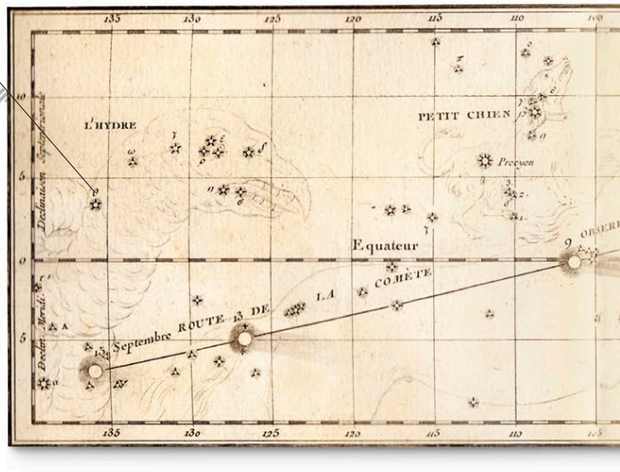
The Cosmos

Looking into space

For thousands of years, humans have told stories to explain the lights in the night sky. Even the earliest stargazers recognized that many of the objects that they could see behaved differently from each other, but it was in ancient Greece – from around the 6th century BCE – that astronomy began to be systematized. Greek astronomers drew up formal lists of constellations, developed a scale of magnitude to describe the brightness of stars, and made attempts to model the paths of the planets. Following the invention of the telescope in 1608, physical differences between the various objects began to become more apparent, leading to an explosion in scientific knowledge.

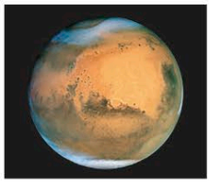
Greek letters indicate a star's rank of brightness within its constellation



Mapping the sky
This star chart was created by astronomer Charles Messier to track the path of the Great Comet of 1769. At the time, constellations were just patterns linking the brighest stars; they were subsequently defined as 88 specific areas of sky surrounding a figure on the celestial sphere.

Celestial objects

The Universe is full of objects, large and small. Many of the closest bodies in our Solar System – asteroids, planets, and moons – are made visible by reflected sunlight. They move against a seemingly fixed background of more distant objects: luminous stars, glowing nebulae, and remote galaxies.



Planets
Planets are spherical bodies that orbit a star on a path mostly clear of other objects.

Dwarf planets
These smaller worlds also circle a star, but may share their orbits with other objects.

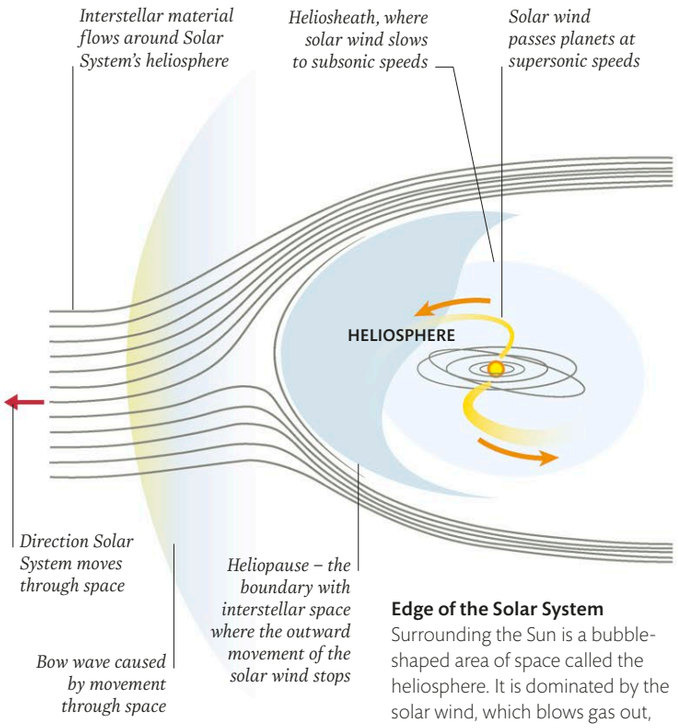
Moons
These objects orbit planets. They range from small rocks to complex worlds.

Asteroids
Usually made of rock or metal, asteroids are planetary debris that orbit stars like the Sun.

Comets
These icy objects form tails of gas and dust when their orbit brings them close to the Sun.

Our Solar System

The region of space governed by the Sun – and everything contained within it – is known as the Solar System. It encompasses eight major planets, at least five dwarf planets, and a wealth of smaller bodies.

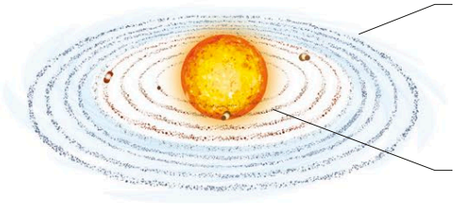


Edge of the Solar System
Surrounding the Sun is a bubble-shaped area of space called the heliosphere. It is dominated by the solar wind, which blows gas out, past the planets, and into space.

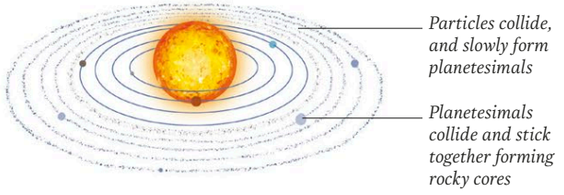
How the Solar System formed

Our Solar System emerged from a collapsing disc of material that was in orbit around the newborn Sun some 4.6 billion years ago. Mid-sized bodies called planetesimals gradually formed, and eventually developed into today's planets.

