the Sun.
- The result is the **change of seasons (4 seasons)**.



[Image by Tfr000 on Wikimedia Commons](#)

# The Inner Planets



[Image by Wikimages on Pixabay](#)

<b>Size</b>	Inner planets are <b>smaller</b> than the outer planets.
<b>Surface &amp; Atmosphere</b>	Inner planets have a <b>solid, rocky surface and very little or no atmosphere</b> . You can stand on any inner planet.
<b>Density</b>	The elements that make up the inner planets are <b>packed together very closely</b> , making them smaller and solid.
<b>Variety of Atmospheres</b>	Mercury: none Venus: mostly carbon dioxide Earth: nitrogen, oxygen, and other gases Mars: carbon dioxide and nitrogen
<b>Ancient Astronomers Knew About Them</b>	The knowledge of inner planets goes back <b>thousands of years to the time of the ancient astronomers</b> .
<b>Spin Slowly</b>	The inner planets <b>spin slower</b> than the outer planets.

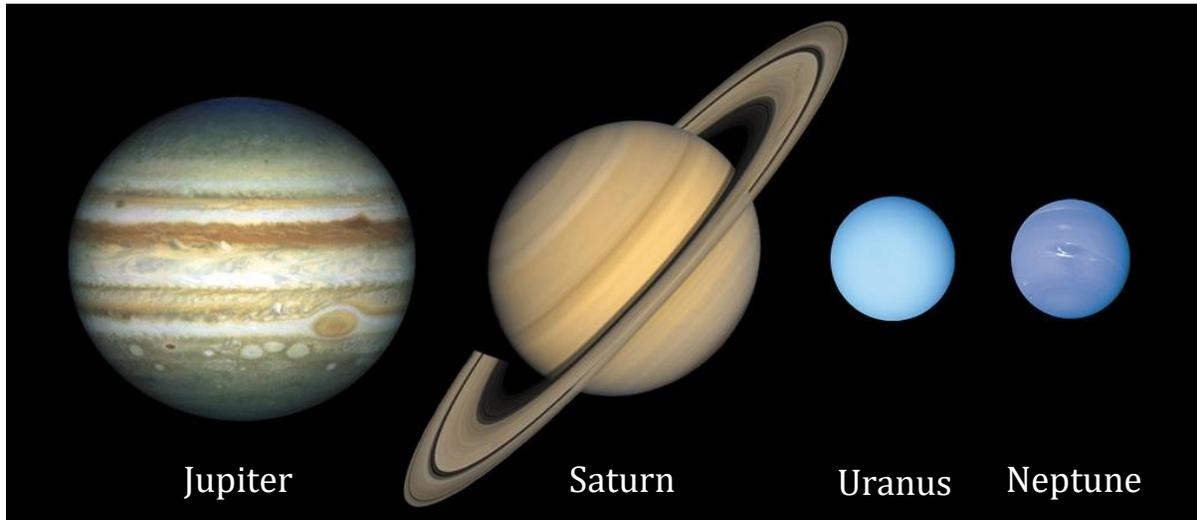
<b>Orbit Quicker</b>	Inner planets <b>orbit the Sun quicker</b> than the outer planets because they are closer.
<b>Few Moons</b>	The only two inner planets that have moons are Earth and Mars.
<b>No Rings</b>	<b>None</b> of the inner planets <b>have rings</b> .
<b>Space Crafts</b>	<b>More space explorations</b> are to the inner planets because they are closer.

# Think Back!

**Directions:** Read each statement. Without using your notes, write a **T** for statements that are **true**; write an **F** for statement that are **false**.

<b>There are six inner planets.</b>	
<b>The inner planets have fewer moons than the outer planets.</b>	
<b>The inner planets orbit quicker than the outer planets.</b>	
<b>Saturn is an inner planet.</b>	
<b>The inner planets are smaller than the outer planets.</b>	
<b>The inner planets haven't been explored as much as the outer planets.</b>	

# The Outer Planets



[Image by Kabsik Park on Flickr](#)

<b>Size</b>	Outer planets are <b>larger</b> than the inner planets.
<b>Surface &amp; Atmosphere</b>	Outer planets are <b>made mostly of gas (aka "The Gas Giants")</b> . You could not stand on any of the outer planets.
<b>Density</b>	The outer planets are <b>less dense</b> than the inner planets.
<b>Variety of Atmospheres</b>	The outer planets have atmospheres made mainly of <b>hydrogen, helium, and methane</b> .
<b>Ancient Astronomers Didn't Know About Them</b>	The only two outer planets that were known by the ancient astronomers were Saturn and Jupiter.
<b>Spin Quickly</b>	The outer planets <b>spin faster</b> than the inner planets.

<b>Orbit Slower</b>	Since the outer planets are further away from the Sun, they <b>orbit slower</b> .
<b>Many Moons</b>	<p>Jupiter: 60 moons  Saturn: 27 moons  Uranus: 13 moons  Neptune: 13 moons</p>
<b>Density</b>	The elements that make up the inner planets are <b>packed together very closely</b> , making them <b>smaller and solid</b> .
<b>Rings</b>	All of the outer planets <b>have rings</b> , but Saturn is the only planet with visible rings. The rings are made up of the dust and rocks of the moons that are not completely formed.
<b>Space Crafts</b>	Space crafts <b>do not travel to the outer planets often</b> . Saturn and Jupiter have been visited a few times, but Uranus and Neptune have been visited twice.

# Think Back!

**Directions:** Read each statement. Without using your notes, write a **T** for statements that are **true**; write an **F** for statement that are **false**.

**There are four outer planets.**

**The outer planets are made mostly of rocks**

**The outer planets spin slowly.**

**All of the outer planets have rings.**

**Uranus and Neptune were not known by ancient astronomers.**

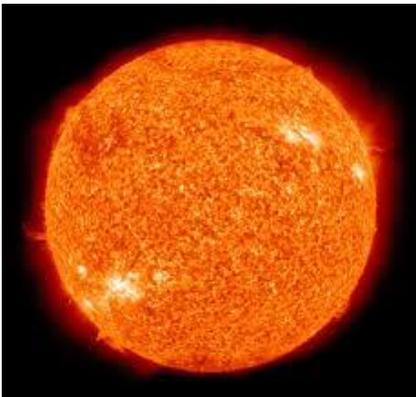
**The outer planets are smaller than the inner planets.**

# Sun Facts

- **Mass:** **4.18** nonillion pounds  
(333 thousand times the mass of the Earth).
- **Diameter:** **2,715,395** miles  
(**4.730,005** kilometers)
- **Surface Temperature:** **5,500°C** (**10,000°F**)
- **Distance from the Earth:** **93 million** miles  
(**149.6** million kilometers)
- **Age:** **4.5 billion** years-old

