

# NEO ROCKS

Near Earth Object Rapid Observation, Characterization and Key Simulations

## WELCOME TO THE NEOROCKS PROJECT!

MINI-NEWSLETTER

IN THIS ISSUE....NEOROCKS4KIDS!

**ASK THE NEOROCKERS**



PROJECT FUNDED BY EU H2020

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# ASK THE NEOROCKERS!

We asked our favourite mini-neorockers from class 3A at the Torrigiani Primary School in Florence to think of everything they wanted to know about asteroids. Our Neorockers then got busy answering them and this mini-newsletter is the result.

Here are the NEOROCKERS that answered the questions:

- **Agata** Rožek works at the University of Edinburgh, investigating asteroids and comets with visible light, but also with radio telescopes, using radar.
- **Benoit** Carry works for the Observatoire de la Côte d'Azur in Nice, France.
- **Elisabetta** Dotto, as well as managing our NEOROCKS project, is Senior Researcher at INAF – Observatory of Rome.
- **Ettore** Perozzi works for the Italian Space Agency, heading up the Space Situational Awareness Office.
- **Jessica** Huntingford works for Resolvo Srl, based in Florence and in charge of outreach for NEOROCKS.
- **Julia** de León is a researcher at the Instituto de Astrofísica de Canarias – IAC (Spain), where she leads the Solar System Group.
- **Monica Lazzarin** is Associate Professor at the University of Padova, heading the Solar System group at the Department of Physics and Astronomy.

Take a look and if there is anything else that you want to know, just drop us an email at [neorocks@resolvo.eu](mailto:neorocks@resolvo.eu).

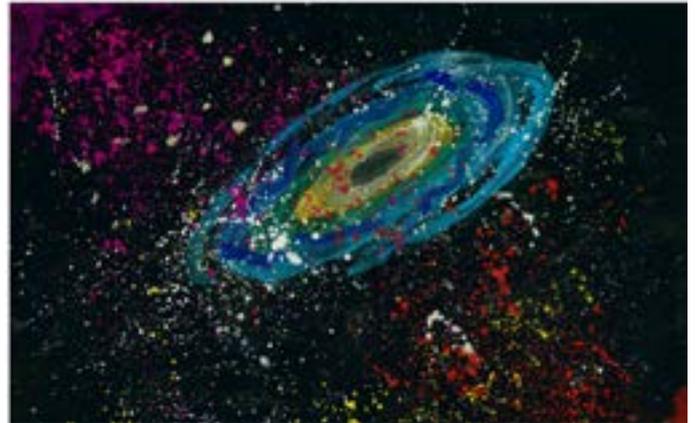


# BASIC ASTEROID FACTS

## Q. How many years ago were asteroids created?

Asteroids are really old. They are almost as old as the Sun, as they started to form together with our star, about 4.6 billion years ago! So, this was at the very beginning of our solar system. They were not “created” by anyone, they are a natural step in the process that lead to the formation of planets around stars. Since they didn’t join together to form a planet, they have remained almost unchanged since their formation.

That is why they are so interesting, because they can tell us about what was happening back in those days, when the planets were forming.



Alessio, “L’universo che cresce”, Year 5, Gabelli School Perugia (courtesy of CRISP University of Perugia and ASI Italian Space Agency “Disegniamo l’Universo” <https://crisp.unipg.it/universo/>)

## Q. How were asteroids formed? And how do we know?

Well, they were formed little by little, leftovers from the formation of our solar system. First, tiny dust particles started to join other tiny dust particles, forming slightly bigger particles (we say “accretion” in astronomy). The process continued until larger bodies were created. Some of these larger bodies were large enough to attract other rocks, collecting material until a planet was formed. Others, simply remained the same size, not adding more material. They became asteroids.



We know this because scientists are constantly examining the formation of our solar system. Nowadays, they use computer based modules to suggest what might have happened back then. We get a lot of information about the formation of asteroids from the study of meteorites that arrive on Earth (small pieces of asteroids) and we learn a lot about their formation from missions into space.

