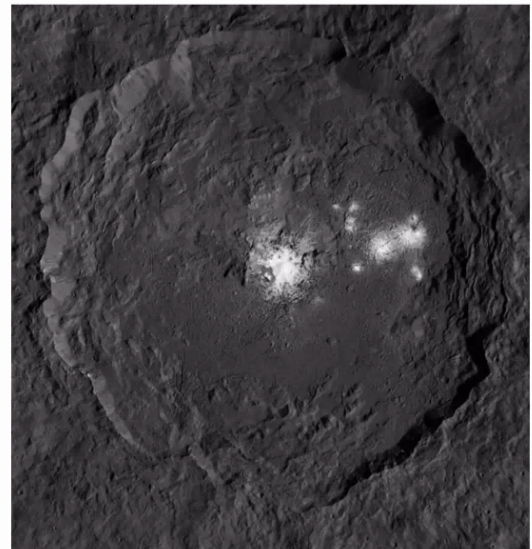


The fundamentals of astronomy for beginners

EXPLAINER

Ceres, the planet that never was

From 'comet' to 'planet', then 'asteroid' to 'dwarf planet', **Jane Green** looks at the changing classifications of Ceres, which reaches opposition this month



Ask anyone to name a dwarf planet and the answer is likely to be Pluto. Since its discovery in 1930, Pluto had been classed as a classical planet and it wasn't 'demoted' to its dwarf status until 2006. But it wasn't the first planet to be reclassified. That honour belongs to the lesser-known dwarf planet Ceres, which happens to reach opposition – when it will be on the opposite side of Earth to the Sun – on 27 November. So, it's a fitting time to shine more than sunlight on this 940km-wide world which has proven to pack a pretty good cryogenic punch.

Ceres is named after the Roman goddess of corn and harvests (she also gives us the word cereal). It was discovered on New Year's Day 1801, by Catholic priest Giuseppe Piazzi at the Palermo Astronomical Observatory, Sicily. Piazzi's discovery was the result of a methodical search using the now discredited

▲ **Above: an image of Ceres taken from a distance of just 13,600km by NASA's Dawn mission in May 2015 reveals mysterious bright patches on the dwarf planet**

Above right: One of the dwarf planet's brightest areas was spotted in the crater Occator – leading to speculation of an underground salty reservoir

Titius-Bode Law, named in 1766 after German astronomer Johann Daniel Titius and popularised from 1772 by his countryman Johann Elert Bode. This law formulaically predicted a pattern in the size of orbits of the planets and mathematically suggested that another planet existed in the gap between the orbits of Mars and Jupiter.

When Piazzi discovered this 'missing planet' he thought the new 'moving star' was a comet. He observed its 'slow' and 'rather uniform' movement a further 24 times before becoming convinced it was not one. He announced his sighting on 24 January 1801. At the time, it was the only known object between Mars and Jupiter yet it soon became lost in the Sun's glare and impossible to see. Nevertheless, its orbit was mathematically predicted by the 24-year-old German mathematician Carl Friedrich Gauss, one of the 'Celestial Police' – an elite group of planet-hunting astronomers who were also making observations of Ceres. However, they kept discovering other objects in similar orbits, and slowly the realisation dawned that they were dealing with an entirely new class of bodies.

In 1802, with the discovery of Pallas, German-born



HOW TO OBSERVE CERES AT OPPOSITION

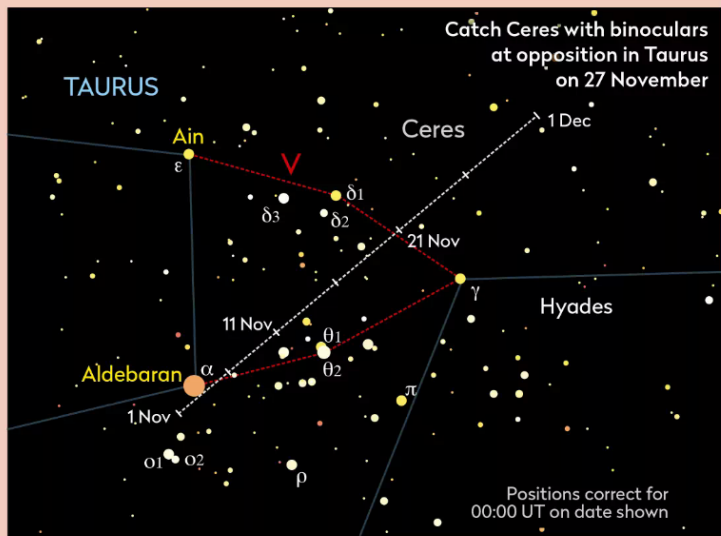
Enjoy the dwarf planet as it appears at its brightest in the night sky

Ceres reaches opposition – a position in space on the opposite side of Earth to the Sun – in the constellation of Taurus, the Bull, on 27 November. Catch it at its closest approach to Earth when it's visible at its highest point in the sky around midnight. Its star-like point of light will shine at mag. -7.2, within the range of 10x50 binoculars.

