

STARDOME OBSERVATORY & PLANETARIUM FACTS, RESOURCES AND ACTIVITIES ON...

ROSETTA

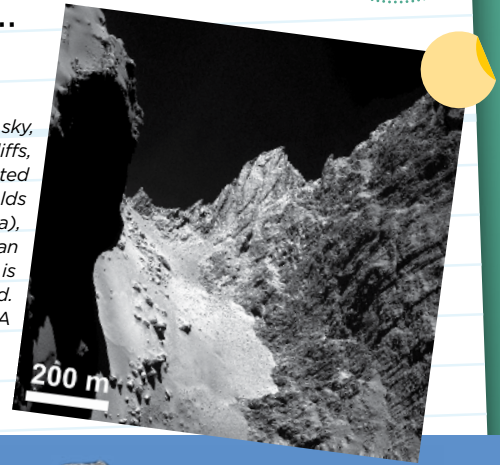
The Rosetta mission was the first to orbit a comet and the first to land on a comet nucleus.

Its target was Comet 67P/Churyumov-Gerasimenko (affectionately nicknamed Comet Chury), which is a 'dirty snowball' circling the Sun in an elliptical 6.5-year orbit that takes it from 1.2AU (a little further from the Sun than Earth) to 5.7AU (just beyond the orbit of Jupiter).

The spacecraft made three gravity-assist flybys of Earth and one of Mars, followed by close flybys of asteroid 2867 Šteins and asteroid 21 Lutetia on its 6.4 billion km journey to 67P.

After arriving and surveying the alien landscape, Rosetta released a lander named 'Philae'. Instead of attaching to the surface, Philae bounced twice, nearly escaping Chury's gravity, before coming to rest. Unfortunately, this was in the shadow of an overhanging cliff that shielded critical sunlight from its solar panels.

A pitch-black sky, massive jagged cliffs, layers of accreted material, ice fields (water, CO₂, ammonia), boulders larger than houses. Chury is a truly alien world. Image credit: ESA



Comet Chury travelled at 135,000 km/h during its closest approach to the Sun (perihelion).

The comet loses about 1m of surface depth on average with each perihelion pass around the Sun.

The surface temperature ranges from -93°C up to -43°C, and the comet rotates once every 12.4 hours. Philae 'sniffed' the comet and detected ammonia and hydrogen sulphide, which smell like urine and rotten eggs!

The two large lobes make the comet look like a 'rubber ducky'. They have layers of smaller concretions of primordial cometary material dating from the formation

of the Solar System. Rosetta determined from the different alignments of these layers in the lobes that the lobes met and fused in a low speed collision to form the comet we see now.

Rosetta observed jets of gas and dust erupting as the Sun's radiation evaporated surface ice. This is the material that forms the distinctive comet 'tail'.



Rankitoto is 5500m across, Comet Chury is 4100m across and weighs about 10 trillion kilograms,

The water found on this comet is different to water on Earth, so this type of comet can't have brought water to our oceans when the Solar System was forming.

After 2 years orbiting the comet, Rosetta was sent on a final downward course in September 2016, gently impacting at 3 km/h to remain as a silent monument on the surface.

1 AU is an Astronomical Unit = 150 million km.

Check out these other resources...

➔ Rosetta blog: <http://blogs.esa.int/rosetta/2016/09/26/the-surprising-comet/>

➔ European Space Agency mission home site: http://www.esa.int/Our_Activities/Space_Science/Rosetta

How long did Rosetta take to reach Comet 67P?

Why were the spacecraft and lander named 'Rosetta' and 'Philae'?

How high did Philae 'bounce' above the surface of Comet 67P?

DISCUSSION POINTS



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ACTIVITY

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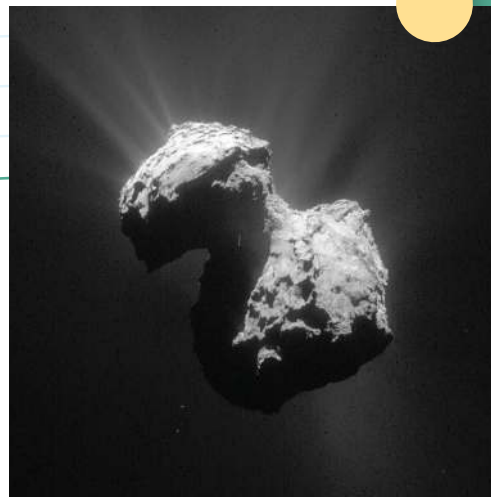
MAKE YOUR OWN COMET

Build a comet with dry ice and investigate the effect the Sun has on comet Chury.

ACTIVITY ONE

MAKING A COMET

- There are various recipes for making a demonstration comet, but the essential ingredient is dry ice (frozen carbon dioxide). This is not expensive and is available from a handful of outlets. Keep it in a chilly bin in the freezer but note that the pellets will disappear in a few days, as the freezer is much warmer (-18°C) than the dry ice (-79°C).
- This is one of the more straight forward methods - <https://www.noao.edu/education/crecipe.html>
- Experiment with the ratios of the different ingredients, especially the amount of added water, to find the recipe best suited to your demonstration.
- Always use gloves (preferably leather) when handling dry ice. Ensure everyone understands that it will damage your skin just like something that is boiling hot.
- It is recommended not to use a fire extinguisher as a source of dry ice.



Jets of dust and gas erupting into space from the surface. Image credit: ESA

ACTIVITY TWO

INVESTIGATING YOUR COMET

Examine how the CO₂ sublimates, and how the imbedded grit and dust are freed from the ice.

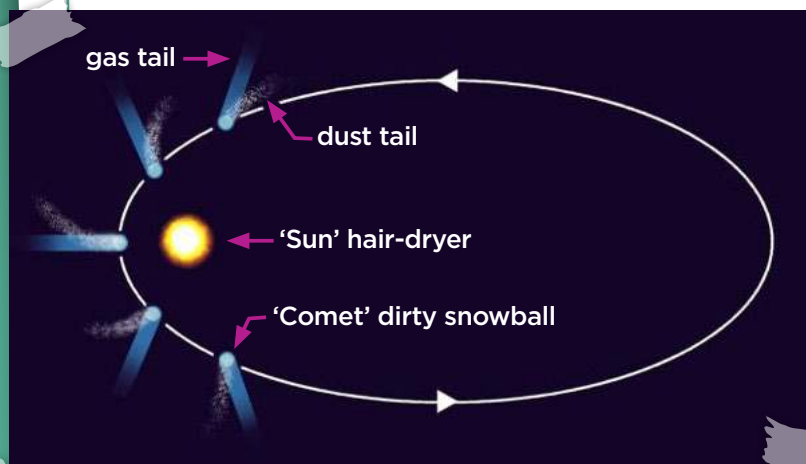
You'll need:

- ⇒ Hot spotlight or desk lamp
- ⇒ Small hairdryer
- ⇒ Your comet

- Use a hot spotlight or desk lamp to change the speed of sublimation, imitating the effect of the Sun on a comet as it speeds around at perihelion.
- Use a small hair dryer to represent the solar wind*. Hold the comet with its outgassing CO₂ vapour away from the dryer beyond the effect of its airflow. Gradually move closer and observe that the vapour always points away from the 'Sun' as you orbit the dryer.

- Observe how the tail can both trail behind and point ahead of the comet as it makes its close approach around the Sun.

* Be clear that the Solar wind is a stream of atomic particles that create a very small pressure on the comet, and the Sun doesn't actually 'blow' a wind.



Take a photo of your activity and send it to us. We'd love to see it! education@stardome.org.nz

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