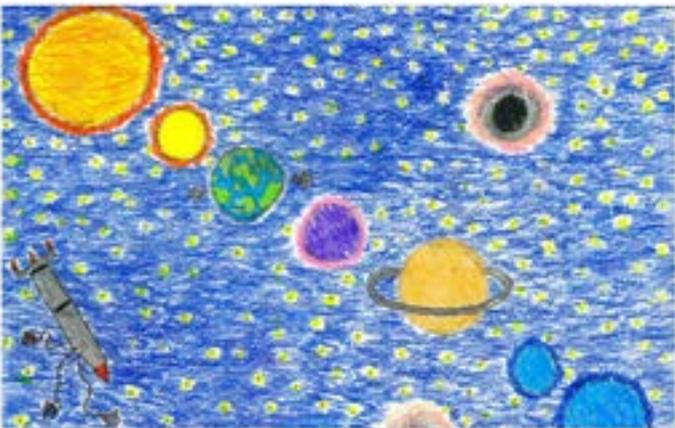
Filippo, “Esplosione strana”, Year 4, Valentini School Perugia (courtesy of CRISP University of Perugia and ASI Italian Space Agency “Disegniamo l’Universo” <https://crisp.unipg.it/universo/>)

**Q. What are asteroids made of?**

A bunch of things! Most of them are rocks, which means they are made of minerals like the ones we find on Earth (basalts, clays,...), but they also contain metals, like iron or nickel. They are differences in compositions, including more or less hydrated minerals, or heated minerals, or grains from even before the formation of the Solar system. Some asteroids are really dark, made of carbon-rich materials. We even find water inside some of the minerals, and even organic material! Remember that water and organics are the precursors of life, and that's why asteroids are so amazing!



Mosaic image of asteroid Bennu. Courtesy of NASA/Goddard/University of Arizona



Diego, "Curioso come Diego", Year 4, Bevagna Cannara School Perugia (courtesy of CRISP University of Perugia and ASI Italian Space Agency "Disegniamo l'Universo" <https://crisp.unipg.it/universo/>)

**Q. How many asteroids are there in total? And how do we know?**

So far, using our telescopes we have identified about 1.2 million asteroids, but we haven't detected the smallest ones yet, so we think this number is even larger. We keep discovering more every day! Well... every night (that's when we observe the sky)!

We expect that there are several millions of asteroids between Mars and Jupiter, they are just too faint to be detected with current telescopes. Asteroids that are over 1 km wide are well identified, the smaller ones are harder to find. Usually, we see them when they pass near to Earth.

How do we know....? Scientists and amateurs all over the world contribute to this and the more advanced our telescopes get, the more we can see. Some telescopes nowadays are huge and are equipped with amazing technologies. In NEOROCKS, we have access to the *Gran Telescopio Canarias*. It is 10.4 meters wide and the largest optical telescope in the world (an optical telescope is used to gather, and focus, light, to view a magnified image and take a photograph....).



Gran Telescopio Canarias (Photo courtesy of GRANTECAN)

Actually, we did a video about these amazing telescopes! [You can check it out here.](#)

### Q. Where do asteroids gather together?

Most of the asteroids are located between Mars and Jupiter, in a region that we call the “main asteroid belt”. They do not really gather together on purpose. Early in the Solar system, they were everywhere. But only those between Mars and Jupiter have managed to survive over long periods of time (lots of theories about why!).

Some of the asteroids in the main belt escape and get close to our planet: those are called “near-Earth asteroids”, or NEAs. Our NEOROCKS project is all about these asteroids next door.

There is also a group of asteroids that orbit the Sun in the same orbit as Jupiter, and are called Trojans.



