## THE SOLAR SYSTEM

## The solar system consists of the Sun at its centre and all the objects which are bound by gravity to the Sun and which directly or indirectly orbit it.

The solar system formed about 4.6 billion years ago when a giant molecular cloud began to collapse due to the gravitational forces acting on it. Most of the cloud collected in the centre and formed the Sun, with the remainder of the mass forming a giant flat spinning disk, known as a 'protoplanetary disk'.


Inside the protoplanetary disk planets formed as the dust coalesced by gradual accumulation as a result of gravitational forces.

## Shape of the solar system

The solar system has a disk-like shape with the Sun in the centre and the remainder spread around it. At its very outer edge a hypothetical spherical cloud is said to exist. This cloud is known as the 'Oort Cloud' and consists mainly of cometary bits.

## Dimensions of the solar system

Inside the solar system distances are measured in Astronomical Units (AU), where 1 AU = about the distance from the sun to the Earth. For the sake of convenience, this distance is rounded off to 150 million km. The furthest planet from the Sun is Neptune at $30.10 \mathrm{AU}(4503$ billion km$)$. In the region beyond Neptune a belt of comets exists known as the 'Kuiper Belt', the outer edge of which is 50 AU from the Sun.

## Mass of the solar system

The total mass of the solar system is estimated to be 1.0014 times the mass of the Sun. This implies that the Sun's mass is $99.86 \%$ of that of the entire solar system. Jupiter is the largest planet with a mass that is 2.5 times greater than that of all the other planets and small solar system bodies combined.

## Population of the solar system

Stars: 1 (the Sun).
Planets: 8 (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune)
Dwarf planets: 5 (Ceres, Pluto, Eris, Haumea, Makemake)
Natural satellites: (moons): 545

## The Sun

The Sun has a diameter of 1.39 million km and consists mainly of Hydrogen ( $71 \%$ by mass), Helium (about $27 \%$ ) and smaller quantities of heavier elements like Iron, Oxygen, Carbon and Neon. The Sun obtains its energy from the fusion of Hydrogen into Helium in its core. About 600 million metric tonnes of Hydrogen is fused into Helium every second.


## The planets

The inner four planets and other small objects in that region are composed mostly called of rock (silicates, iron and/or nickel). They are called the 'Rocky planets' and include the Earth. The outer four giant planets starting at Jupiter are mainly 'Gas giants' (in the case of Jupiter and Saturn) and 'Ice giants' (Uranus and Neptune).

The gas giants are mainly composed of Hydrogen and Helium (as in the case of the Sun), whereas the ice giants comprise substances with high melting points as compared to Hydrogen and Helium. These substances are called 'volatiles' and include water, ammonia and methane.

## Planetary orbits

The orbits of the eight planets of the Sun are all in about the same plane. Although they are elliptical, most, with the exception of Mercury, have very nearly circular orbits.

## Moons

Six of the planets (Earth, Mars, Jupiter, Saturn, Uranus and Neptune) and four of the dwarf planets (Pluto, Haumea, Makemake and Eris) have natural satellites or moons. The largest five of these moons are Ganymede, Callisto, lo (Jupiter), Titan (Saturn) and the Earth's moon. Ganymede and Callisto are both larger than the planet Mercury. It is currently accepted that there may be as many as 545 known natural satellites in the solar system but some of them may be quite small.

## Planetary ring systems

Saturn's system of rings is visible as a flat disk surrounding the planet. These rings consist of dust and ice particles and also include small moonlets. The faint ring systems that exist around the other three giant planets were discovered when the Voyager 1 and Voyager 2 spacecraft flew past these planets.

## Asteroids

Asteroids are minor planets and are also known as 'small solar system bodies'. It is estimated that there may be millions of asteroids, small bodies that never became large enough to be planets, perhaps because they were disrupted by the gravitational attraction of a large planet like Jupiter.

The main asteroid belt is situated between the orbits of Mars and Jupiter. There are also a large number of asteroids in Jupiter's orbit in what is known as the L4 and L5 Lagrange Points. These asteroids are called 'Jupiter's Trojans'. Asteroids are classed as being 'carbon rich', 'metallic' or 'silicate' (stony).


There are also 'Near-Earth Asteroids' (NEAs) that orbit the Sun in the vicinity of the Earth's orbit. They are classed into four types, two of which (known as Atens and Apollos) cross the Earth's orbit from time to time.

## Comets

A comet is an icy small solar system body that, when it passes close to the Sun, warms up and begins to release gases (called 'out-gassing'). This out-gassing creates an atmosphere or 'coma' around the comet as well as a tail that is caused by the solar wind. Comets have highlyeccentricorbitsaround the Sun and are divided into two classes, 'short period comets' and 'long comets'. Short period comets normally originate from the Kuiper Belt while long period comets may originate from the Oort Cloud. Comet McNaught, also known as the 'Great Comet of 2007', was photographed from Hermanus.


Comet McNaught


Photo taken in Hermanus