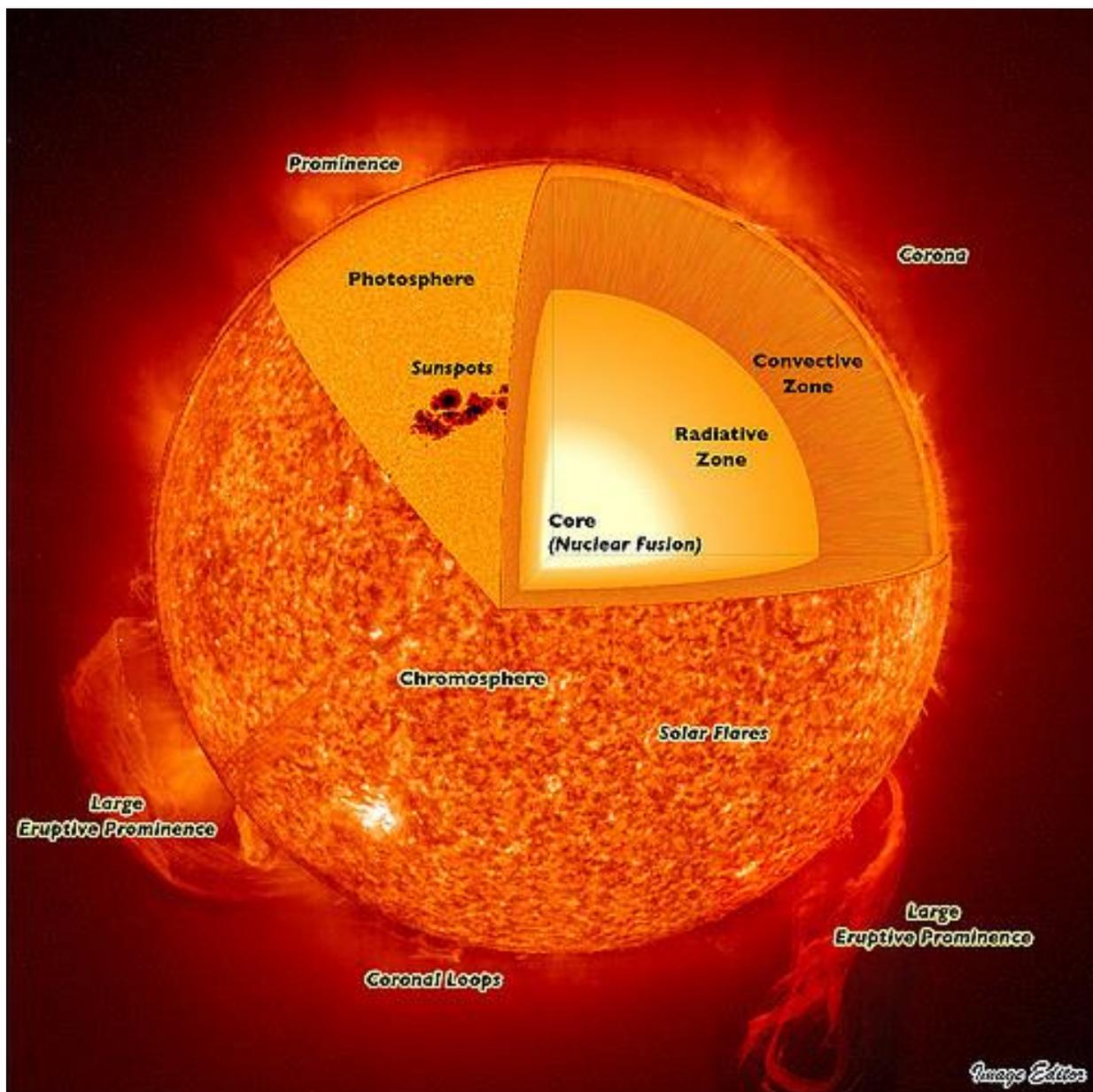
# One Giant Star: The Sun

- The Sun is classified as a **yellow dwarf star**.
- The Sun is the **center** of the Solar System.
- All the **planets orbit the Sun**.
- The Sun contains **99.8%** of the total mass of the Solar System.
- The Sun is made up of **hydrogen and helium gas**.
- **Hydrogen** makes up **74%** of the Sun's total mass.
- In the Sun's center, **hydrogen atoms** are exposed to **intense pressure** and undergo a process called **nuclear fusion**. **The hydrogen atoms change into helium atoms**.
- Nuclear fusion generates a lot of heat and radiation, which results in **sunlight**.
- Without the Sun, the Earth would not have an energy source. The **planet would be frozen** solid.



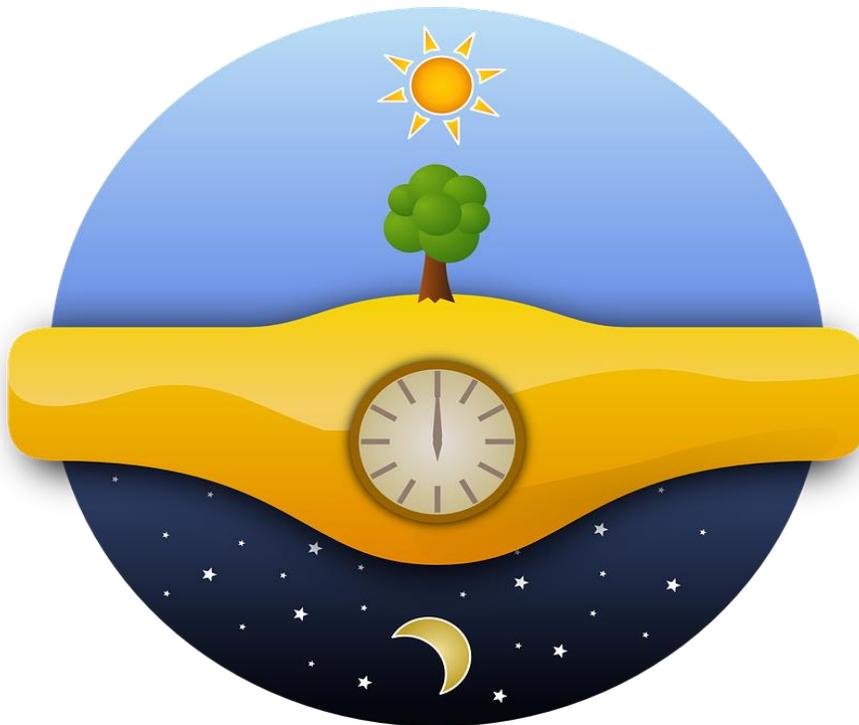
- The Sun has been **observed for hundreds of years**.
- **Galileo** and **Sir Isaac Newton** discovered that the planets orbited the Sun.
- The Earth is much closer to the Sun, which is why we **see the Sun as a ball**.
- Sun's **radiation escapes** as sunlight through the Sun's **photosphere**.

## Internal Structure of the Sun



# What Makes Night and Day?

- Earth spins on its axis.
- The Sun will always be on **one side of the Earth**.
- The side of the Earth that is **facing the Sun** will experience **heat and light (day)**.
- The side of the Earth of the Earth that is **not facing the Sun** is **darker and cooler (night)**.