Julia, Year 5, Ficulle School Perugia (courtesy of CRISP University of Perugia and ASI Italian Space Agency “Disegniamo l’Universo” <https://crisp.unipg.it/universo/>)

# ASTEROID NAMES

## Q. What did they call the first asteroid and why?

The very first asteroid to be discovered was named Ceres.

This asteroid (originally considered as a planet, then an asteroid, then a dwarf planet) was discovered in January 1801 by Giuseppe Piazzi, from Palermo Astronomical Observatory in Sicily.

At first it was called "Ceres Ferdinandea", Ceres after the Roman goddess of agriculture, whose earthly home, and oldest temple, lay in Sicily; and Ferdinandea in honour of King Ferdinand IV (1751-1825) of Sicily. Not everyone was happy with the second part, so it was dropped and the asteroid became simply Ceres.

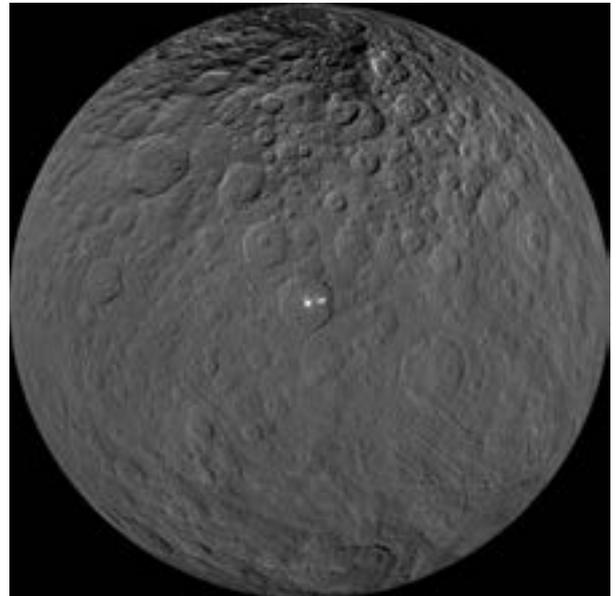


Image of Ceres (September 2017 from the Dawn mission). Courtesy of NASA/JPL-Caltech/UCLA/MPS/DLR/IDA

## Q. Are any asteroids called: Hera, Nemesis, Demeter, Hercules or Poseidon? I love Greek myths!



Photo courtesy of Daniels Joffe on Unsplash

Many asteroids have names related to Greek myths and other mythology. You saw above that the very first asteroid was called Ceres (so Demeter in the Greek myths). There was some discussion about this name and, for example, some proposed that it be called Juno or Hera. Since then many asteroids have been given names related to mythology. Hera, goddess of marriage, family and childbirth and wife of Zeus, got her own small planet in 1868.

Asteroids are not just named after the gods themselves, but also other characters: one asteroid is called Cerberus, for the three-headed dog that guarded the entrance to Hades, another is Amphitrite after an Oceanid, wife of Poseidon and mother of Triton.

So, if you love Greek myths, you will have lots of fun reading about the names of the asteroids! We made a video about the Asteroid names too!

[Check it out here.](#)

**Q. Are there still some asteroids without names?**

Yes, of course, plenty of them!

When a new asteroid is discovered, we first name it using a code of numbers and letters that refers to the exact date of its discovery (provisional designation). Then, if we keep observing it and learning more about its characteristics and its orbit, we assign a fixed number to it (this number follows the order of discovery). Finally, when its orbit is really well known, we can give it a name.

Here is an example: asteroid 2012 DA14 was discovered on February 22nd, 2012. Later on, it received the fixed number 367943. And finally, it was named as "Duende". The Duende are a race of fairy or goblin-like mythological creature from Iberian folklore, so we are back to myths again!

