

= Ceres (dwarf planet) =

Ceres (/ ˈsɛrɪz / ; minor planet designation : 1 Ceres) is the largest object in the asteroid belt that lies between the orbits of Mars and Jupiter . Its diameter is approximately 945 kilometers (587 miles) , making it the largest of the minor planets within the orbit of Neptune . The thirty second largest known body in the Solar System , it is the only one identified orbiting entirely within the orbit of Neptune that is a dwarf planet . Composed of rock and ice , Ceres is estimated to comprise approximately one third of the mass of the entire asteroid belt . Ceres is the only object in the asteroid belt known to be rounded by its own gravity . From Earth , the apparent magnitude of Ceres ranges from 6.7 to 9.3 , and hence even at its brightest , it is too dim to be seen with the naked eye , except under extremely dark skies .

Ceres was the first asteroid discovered , by Giuseppe Piazzi at Palermo on 1 January 1801 . It was originally considered a planet , but was reclassified as an asteroid in the 1850s when many other objects in similar orbits were discovered .

Ceres appears to be differentiated into a rocky core and icy mantle , and may have a remnant internal ocean of liquid water under the layer of ice . The surface is probably a mixture of water ice and various hydrated minerals such as carbonates and clay . In January 2014 , emissions of water vapor were detected from several regions of Ceres . This was unexpected , because large bodies in the asteroid belt do not typically emit vapor , a hallmark of comets .

The robotic NASA spacecraft Dawn entered orbit around Ceres on 6 March 2015 . Pictures with a resolution previously unattained were taken during imaging sessions starting in January 2015 as Dawn approached Ceres , showing a cratered surface . Two distinct bright spots (or high albedo features) inside a crater (different from the bright spots observed in earlier Hubble images) were seen in a 19 February 2015 image , leading to speculation about a possible cryovolcanic origin or outgassing . On 3 March 2015 , a NASA spokesperson said the spots are consistent with highly reflective materials containing ice or salts , but that cryovolcanism is unlikely . On 11 May 2015 , NASA released a higher resolution image showing that , instead of one or two spots , there are actually several . On 9 December 2015 , NASA scientists reported that the bright spots on Ceres may be related to a type of salt , particularly a form of brine containing magnesium sulfate hexahydrate ($\text{MgSO}_4 \cdot 6\text{H}_2\text{O}$) ; the spots were also found to be associated with ammonia rich clays . In June 2016 , near infrared spectra of these bright areas were found to be consistent with a large amount of sodium carbonate , (Na_2CO_3) , implying that recent geologic activity was probably involved in the creation of the bright spots .

In October 2015 , NASA released a true color portrait of Ceres made by Dawn .

= = History = =

= = = Discovery = = =

Johann Elert Bode , in 1772 , first suggested that an undiscovered planet could exist between the orbits of Mars and Jupiter . Kepler had already noticed the gap between Mars and Jupiter in 1596 . Bode based his idea on the Titius – Bode law ? a now discredited hypothesis Johann Daniel Titius first proposed in 1766 ? observing that there was a regular pattern in the semi major axes of the orbits of known planets , marred only by the large gap between Mars and Jupiter . The pattern predicted that the missing planet ought to have an orbit with a semi major axis near 2.8 astronomical units (AU) . William Herschel 's discovery of Uranus in 1781 near the predicted distance for the next body beyond Saturn increased faith in the law of Titius and Bode , and in 1800 , a group headed by Franz Xaver von Zach , editor of the *Monatliche Correspondenz* , sent requests to twenty four experienced astronomers (dubbed the " celestial police ") , asking that they combine their efforts and begin a methodical search for the expected planet . Although they did not discover Ceres , they later found several large asteroids .

One of the astronomers selected for the search was Giuseppe Piazzi , a Catholic priest at the Academy of Palermo , Sicily . Before receiving his invitation to join the group , Piazzi discovered Ceres on 1 January 1801 . He was searching for " the 87th [star] of the Catalogue of the Zodiacal stars of Mr la Caille " , but found that " it was preceded by another " . Instead of a star , Piazzi had found a moving star @-@ like object , which he first thought was a comet . Piazzi observed Ceres a total of 24 times , the final time on 11 February 1801 , when illness interrupted his observations . He announced his discovery on 24 January 1801 in letters to only two fellow astronomers , his compatriot Barnaba Oriani of Milan and Bode of Berlin . He reported it as a comet but " since its movement is so slow and rather uniform , it has occurred to me several times that it might be something better than a comet " . In April , Piazzi sent his complete observations to Oriani , Bode , and Jérôme Lalande in Paris . The information was published in the September 1801 issue of the *Monatliche Correspondenz* .