[Image by Ciker-Free-Vector-Images on Pixabay](#)

# Why Do Planets Orbit the Sun?

- The Sun's mass makes up **99.8%** of the Solar System.
- The **Sun's mass is greater** than the mass of all the other planets combined.
- The Sun's **mass causes a "dip"** within the Solar System.
- The Sun's gravity **pulls the planets towards it.**
- Scientists use the term **"gravitational pull"** to explain why the Sun pulls planets towards it.
- "Gravitational Pull" is the **invisible force that pulls objects toward an object with greater mass.**

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Think back to the demonstration at the beginning of class. What would happen to the planets if the Sun didn't exist?

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## Think About It!



[Image by cheifyc on Pixabay](#)

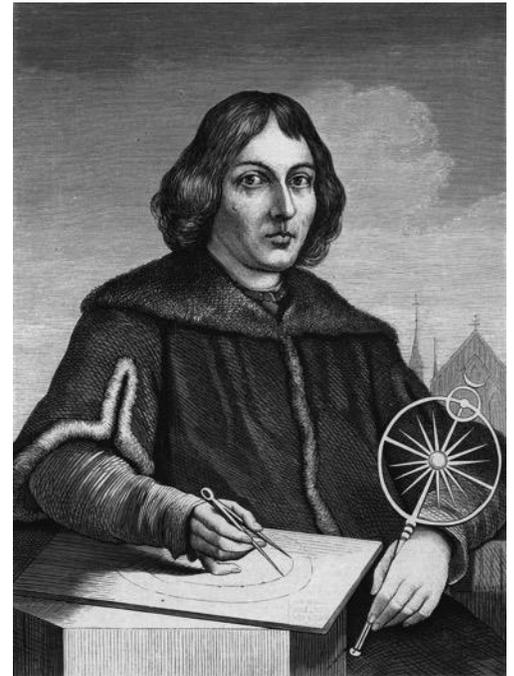
# Heliocentric Model of the Universe

- “Helios” is **Greek** for **Sun**.
- “Heliocentric Theory” is the theory that the **Sun is the center of the Solar System**.
- First proposed by **Aristarchus** in **270 BC**, but is credited to **Copernicus**.
- The Heliocentric Theory **replaces the older theory** that the **planets and Sun orbit the Earth**.

## Aristarchus



[Image by Dr. Manuel on Wikimedia Commons](#)



[Image by on Wikimedia Commons {{PD-Art}}](#)

## Copernicus

# Moon Facts

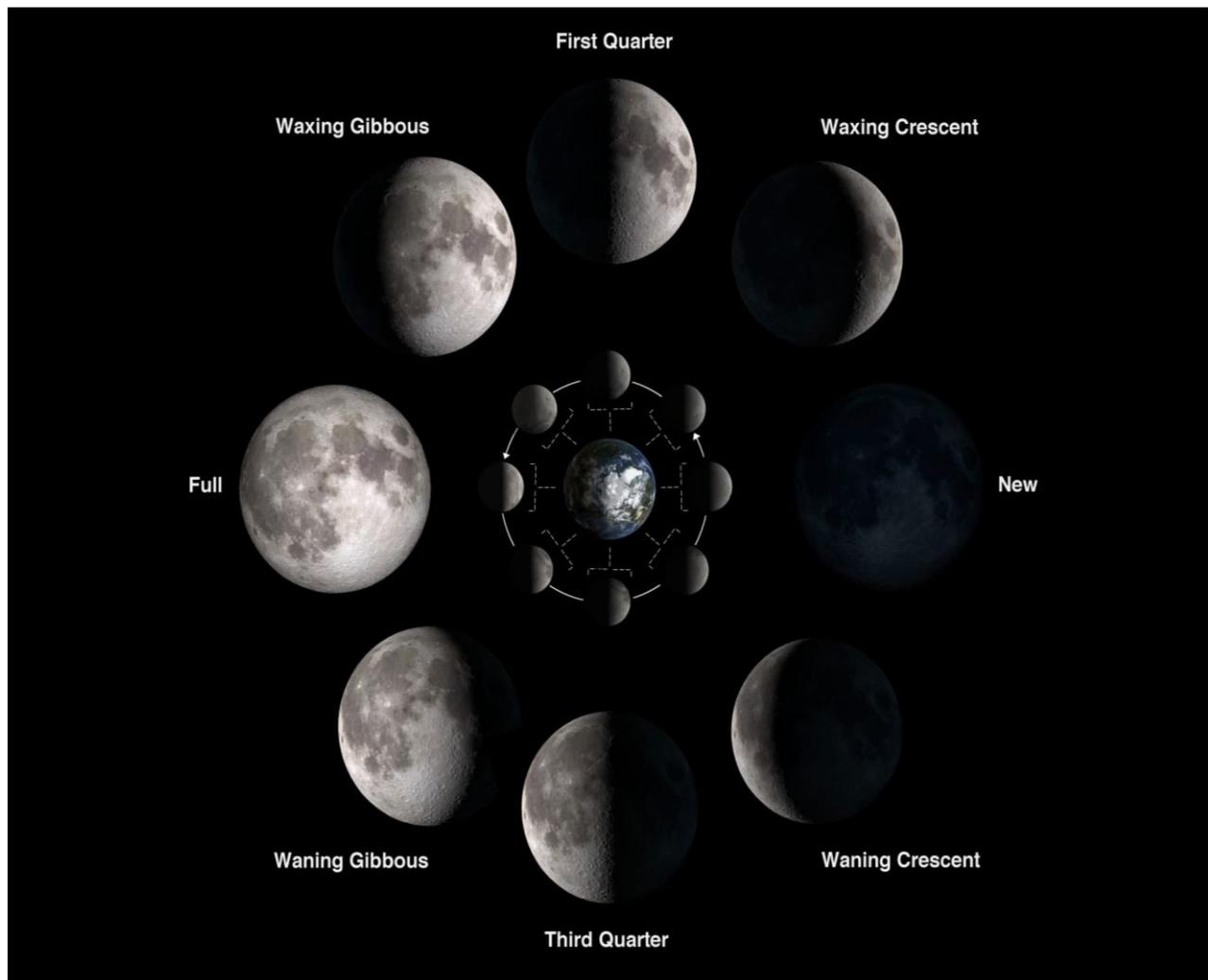
- **Mass:**  **$7.3477 \times 10^{22}$  kilograms**  
(73,477,000,000,000,000,000,000 kilograms)
- **Diameter:** **2,159** miles  
(**3,474** kilometers)
- **Surface Temperature:** Daytime: **100°C (212°F)**  
Nighttime: **-173° C (279.4°F)**
- **Distance from the Earth:** **238,900** miles  
(**384472.2** million kilometers)
- **Age:** **4.53 billion** years-old

# What's It Like on the Moon?

- The Moon **does not have an atmosphere**.
- **Meteors often crash** into the Moon because there is no atmosphere.
- The Moon's **craters** are the **result of the meteor crashes** and the **lack of atmosphere**.
- On the **surface** of the Moon, there is about **2 inches of dust**.
- The **dust** comes from **crashes**.
- **Temperature** on the Moon gets **very hot and very cold**, due to the lack of atmosphere.
- The Moon **orbits and spins** at the **same time**.
- The Moon's **orbit takes 29 days**, which results in the Moon phases.
- The Moon is responsible for **tides, weather**, and **seasons**.