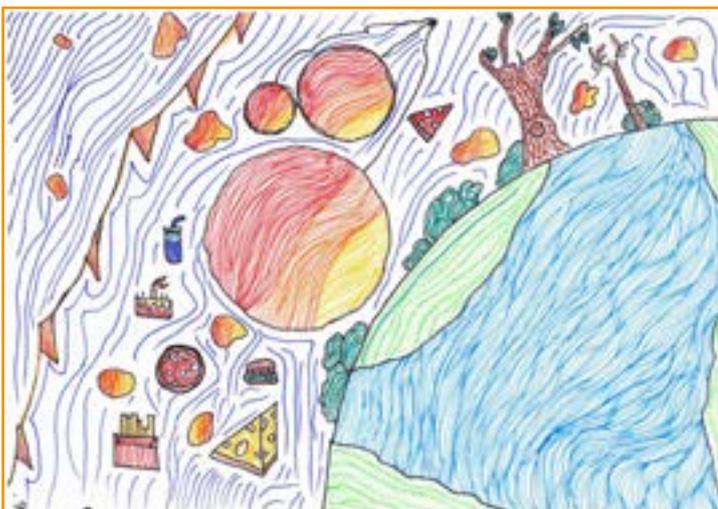
To date, about half of the 1.2 million asteroids identified have received a number, and only 20.000 have a name, so there is plenty of opportunities for naming asteroids! The first asteroids were named after Gods in the mythology, then cities, famous people... Many NEOROCKERS have an asteroid named after them!



Aicha, Year 3, Un Asteroide Infuocato Dritto Sulla Terra, S.Filippo School, Citta Di Castello



Alexia, Year 5, L'asteroide nell'Universo Colorato, Montegabbione School, Perugia.



Emma, Year 5, Scia di Meteoriti, M.Valenti School, Perugia



Mattia, Year 5, Uno Sguardo al Cielo di Notte, M.Valenti School, Perugia

(drawings courtesy of CRISP University of Perugia and ASI Italian Space Agency "[Disegniamo l'Universo](#)")

# PLANETARY DEFENSE

## Q. What does Planetary Defense mean anyway?

Since its formation, our planet has been subject to many impacts by asteroids and comets. Some of these objects have been responsible for huge disasters, even mass extinctions...such as the most famous one that happened almost 60 million years ago and made dinosaurs disappear from the Earth. That is why a lot of effort is made to studying strategies to defend our planet from possible future impacts. Space agencies around the world receive money from governments to study how to defend our planet from possible impacts by asteroids and comets.



NASA's DART Spacecraft Launches in World's First Planetary Defense Test Mission (24th November 2022).  
Courtesy of: NASA/Bill Ingalls

NASA DART is one of these space missions. On 26th September 2022, for the first time ever, DART will see if intentionally crashing a spacecraft into an asteroid is a good way to change its course. This would be important if an Earth-threatening asteroid were discovered in the future. Some of our Neorockers are involved in the European contribution to this mission, so stay tuned for updates later this year!

## Q. How many times have asteroids bashed into the Earth?

We do not know exactly, but quite a lot actually!

We think that there was a period in Earth's history, around 4 billion years ago, when the surface of our planet was frequently hit with asteroids and comets. This was called Late Heavy Bombardment. But Earth's neighbourhood was much busier back then, and the young Solar System was still crowded with fragments of forming planets. That's why it was quite easy for asteroids to hit Earth.

Nowadays, there is not this much space debris flying around, so the collisions are much less likely. We still see some evidence of asteroids hitting Earth within the last few hundred million years in the form of impact craters.

[You can see here a map of known impact.](#)



Scientists collect a meteorite in Antarctica.  
Courtesy of: NASA/JSC/ANSMET

Not all asteroids create craters, though! When they enter the Earth's atmosphere they burn up and you can

observe them as meteors. When a meteoroid survives a trip through the atmosphere and hits the ground, it's called a meteorite. For a while, these meteorites were the main source of iron for humans!

**Q. How many people have asteroids killed in total?**

A whole bunch of dinosaurs...but as far as we know, there is only 1 death that can be attributed to the fall of an asteroid. It was in the Kurdistan Region of Iraq, back in 1888!

