

Study of asteroids

-also a part of the mission



Rosetta fly-by an asteroide.
Illustration: ESA

On the way to the comet, Rosetta will pass two asteroids that can be observed in detail. Asteroids are like comets very interesting bodies for the scientists. But in contrast, while comets can be seen by the naked eye and have always been spectacular objects in the sky, asteroids are unknown to the public, and the detection and most of the knowledge about these objects are closely connected to use of satellites and large telescopes.

What then are the Asteroids?

Asteroids are often known as ‘minor planets’, since they are too irregular in size, too numerous and too small to be considered as proper planets. There are thought to be billions of these rocky objects orbiting the Sun.

Since they can only be seen as points of light in telescopes, British astronomer William Herschel coined the term ‘asteroid’ - from a Greek word meaning ‘star like’ - to describe this new class of celestial objects. Previously, astronomers coined a less poetic term for them – ‘vermin of the skies’ – as they regularly appeared in photographs of distant galaxies and nebulae, spoiling the sensitive observations.

The largest of the asteroids, *Ceres*, was the first to be discovered. It was found by Giuseppe Piazzi from Palermo, Sicily on 1 January 1801. Wilhelm Olbers found a second minor planet, Pallas, in 1802, followed by *Juno* (1804) and *Vesta* (1807). Nearly four decades passed without any further discoveries, but this changed with the introduction of improved star maps and better telescopes. From 1847 onwards, not a year has passed without the discovery of at least one asteroid.

Ceres is now known to have a diameter of about 940 km, only about one quarter the diameter of the Earth’s Moon. However, it contains more than one quarter of the total mass of all the asteroids. Another sixteen have diameters greater than 240 km. The smallest are like fragments of rock and boulders a few metres across. If all the asteroids were squashed into one object, they would still be smaller than the Moon.

About 70,000 asteroids have so far been discovered and given permanent numbers, but there are thought to be billions more waiting to be found. Nearly all of these are contained within a doughnut-shaped region between the orbits of Mars and

Jupiter. On the inner edge of this main belt, asteroids take about three years to orbit the Sun, while those near the outer limit of the main belt take twice as long.

The main belt is thought to exist because of the strong gravitational influence of the giant planet, Jupiter. At a time when ‘protoplanets’ were colliding and growing, Jupiter prevented the formation of a planet.

Families and Gaps

Asteroids in the main belt are not evenly distributed. The gravitational influence of the planets, particularly the giant Jupiter, causes them to gather in groups or ‘families’.

Other parts of the main belt, known as Kirkwood gaps after their discoverer, are almost empty, due to so-called gravitational resonances. This means that regular gravitational interactions with Jupiter enable the planet to sweep the region clear of asteroids.

Substantial numbers of asteroids also exist outside the main belt. Some of them are thought to be burnt-out comets that have lost much of their water ice after numerous close flybys of the Sun.

Others have been trapped by the gravity of the planets so that they follow unusual orbits. For example, over 200 asteroids share the orbit of Jupiter. These Trojan asteroids are trapped in two groups, one that follows 60 degrees behind the planet and another, which is 60 degrees in front. Many thousands of asteroids also inhabit the inner Solar System.

Rosetta will observe the selected asteroids from a distance of a few thousand kilometres. Science data recorded on board are transmitted to Earth after the fly-by.