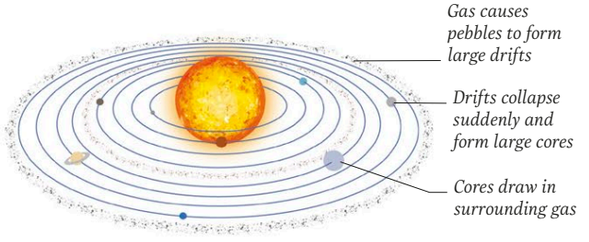
1 Rings formed around the Sun
Heat and wind from the Sun drove ice and gas away from the inner region, leaving particles of rock and metal.



2 Rocky cores developed
Pebble-sized grains accumulated into planetesimals. Their substantial gravity allowed them to pull in more material.



3 Giant planets emerged
Away from the Sun, rapidly-formed cores of rock and ice accumulated gas before it escaped the Solar System.



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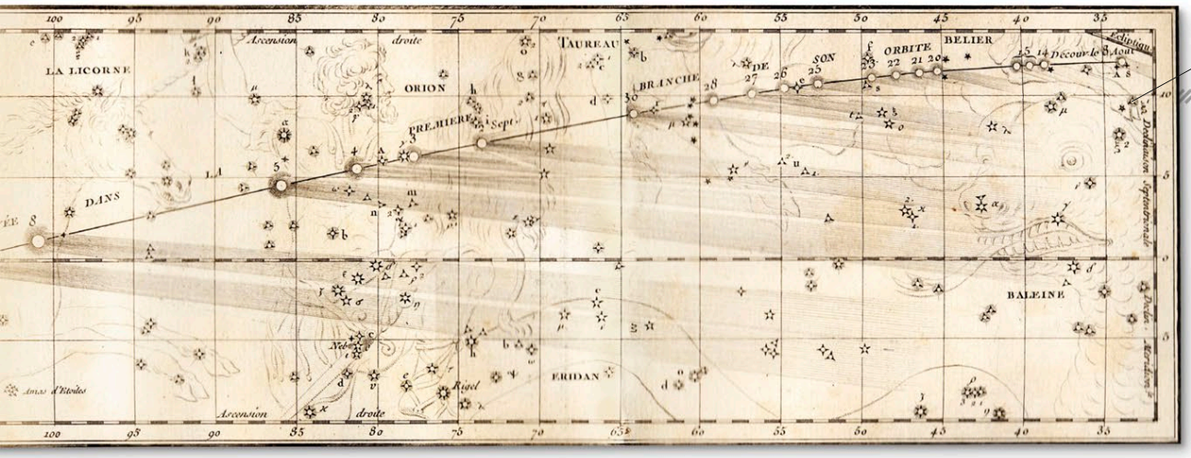


Stars of different magnitudes are depicted at different sizes on a scale of 1–9, in decreasing order of brightness

In perfect conditions, **around 4,000 stars** may be **visible** to the **naked eye** in one moment

Stars
A star is a vast, glowing ball of hot gas that shines due to nuclear reactions in its core.

Asterisms
Asterisms like the sickle are patterns formed in the sky by stars, and the basis of constellations.

Star clusters
Groups of stars that orbit each other may be loose or "open" in structure, or dense, "globular" groups.

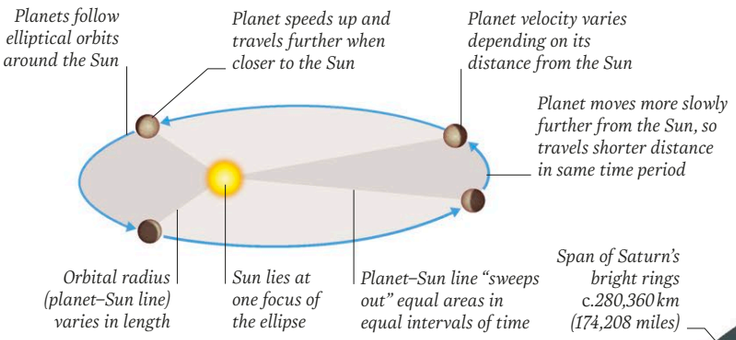
Nebulae (sing. nebula)
Nebulae are interstellar clouds of material that shimmer and glow in the light of nearby stars.

Black holes
These superdense objects are formed by dying stars and in the hearts of galaxies.

Galaxies
A galaxy is an aggregation of millions of stars with clouds of gas and dust held together by gravity.

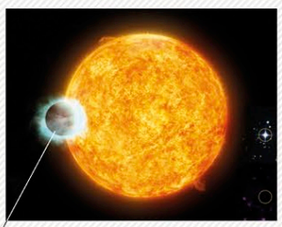
Kepler's laws of planetary motion

Three laws, discovered by Johannes Kepler between 1609 and 1619, govern the behaviour of planets orbiting the Sun, or any object in an elliptical orbit around another. They reflect the changing influence of gravity with distance.



EXOPLANETS

Since the 1990s, astronomers have discovered thousands of "exoplanets" – planets around stars outside our Solar System. Hot Jupiters are a class of giant exoplanets that orbit close to their stars; others have highly elongated or tilted orbits. Some exoplanets even orbit one or both stars in a binary (double) star system.



Wasp 18b orbits its star Wasp 18 in less than 23 hours

"HOT JUPITER"

Solar System planets size and scale

Earth is the largest of the rocky planets in the inner part of the Solar System, but it is dwarfed in size by the gas giants found in the outer region. These, in turn, are relatively tiny when compared with the vast size of our Sun.