# Phases of the Moon

- The Moon **does not emit light**. When we see the Moon, we are seeing the **reflection of sunlight off the Moon**.
- The **Moon phases** are the result of the **Moon's orbit around the Earth**.
- The **Moon we see** is the **result of the phase** it is in.
- The **Moon's orbit** is **29 days**.



[Image by NASA/JPL-Caltech/Bill Dunford on JPL](#)

<b>New Moon</b>	When the Earth and Sun are <b>aligned</b> .
<b>Waxing Crescent</b>	When the sunlight portion <b>increases</b> , but it <b>still less than half</b> .
<b>First Quarter</b>	Moon is at a <b>90° angle</b> to the Earth and Sun.
<b>Waxing Gibbous</b>	After the new moon, when the <b>sunlit portion is more than half</b> .
<b>Full Moon</b>	When the <b>Earth and Sun and aligned</b> , like the New Moon but it is on the opposite side.
<b>Waning Gibbous</b>	When the sunlit portion <b>begins to decrease</b> .
<b>Third Quarter</b>	Moon is at a <b>90° angle</b> to the Earth and Sun.
<b>Waning Crescent</b>	The Moon is <b>partially visible, but less than half</b> is illuminated.
<b>Dark Moon</b>	When the Moon is <b>invisible</b> .

# Moons in the Solar System

- Moons are also called **natural satellites**.
- There are a total of **181 moons** in the Solar System.
- **173** of those moons **orbit the “main” planets**.
- The other **8** moons **orbit the dwarf planets**.
- Each of the moons has a unique name.
- Most of the **names**, except for the moons of Uranus, come from **mythological creatures**. The **moons of Uranus** come from William Shakespeare's story, **A Midsummer Night's Dream**.
- The only two planets **without moons** are **Mercury** and **Venus**.

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If you discovered a moon, what would you name it and why?

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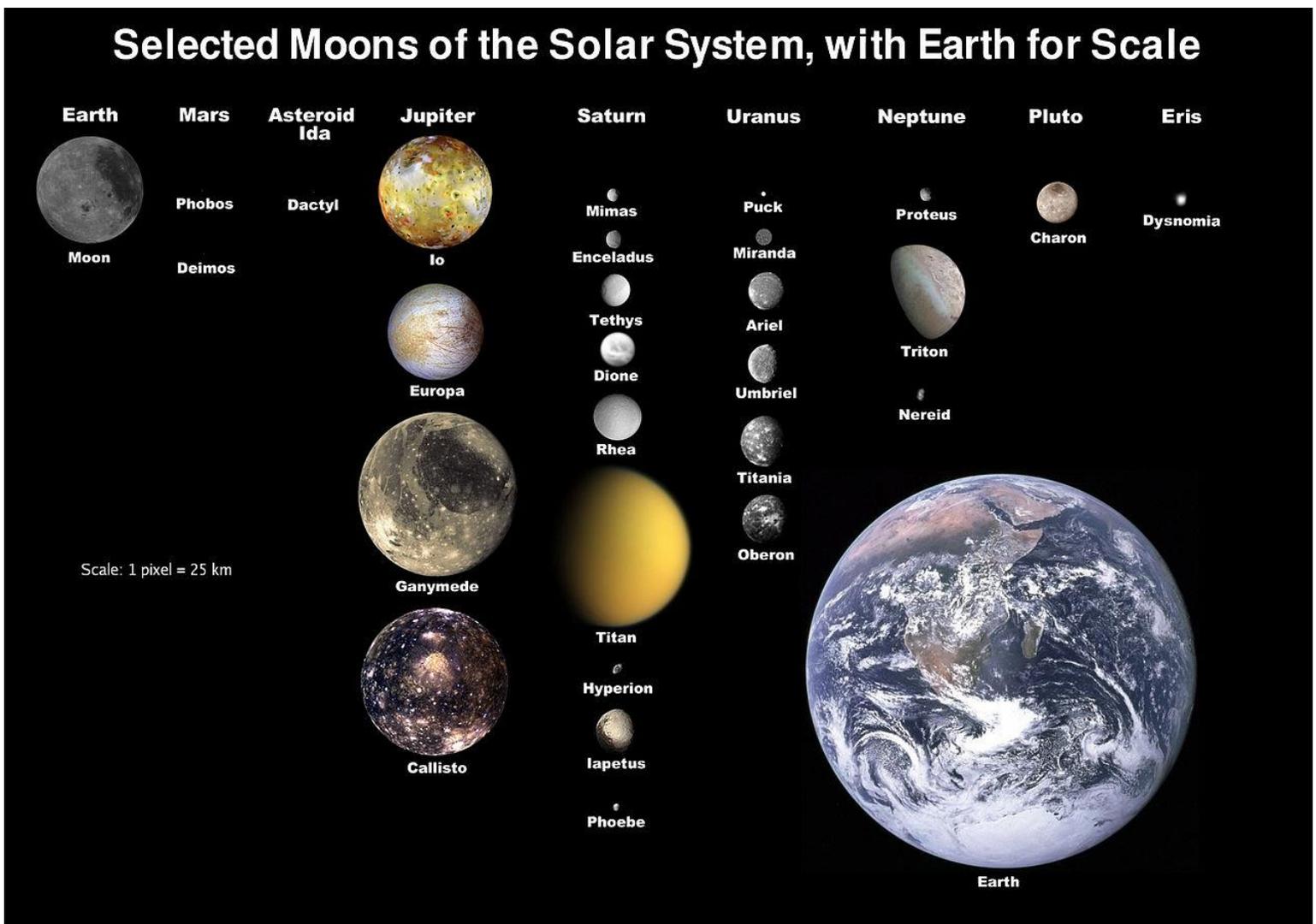
## Think About It!



[Image by PIX1861 on Pixabay](#)

Planet	Number of Moons
Mercury	0
Venus	0
Earth	1
Mars	2
Jupiter	67
Saturn	62
Uranus	27
Pluto	5

## Selected Moons of the Solar System, with Earth for Scale



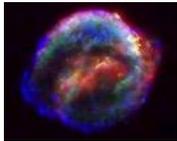
[Image by NASA on Wikimedia Commons](#)