One of the last significant impacts occurred on 30 June 1908, when an asteroid exploded 6.2 miles (10km) above a forest in Tunguska, Siberia. Trees were scorched and denuded of branches over a "ground zero" region 8km (5 miles) in diameter. Trees were blown down over a region of 70x55km (45x35 miles). People were knocked off their feet at distances of 60km (35 miles) from the impact.

However, this was a remote area and there seem to have been no casualties.

Some scientists have said that if it had landed 4 hours and 47 minutes later, it would have hit St Petersburg, which then had a population of around 1.5 million people. The figures would have been a bit different then....More recently, in 2013, many people were injured in Chelyabinsk (in Russia). An asteroid fell next to the city, blasting many, many, MANY windows. The flying pieces of glass injured about 1,500 people, who needed medical attention, but no casualties there either.



Photo by Leonid Kulik during a mission to Tunguska in 1938. Courtesy of Sovfoto/UIG via Getty Images



Trail left by Chelyabinsk, 15 February 2013. Courtesy of Elizaveta Becker/ullstein bild via Getty Images

So...the threat by asteroid is VERY small for a single person. It is also VERY small over a short period of time. It is, however, large for the entire Earth, once we consider a long period of time. The dinosaurs (and many other species) disappeared 65 millions of years ago. It is a catastrophic natural hazard. Good news: it only occurs seldomly, and we can prepare for it. NEOROCKS is part of the international efforts to be ready in the unlikely events we would be threatened.

# SOME MORE QUESTIONS.....

## Q. How can we tell what asteroid we are looking at?

Looking at the sky (through our telescopes), we can tell they are not stars, because stars stay still while asteroids move.

The asteroids move around the Sun on their special tracks called "orbits". Astronomers have figured out how those orbits work, so once we have observed an asteroid for a while, we can calculate exactly what orbit it will move on and where it will go!

It's like with buses, we know what route each line takes, so when you spot a bus on that route you can tell which bus line it is. When we observe an asteroid, we can check if we know of any asteroid that is expected to be there. The list of known asteroids is managed by the [Minor Planet Center](#).

You can tell them what part of sky you were looking at, and they let you know which asteroid was there. If we cannot identify it using the Minor Planet Center's list, it means we have discovered something new!



## Q. Is there a boss of all the asteroids?



Looking Down on a Shooting Star (rare photo of a meteor entering Earth's atmosphere, seen from the International Space Station).  
Courtesy of: NASA/Ron Garan

Well, not a boss exactly, but some asteroids are much bigger than others! Astronomers measure not only the size or diameter of the asteroids, but also the mass (so the amount of matter present, which gives us its kilograms) and the density (so basically, how tightly matter is crammed together). The largest asteroid ever discovered is Ceres, the one we told you about before. Ceres is about one-quarter the size of the moon. She is the largest in diameter, mass and density (so that really makes her the big-boss of all the asteroids!). After her

come Pallas (discovered in 1802) and Vesta (discovered in 1807).

Among the Near Earth Objects, the ones NEOROCKS is most interested in, the largest known is 1036 Ganymed with a diameter of nearly 41 kilometers (25.5 miles). He is a Potentially Hazardous Asteroids (PHA). Asteroids that are larger than 150m across and that travel closer than 7.5 million kilometres to the Earth are classified as PHA. This doesn't mean that they will definitely impact the Earth. It just means they need to be tracked and monitored.

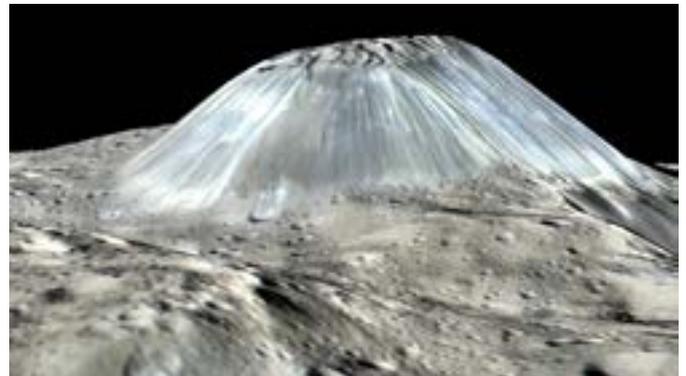
But remember, size isn't everything! Some of the smaller asteroids, orbiting near Earth, are pretty powerful too.

