

Other tenants

Asteroids

We have already mentioned that the planets with their satellites and rings are not the only bodies that occupy the Solar System. To start with, between the orbits of Mars and Jupiter, there is the Main Asteroid Belt that is not just a flat disc with rocks of different sizes and shapes as we usually imagine it. Scientists have known for some years that it is actually a three-dimensional doughnut-shaped ring curved around our star. The vertical size of this tube is equal to the distance between the Earth and the Sun, about the length of the penalty area of a football pitch (according to the scale mentioned in the preceding paragraph). Within the belt, the asteroids are not distributed uniformly, but form ringed structures interrupted by some gaps, empty zones that Jupiter has “cleaned out” expelling the bodies that were present. The orbit of the Trojans, two groups of asteroids coming from the Main Belt, is influenced by Jupiter; in fact, they revolve around the Sun, one preceding and one following the giant planet.

Far from the heat of our star, at the border of the Solar System, the Kuiper Belt and the Oort Cloud can be found, real reservoirs of asteroids and comets. The former, older but less famous than the Main Belt, begins right after Neptune’s orbit and extends up to 100 times the distance between the Earth and the Sun, i.e. the length of 20 football pitches. Today we are aware of about 40 bodies belonging to this belt with sizes greater than 100 km, but scientists estimate many more, about 50,000, not counting those with smaller sizes. Since August 2006, to classify the new bodies discovered beyond Pluto’s orbit, scientists have created a new category: the dwarf planets. Currently, there are three: Pluto, the progenitor, Xena or Eris, bigger and further than Pluto itself, and Ceres, the biggest asteroid of the Main Belt. Some comets too can originate in the Kuiper Belt. These bodies are subject to the gravitational pull of the giant planets and their trajectories can undergo modifications; this is the case of the family of Centaurs, bodies of different sizes that orbit between Jupiter and Neptune.

The Oort Cloud lies even further from the Sun, a vast reservoir of comet nuclei that envelops us completely; it is an enormous shell with a diameter 1,500 times that of the Solar System it contains. The comet nuclei are smaller respect to the bodies of the Kuiper Belt and are made up of blocks of ice mixed with rock, with diameters ranging from 1 to 10 km. If they are subjected to the gravitational attraction of the giant planets for having passed close to them, these solid, opaque objects are removed from their secluded orbits in the dark recesses of the Solar System and become one of the most luminous and fascinating objects of the sky: comets. They plunge into the Solar System like bullets and as they approach the Sun, the water their nuclei are composed of starts to sublime (i.e. it passes from the solid to the gaseous state) and creates the characteristic tail. Comets get more and more consumed with each successive passage near to our star, until they totally disintegrate, leaving a trail of rocky debris. This phenomenon is at the basis of shooting stars: when the Earth, as it revolves around the Sun, passes through the orbit of a comet, its debris comes into contact with the Earth’s atmosphere and air friction causes it to burn forming the trail of light we all know.

To deviate an asteroid you need...

In the Solar System, collisions between minor bodies occur frequently; in fact, hundreds of thousands of tonnes of dust and small-sized stones rain down on Earth, wandering residues of these vigorous interplanetary collisions. Due to the influence of the bigger planets, some minor bodies can, in fact, deviate from their original orbit and undergo changes that cause them to come into collision with other objects. In particular, asteroids are continuously subjected to the gravitational pull of Jupiter which, in the majority of cases, provokes their ejection from the Solar System or, worse still, their destruction on the Sun’s surface. A part of these asteroids however may become a NEA (Near-Earth Asteroid), i.e. asteroids that orbit close to the Earth. Asteroids that might have catastrophic consequences on our planet are those with a diameter greater than 1 km; despite the low probability that they might collide with the Earth (from 0.75 to 6 impacts every million years) it has been proven that in past eras asteroid impacts have caused mass extinctions on Earth (see the section Earth – Mass extinctions).

How can we avoid collisions with a dangerous asteroid? One of the traditional, more popular methods is the bombardment at a safe distance. Its aim is to reduce the dangerous object into fragments and to change its course.

However, there are less violent means of deflecting an asteroid: covering it with sugar, for example! This solution is based on the physical phenomenon known as Yarkovski effect: during its period of rotation, the surface of an asteroid does not absorb the light coming from the Sun uniformly; subsequently it re-emits it in the form of thermal radiation. The variations in the emission create a thrust in the opposite direction as a result of the action-reaction principle. Despite its modest entity, the thrust is applied continuously for a long time and it produces significant effects. From this we can infer that it would be possible to deflect an asteroid's path by modifying its capacity to absorb light: it would be sufficient to cover a thousandth of its surface with white dust. This demonstrates that with politeness you can get whatever you want.