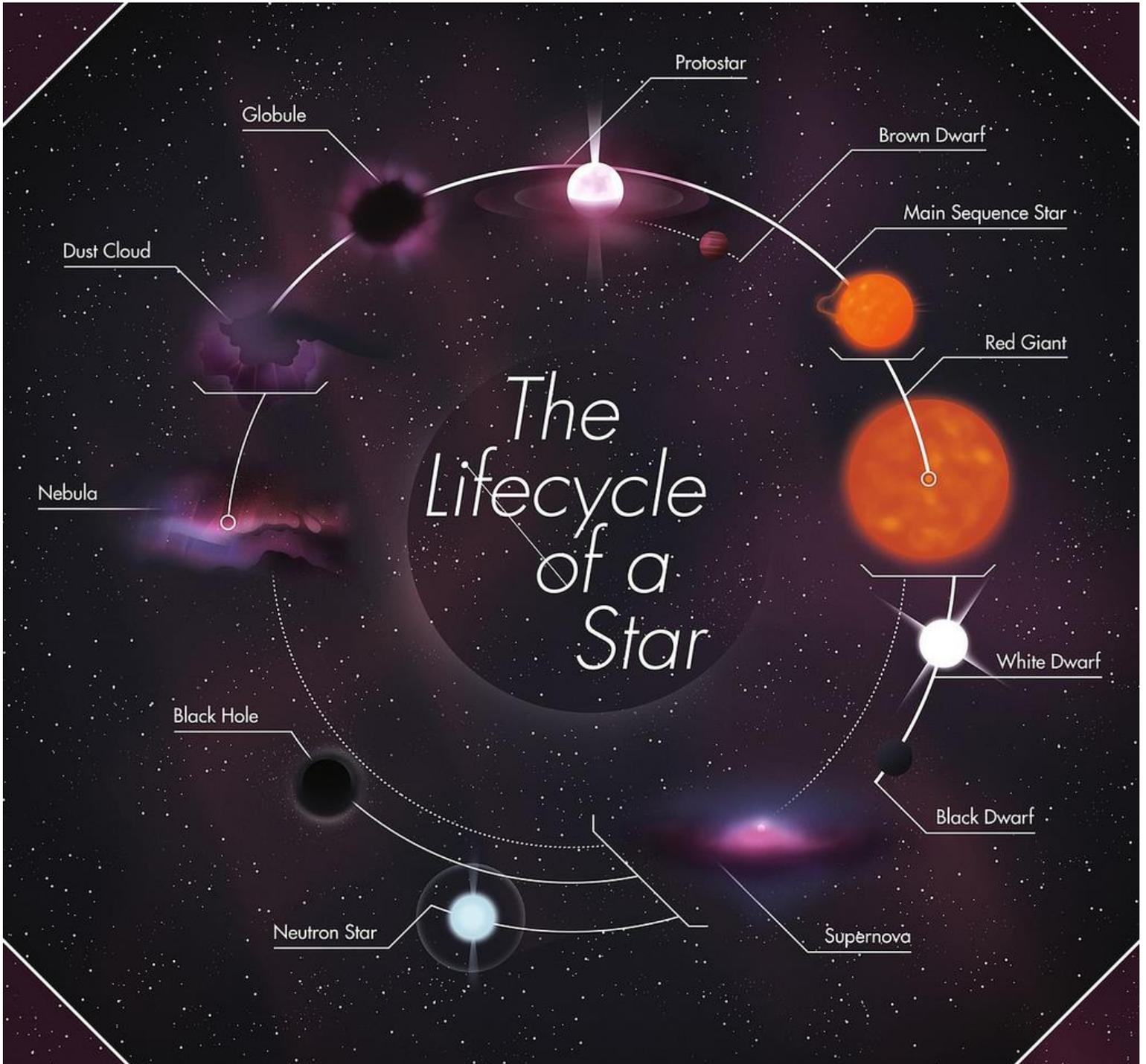
# Star Facts

- Stars are **spheres of hot gas** called **plasma**.
- Stars are **held together** by their **own gravity**.
- **Nuclear fusion** causes the star to **radiate energy**.
- Nuclear fusion occurs in the **core** of the star and is the **process of hydrogen fusing and making helium**.
- There are between **200 million and 400 million stars** in the Milky Way Galaxy.
- Stars range in age from **1 year-old to 10 billion years-old**.
- There is a lot of **turbulence in the atmosphere**, which is why **stars appear to twinkle**—they do not twinkle on their own.
- Stars can be a range of colors: **brown, red, orange, yellow, white, or blue**.
- **Brown** stars are the **hottest** while **blue** stars are the **coolest**.
- The **smaller** the star, the **longer lifespan** it has.
- It takes a **million years** for the light from a star to reach Earth.
- A **galaxy** is a **collection of stars**, while a **constellation** is a **group** of stars that **form a pattern**.
- A supernova is a star that suddenly **increases greatly in brightness** because of a **catastrophic explosion** that **ejects most of its mass**.
- Stars have **played an important role in history**—helping to guide early explorers and helping to create calendars.

# Life Cycle of a Star

- Like living beings, stars have a life cycle.

<p><b>Nebula</b></p>  <p><a href="#">Image by ESO on Wikimedia Commons</a></p>	<p><b>Cloud</b> of hydrogen and gas. Also known as the <b>"birthplace of stars."</b></p>
<p><b>Star</b></p>  <p><a href="#">Image by NASA, ESA, AURA/Caltech, Palomar Observatory on Wikimedia Commons</a></p>	<p>Sphere of <b>gas</b>. <b>Nuclear fusion</b> helps the star produce its own heat and light. Stars live for <b>less than a million years</b>. Stars emit light that is <b>equal to a million suns</b>.</p>
<p><b>Red Giant</b></p>  <p><a href="#">Image by ALMA (ESO/NAOJ/NRAO) on Wikimedia Commons</a></p>	<p><b>Large bright star</b> that has a <b>cool surface</b>. It is formed when the <b>hydrogen fuel begins to run out</b> in the center of the star.</p>
<p><b>Red Dwarf</b></p>  <p><a href="#">Image by NASA/Walt Feimer on Wikimedia Commons</a></p>	<p><b>Smaller</b> stars that are <b>cool and faint</b>. Live about <b>100 billion years</b>.</p>
<p><b>White Dwarf</b></p>  <p><a href="#">Image by Sephirohq on Wikimedia Commons</a></p>	<p><b>Last stage of a star's life</b>. At this point the star is <b>very small and hot</b>. White dwarfs are the result of the remains of <b>normal stars, just smaller</b>.</p>
<p><b>Supernova</b></p>  <p><a href="#">Image by NASA/ESA/JHU/R.Sankrit &amp; W.Blair on Wikimedia Commons</a></p>	<p><b>Death of a star</b>. Usually <b>explosive</b> and results in a star becoming as <b>bright as 100 million suns</b>. There are <b>two types of supernovas</b>: Type I and Type II.</p>
<p><b>Neutron Stars</b></p>  <p><a href="#">Image by Casey Reed - Penn State University on Wikimedia</a></p>	<p>Made up of <b>neutrons</b> and are the result of a <b>supernova that has exploded</b>.</p>
<p><b>Black Holes</b></p>  <p><a href="#">Image by Ute Kraus on Wikimedia Commons</a></p>	<p>Result of <b>massive stars</b> that are in the <b>last stage of their life</b>. Black holes have <b>a lot of gravity</b>. <b>Nothing can escape a black hole</b>. Black holes often take in the neighboring matter them.</p>



[Image by Oaswara.awad on Wikimedia Commons](#)

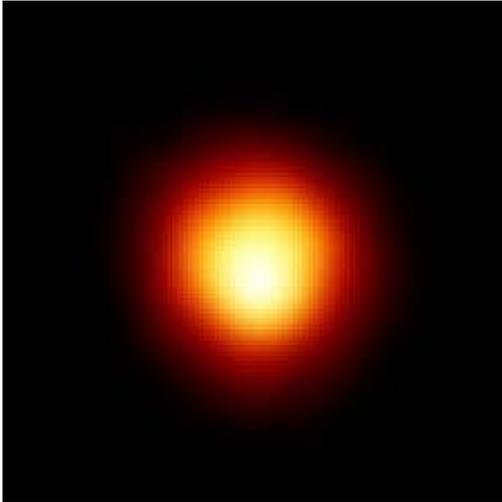
# Types of Stars

- There are **three** different types of stars:
  - Dwarfs
  - Giants
  - Neutrons
- **Normal stars** (stars in their main sequence) are **categorized by color**.
- **Small stars** are red and **do not emit much light**.
- **Medium** sized stars are **yellow**.
- **Large** stars are **blue** and very **bright**.