### Q. Are there any stories about asteroids?

Yes, the asteroids and the potential threat they pose, have been used multiple times in literature and in films too.

You must have read the Little Prince, by Antoine de Saint-Exupéry? If you haven't get reading now!

Anyway, the little Prince actually lives on asteroid... it was one of the first works of literature to include asteroids as a setting for adventures. This is a made up story, but it has lots of parts that helps you to learn more about asteroids.



Looking Down on a Shooting Star (rare photo of a meteor entering Earth's atmosphere, seen from the International Space Station).  
Courtesy of: NASA/Ron Garan

About asteroid names for example: the books suggests that the prince came from an asteroid called B612. An asteroid discovered in 1993 received the name *Bésixdouze*, the French name for "B six twelve", in tribute to The Little Prince.

The book also talks about volcanoes, because asteroid B612 has three volcanoes. We found out about the real existence of volcanoes on asteroids in 2018, thanks to [NASA's Dawn spacecraft, which launched in 2007 to reach Ceres and Vesta.](#)

The mission identified 'cryovolcanoes' in Ceres (these are ice volcanoes, that erupt with water-ice and other frozen molecules, not boiling lava like here on earth) and traces of volcanic activity in Vesta. You can [check out the video of Ceres here.](#)

Scientists are still working on new missions to find out more about volcanoes on asteroids.

More recently, the film Don't Look Up talked about a huge asteroid traveling towards earth and the reaction of people and politicians alike. [Our Neorocker Ettore, from the Italian Space Agency, prepared an article about it for our last newsletter.](#) He explained some of the technical developments and how people are working together across the globe on planetary defence.

**Q. Are there any statues of asteroids? Or even better, a real asteroid that I can see?**

Maybe not statues, but you can see pieces of asteroids, called meteorites, in some museums. Some of them were found by astronomers just by searching nearby old impact craters. Some were found by people a long, long time ago and smelted to be used in iron tools, weapons, and decorations.

Near Florence, in Prato, the [Museum of Planetary Sciences](#) has a meteorite that you can touch and a whole collection of smaller pieces.



The meteorite Nantan



The big meteorite room



Slice of the meteorite Imilac



The meteorite Gujba

Images courtesy of the Museo di Scienze Planetarie

There are many other planetary museums in other countries. Ask your partners and teachers to take you there!

We can also see asteroids enter Earth's atmosphere and burn up leaving a trail, we mentioned them above: the meteors. There are networks of observers around the world monitoring the skies for meteors and they can sometimes locate places where asteroid fragments, called meteorites, fell. [In fact, just a couple years ago such meteorite fell on New Year's Day and was found in Italy, near Cavezzo, not very far from Florence.](#)

# MORE INFORMATION ABOUT ASTEROIDS

Neorockers, large and small, can learn more about asteroids with NEOROCKS4KIDS videos ([available in English with subtitles in Spanish, Italian and Polish](#)).

[Asteroid Day happens once a year, on 30th June](#) on Asteroid day, there are events all across the world and there is a website FULL of information. Here you can find [Asteroid Day's Learn Series](#), with bite-sized pieces on information about Asteroids.

Also, Asteroid day gives us some models...If you want to recreate some of the spacecrafts that went on missions (like the Dawn mission we talked about above), [you can download the models here](#).

And let's not forget [ESA KIDS](#), the [European Space Agency's site](#) with multi-media information about Space, include asteroids and [NASA Science Space Place](#).



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