A binocular object throughout the month, the best times to view Ceres will be from midnight UT on 1 November, 23:00 UT on the 15th and 22:00 UT on 30 November.

Between 1/2 and 3/4 November the dwarf planet passes just south of the red giant star Aldebaran (alpha α Tauri) with the pair closest on the night of 2/3, separated by only 7 arcminutes.

Thereafter, Ceres crosses the Hyades open cluster, before exiting mid-month towards the constellation of Aries, the Ram.

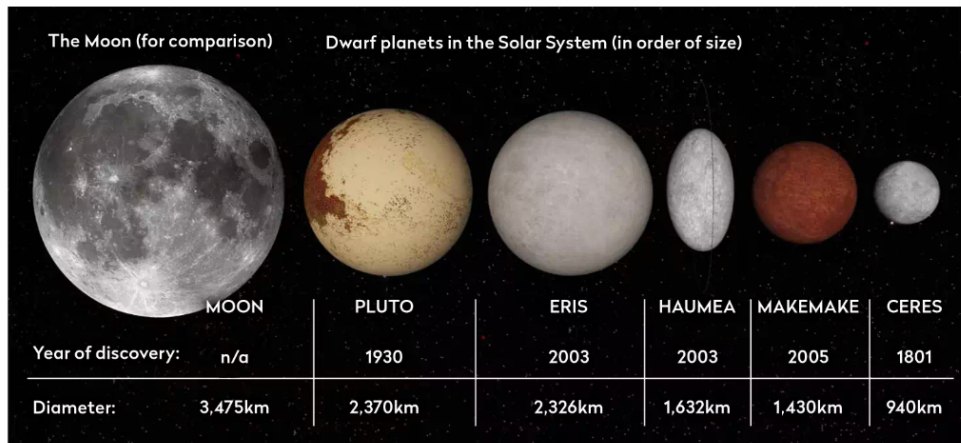


British astronomer William Herschel dubbed this new class of bodies 'asteroids'. In 1851 Ceres was reclassified as an asteroid and designated 1 Ceres, since it had been the first to be discovered. We know now it is the largest of many planetary leftovers forming the asteroid belt between Mars and Jupiter, and accounts for a third of the belt's mass.

Name changes

There Ceres remained, classified as an asteroid, until August 2006, when the International Astronomical Union (IAU) – the body responsible for astronomical nomenclature and classification – determined the three criteria necessary for an object to be defined as a planet. These are: to have enough mass to be nearly rounded by its own gravity – known as hydrostatic equilibrium; to be in orbit around a star, not be a star itself nor a satellite of a planet; and, crucially, to have cleared the neighbourhood around its orbit. Pluto failed to meet these new criteria and was demoted from being a classical planet to a dwarf planet – amid some controversy. Ceres, however, was large enough to be rounded by its own gravity and was, therefore, officially upgraded from asteroid to dwarf planet – the only one inside Neptune's orbit. Vesta, once second to Ceres, took on the mantle of the largest asteroid.

Ceres has proven to be an exciting object to explore. NASA's Dawn spacecraft – launched 2007 – arrived at Ceres in 2015, making it the first dwarf planet visited by a spacecraft. As it flew over its cratered surface, Dawn discovered 130



▲ A comparison of sizes between each of the five confirmed dwarf planets in our Solar System and the Moon



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mysterious 'bright spots', the brightest nestling within the recently formed 92km-wide Occator crater. Variations in the gravitational field of Ceres led astronomers to believe they were seeing signs of an underground reservoir of salty water, possibly stretching for hundreds of kilometres and reaching depths of some 40km.

It's speculated that many millions of years ago a space rock impacted the area, and elsewhere, puncturing the icy crust of Ceres to release briny fluid from below. The salty crust then froze over, sealing beneath it a chamber of meltwater and a cocktail of chemicals. This later erupted – perhaps as recently as two million years ago – in the form of an icy volcano disgorging its frozen contents to splatter and dazzle the shadowy world. Indeed, before Dawn, ESA's Herschel Space Telescope had detected water vapour in this area. Ceres could be composed of as much as 25 per cent water – more than Earth – so who knows what exciting revelations future missions will reveal? Until they do, let's enjoy this month's optimum views! 🌌