<b>Dwarf</b>	<p>Small</p> <p>Usually red or brown</p> <p>Brown stars do not undergo a nuclear fusion</p> <p>White dwarf is the result of collapsed red giant</p>
<b>Giant</b>	<p>Can be a main sequence (normal) stars or red giants that are expanding.</p>
<b>Neutron</b>	<p>Result of a giant star that has collapsed</p> <p>Very tiny</p>

# Guess the Star

Next to each picture, write either dwarf, giant, or neutron.



[Image by WikiImages on Pixabay](#)

**Giant**

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[Image by Kevin Gill on Flickr](#)

**Neutron**

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[Image by WikiImages on Pixabay](#)

**Dwarf**

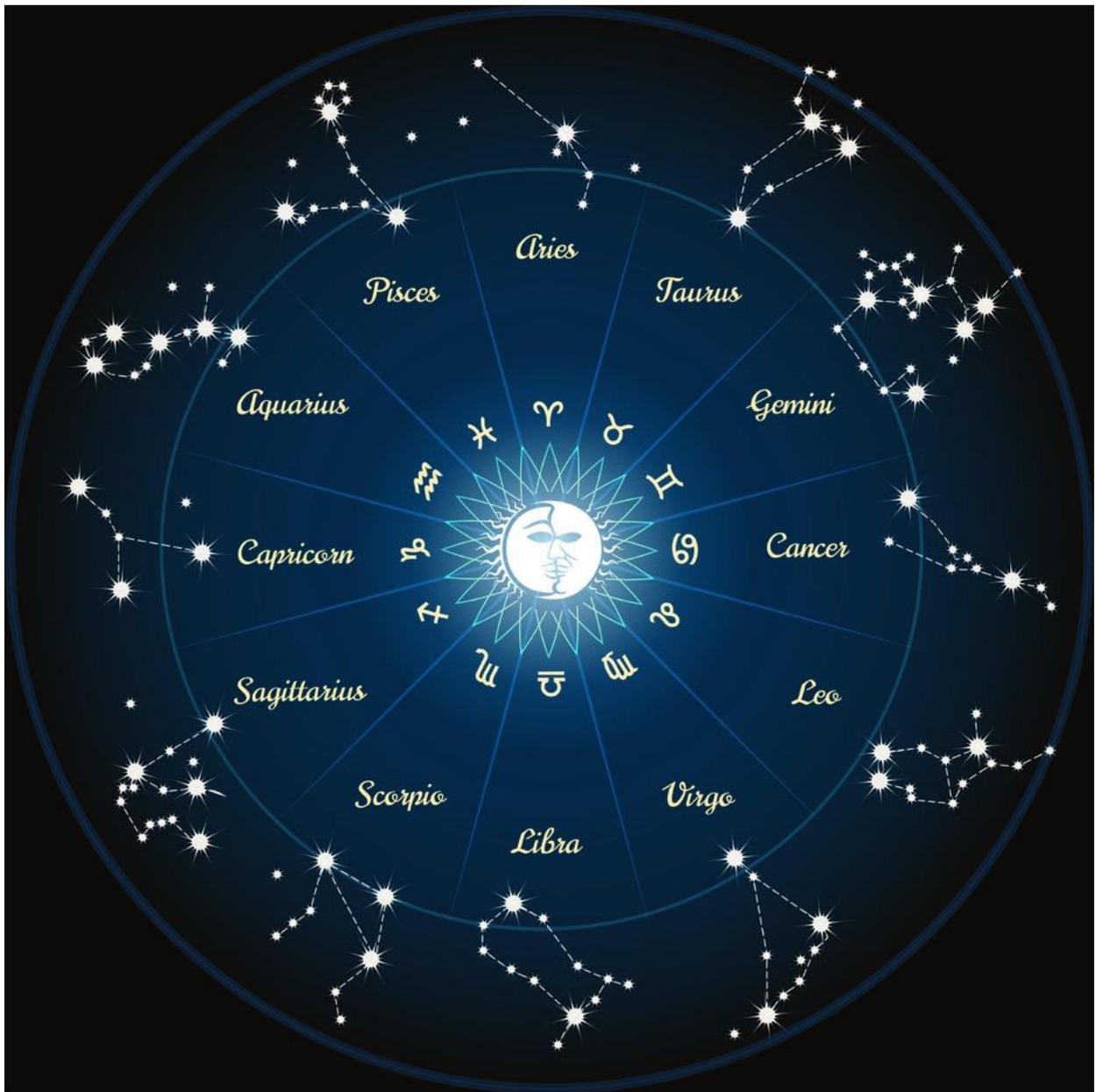
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# Constellations

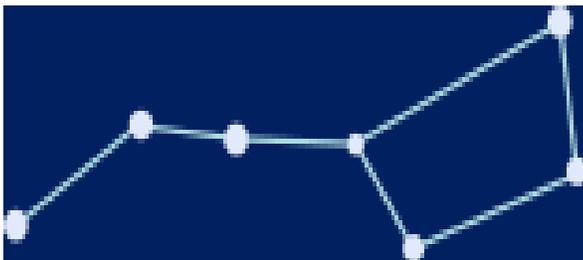
- Constellations are a **group of stars that form a pattern** when they are **viewed from Earth**.
- Constellations can look like:
  - Mythological creatures
  - People
  - Objects
- In **1922**, there were **88 known constellations**. **48** were the **ancient constellations** discovered by Ptolemy. **40** were **new constellations** that had just been discovered.
- Constellations **divide up the night sky**.
- **Star maps** help to guide you as to where in the sky you can see the constellations.
- The stars in the constellations **aren't always close together**.
- **Not all** the constellations are **visible** from **every location on Earth**.
- There are constellations for the **Northern Hemisphere** and **Southern Hemisphere**.
- Constellations also **vary by seasons**.
- Constellations can help you **identify the stars in the sky**.
- Constellations were very **helpful in the ancient times**. People relied on the constellations when it was **harvest time**. People also used the constellations to **keep track of months**.
- Constellations are also used for **navigation**. **Ursa Minor** helps you **find the North Pole**.

- Here are the names of the most famous constellations and where they can be seen.

Constellation	Description	Location
Orion	Named after a <b>hunter from Greek Mythology</b> .	Can be seen <b>all over the world</b> .
Ursa Major	Name comes from <b>Latin</b> and means <b>"Large Bear"</b> . Also known as the <b>"Big Dipper"</b> . Used to help find the North Pole.	Northern Hemisphere
Ursa Minor	Name comes from <b>Latin</b> and means <b>"Small Bear"</b> . Also known as the <b>"Little Dipper"</b> .	Northern Hemisphere
Draco	Comes from the <b>Latin</b> word for <b>"dragon"</b> . Draco is one of the <b>ancient constellations</b> .	Northern Hemisphere
Pegasus	Comes from the <b>Greek</b> word for <b>"flying horse"</b> .	Northern Sky
Zodiac	<b>13 constellations</b> that are named after the <b>Zodiac/Astrology signs</b>	<p>Northern Zodiac (found in the Eastern Celestial Hemisphere): Pisces, Aries, Taurus, Gemini, Cancer, Leo</p> <p>Southern Zodiac (found in the west): Virgo, Libra, Scorpius, Sagittarius, Capricornus, and Aquarius.</p>

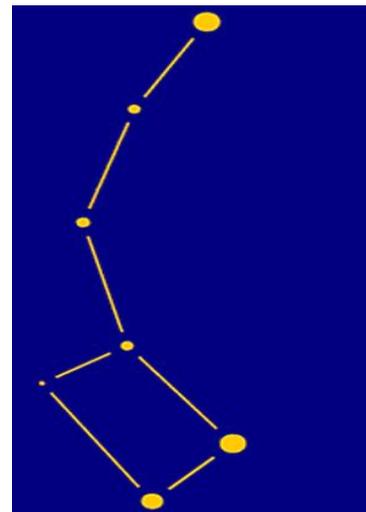


## Little Dipper



[Image by MatthiasBock on Wikimedia Commons](#)

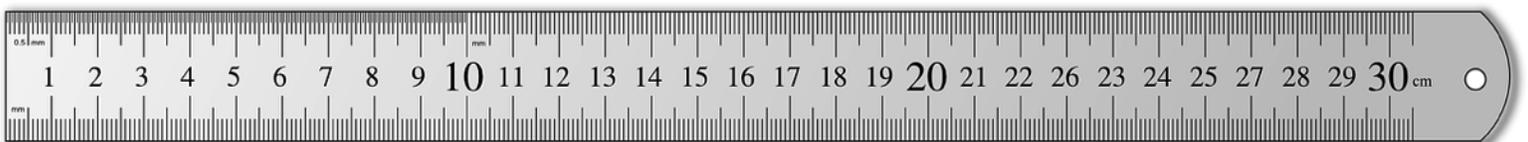
## Big Dipper



[Image by Torsten Bronger on Wikimedia Commons](#)

# How Big is Each Planet?

Planet	Actual Size (Diameter in Kilometers)	Scaled Size (Diameter in Centimeters)
Sun	<b>1,392,000</b> km	139.2 cm
Mercury	<b>4,800</b> km	0.5 cm
Venus	<b>12,100</b> km	1.2 cm
Earth	<b>12,800</b> km	1.3 cm
Mars	<b>6,800</b> km	0.7 cm
Jupiter	<b>142,000</b> km	14.2 cm
Saturn	<b>120,000</b> km	12.0 cm
Uranus	<b>51,200</b> km	5.1 cm
Neptune	<b>48,600</b> km	4.9 cm
Pluto	<b>2,200</b> km	0.2 cm



[Image by OpenClipart-Vectors on Pixabay](#)

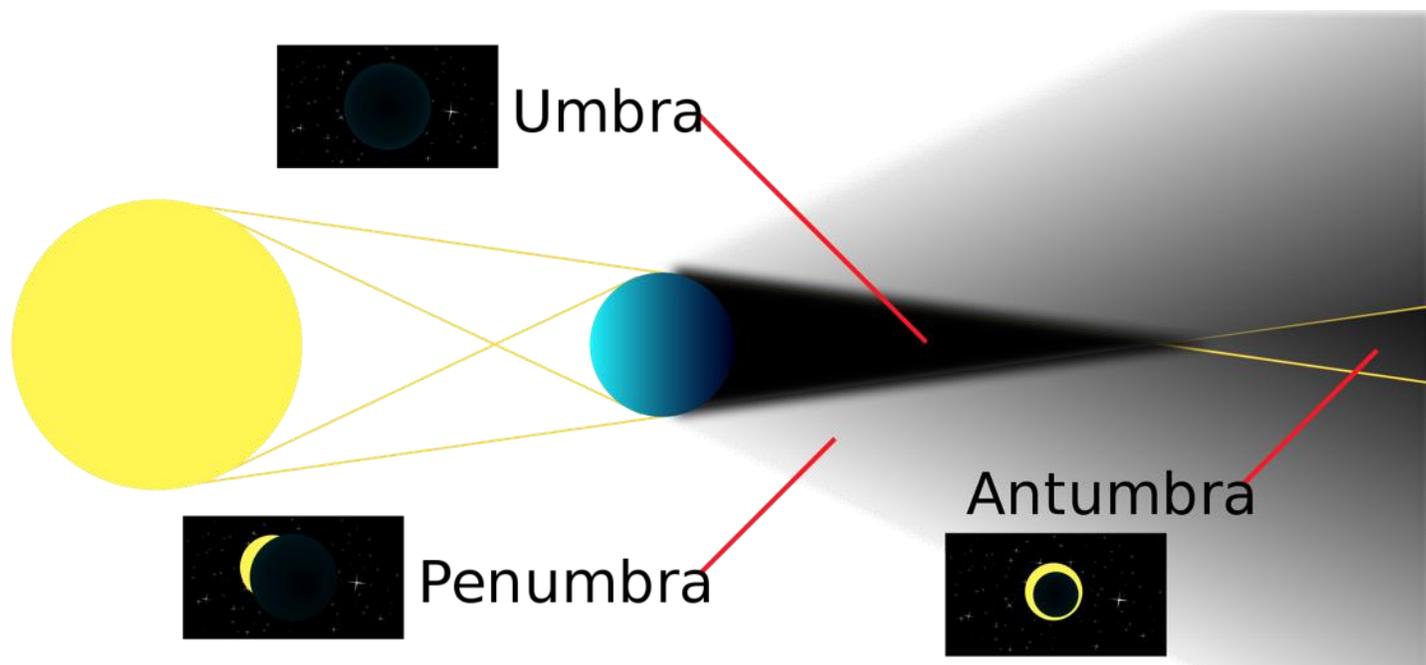
# Words to Describe Eclipses

- During an eclipse, the shadow of the Moon has three main parts:

<b>Umbra</b>	Moon is <b>completely covered</b> by the Sun
<b>Antumbra</b>	Moon is in front of the Sun, but <b>doesn't entirely cover it</b> . The Sun's outline can be seen.
<b>Penumbra</b>	A <b>portion</b> of the Moon is in front of the Sun.

- There are three types of eclipses which vary by which part of the shadow you are located:

<b>Total</b>	Sun is <b>completely covered</b> by the Moon.
<b>Annular</b>	The Sun is covered by the Moon, but <b>can still be seen</b> (edges).
<b>Partial</b>	A portion of the Sun is blocked by the Moon.



# What is a Solar Eclipse?

- When the **Moon passes in front of the Sun**, a solar eclipse occurs. The **Moon** is **between the Earth and the Sun**.
- A **shadow falls** on certain parts of the Earth.
- Only **certain locations** see the solar eclipse.
- When a solar eclipse occurs, the **Sun looks dark**.
- Even though the Sun is dark, **you should never look at a solar eclipse**. The Sun's rays can damage your eyes.
- **Syzygy** is a word used by astronomers to describe the **alignment of the Sun, Moon, and Earth during an eclipse**. This happens **only during the New Moon**.
- In **one century** (100 years), there are about **240 solar eclipses**.

**The next solar eclipse will occur on:  
August 21, 2017**



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# What is a Lunar Eclipse?

- When the **Moon passes through the shadow of the Earth**, a lunar eclipse occurs. The **Earth is between the Sun and Moon**.
- During a lunar eclipse, the **Moon will see Earth's shadow**.
- Lunar eclipses and solar eclipses have the **same three phases**.
- Lunar eclipses are **seen by a much larger area**.
- You can view a lunar eclipse **without wearing special eye protectors/ equipment**.
- During a lunar eclipse, with help from the Earth's atmosphere, **some sunlight is refracted**. The refraction causes the Moon to look **dark brown/red**.
- In terms of length, **lunar eclipses last longer**.

**The next solar eclipse will occur on:  
February 11, 2017**



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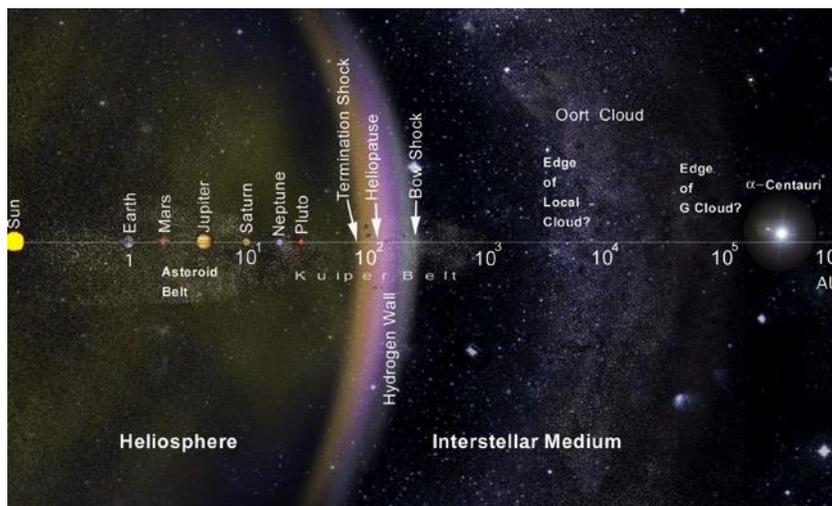
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# How Big is the Solar System?

- If you drove from the **Sun to Pluto**, the distance would be **7,440,000,000 miles**, which is equivalent to **roughly 6,000 years**.
- If you drove from the **Sun to the comets and clouds that surround the Solar System**, then the distance would be **5,580,000,000,00 miles**.
- In August 1977, the spaceship **Voyager 2** was launched. Two-years later, in July 1979, it reached Jupiter. In August 1981, it passed Saturn. By January 1986, it reached Uranus and by August 1989, it reached Neptune. This spaceship took **12 years to complete its journey**.
- The Solar System doesn't end at the last planet. The **Solar System ends where gravity does**—where objects can **no longer orbit the Sun**.
- Scientists have predicted that it would take **19 million years** to **travel from the Sun to the end of gravity in the Solar System**.
- NASA has been working on a spaceship called, **New Horizons**. This spaceship will be the **fastest that has ever been launched from Earth**. This spaceship, however, would need **37,000 years** to **travel from the Sun to the end of the Solar System**.



# Galaxies in the Universe

- Scientists have estimated that there are **100 billion galaxies** in the Universe.
- Scientists have also estimated that there are about **300 million stars** in the Milky Way Galaxy.
- The **Andromeda Galaxy** is the **closest galaxy to the Milky Way** and is about 6 trillion miles away.
- Galaxies come in **four different types**:
  - Spiral
  - Barred Spiral
  - Elliptical
  - Irregular

<p><b>Spiral</b></p>	<p>Has long arms that spiral around the center. <b>Older stars</b> make up the <b>center</b>; <b>newer stars</b> make up the <b>arms</b>.</p>	 <p><a href="#">Image by European Space Agency &amp; NASA on Wikimedia Commons</a></p>
<p><b>Barred Spiral</b></p>	<p>Has a <b>long bar in the center</b> and arms that spiral.</p>	 <p><a href="#">Image by NASA, ESA, and The Hubble Heritage Team STScI/AURA on Wikimedia Commons</a></p>
<p><b>Elliptical</b></p>	<p><b>Stars</b> are <b>clumped together</b> and look like an <b>elliptical disc</b>.</p>	 <p><a href="#">Image by ESA/Hubble &amp; NASA on Wikimedia Commons</a></p>
<p><b>Irregular</b></p>	<p>Any other galaxy that is <b>shaped other than</b> spiral, barred spiral, or elliptical.</p>	 <p><a href="#">Image by NASA, ESA, and The Hubble Heritage Team (STScI/AURA) on Wikimedia Commons</a></p>

# Our Galaxy: The Milky Way

- We live in the Milky Way Galaxy, in one of the **spiral arms**.
- The Milky Way is about **14 billion years old**.
- The Milky Way **rotates every 200 million years**.
- The Milky Way Galaxy contains **100 billion stars**, **dust**, and **gas**.
- It takes **100,00 years** for **light to get from one side of the galaxy to the other**.
- Scientists have predicted that in the **center of the Milky Way Galaxy** there is a **giant black hole**.
- The Milky Way Galaxy belongs to a group of **40 galaxies**.
- The Local Group contains **two large spiral galaxies**: the **Milky Way** and the **Andromeda**.
- When looking at the Milky Way in the night sky, it has a **milky appearance**—which is how it got its name.
- The **Sun's orbit around the Milky Way** takes **225 million to 250 million years**.
- **Edwin Hubble** discovered the shape of the Milky Way.



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# What is the Hubble Telescope?

- The Hubble Telescope is one of the **most famous telescopes in history**.
- The Hubble Telescope was put into orbit on **April 24, 1990** by **Space Shuttle**.
- The Hubble Telescope is situated **outside of the Earth's atmosphere**.
- Pictures from the Hubble Telescope **do not have a background light**, so galaxies and stars are clearer.
- Technology in the Hubble Telescope allows it to **lock in on the object** it is photographing and **take the perfect picture**.
- The Hubble Telescope is expected to **stay in orbit for 20 years**.
- The Hubble Telescope is named **after Dr. Edwin Hubble**, a famous astronomer who **believed there were other galaxies in outer space** and they were **moving away from the Milky Way**.
- The Hubble Telescope is very big and very wide! It weighs **24,500 pounds** and is **43.5 feet long and 14 feet wide**.
- The Hubble Telescope is located **353 miles above Earth**.
- Many of the beautiful pictures of outer space have been taken by the Hubble Telescope.
- In **2018**, **James Webb Space Telescope**, will be launched. This is the Hubble Telescope's **successor**.



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