By this time , the apparent position of Ceres had changed (mostly due to Earth 's orbital motion) , and was too close to the Sun 's glare for other astronomers to confirm Piazzi 's observations . Toward the end of the year , Ceres should have been visible again , but after such a long time it was difficult to predict its exact position . To recover Ceres , Carl Friedrich Gauss , then 24 years old , developed an efficient method of orbit determination . In only a few weeks , he predicted the path of Ceres and sent his results to von Zach . On 31 December 1801 , von Zach and Heinrich W. M. Olbers found Ceres near the predicted position and thus recovered it .

The early observers were only able to calculate the size of Ceres to within an order of magnitude . Herschel underestimated its diameter as 260 km in 1802 , whereas in 1811 Johann Hieronymus Schröter overestimated it as 2 @,@ 613 km .

== = Name == =

Piazzi originally suggested the name *Cerere Ferdinanda* for his discovery , after the goddess Ceres (Roman goddess of agriculture , *Cerere* in Italian , who was believed to have originated in Sicily and whose oldest temple was there) and King Ferdinand of Sicily . " *Ferdinanda* " , however , was not acceptable to other nations and was dropped . Ceres was called *Hera* for a short time in Germany . In Greece , it is called *Demeter* (???????) , after the Greek equivalent of the Roman *Cerēs* ; in English , that name is used for the asteroid 1108 *Demeter* .

The regular adjectival forms of the name are *Cererian* and *Cererean* , derived from the Latin genitive *Cereris* , but *Ceresian* is occasionally seen for the goddess (as in the sickle @-@ shaped *Ceresian Lake*) , as is the shorter form *Cerean* .

The old astronomical symbol of Ceres is a sickle , ☾ () , similar to Venus ' symbol ♀ but with a break in the circle . It has a variant ☿ , reversed under the influence of the initial letter ' C ' of ' Ceres ' . These were later replaced with the generic asteroid symbol of a numbered disk , ♂ .

Cerium , a rare @-@ earth element discovered in 1803 , was named after Ceres . In the same year another element was also initially named after Ceres , but when cerium was named , its discoverer changed the name to *palladium* , after the second asteroid , 2 *Pallas* .

== = Classification == =

The categorization of Ceres has changed more than once and has been the subject of some disagreement . Johann Elert Bode believed Ceres to be the " missing planet " he had proposed to exist between Mars and Jupiter , at a distance of 419 million km (2 @.@ 8 AU) from the Sun . Ceres was assigned a planetary symbol , and remained listed as a planet in astronomy books and tables (along with 2 *Pallas* , 3 *Juno* , and 4 *Vesta*) for half a century .

As other objects were discovered in the neighborhood of Ceres , it was realized that Ceres represented the first of a new class of objects . In 1802 , with the discovery of 2 *Pallas* , William Herschel coined the term *asteroid* (" star @-@ like ") for these bodies , writing that " they resemble small stars so much as hardly to be distinguished from them , even by very good telescopes " . As the first such body to be discovered , Ceres was given the designation 1 *Ceres* under the modern

system of minor planet designations . By the 1860s , the existence of a fundamental difference between asteroids such as Ceres and the major planets was widely accepted , though a precise definition of " planet " was never formulated .

The 2006 debate surrounding Pluto and what constitutes a planet led to Ceres being considered for reclassification as a planet . A proposal before the International Astronomical Union for the definition of a planet would have defined a planet as " a celestial body that (a) has sufficient mass for its self gravity to overcome rigid body forces so that it assumes a hydrostatic equilibrium (nearly round) shape , and (b) is in orbit around a star , and is neither a star nor a satellite of a planet " . Had this resolution been adopted , it would have made Ceres the fifth planet in order from the Sun . This never happened , however , and on 24 August 2006 a modified definition was adopted , carrying the additional requirement that a planet must have " cleared the neighborhood around its orbit " . By this definition , Ceres is not a planet because it does not dominate its orbit , sharing it as it does with the thousands of other asteroids in the asteroid belt and constituting only about a third of the mass of the belt . Bodies that met the first proposed definition but not the second , such as Ceres , were instead classified as dwarf planets .

Ceres is the largest object in the asteroid belt . It is sometimes assumed that Ceres has been reclassified as a dwarf planet , and that it is therefore no longer considered an asteroid . For example , a news update at Space.com spoke of " Pallas , the largest asteroid , and Ceres , the dwarf planet formerly classified as an asteroid " , whereas an IAU question and answer posting states , " Ceres is (or now we can say it was) the largest asteroid " , though it then speaks of " other asteroids " crossing Ceres ' path and otherwise implies that Ceres is still considered an asteroid . The Minor Planet Center notes that such bodies may have dual designations . The 2006 IAU decision that classified Ceres as a dwarf planet never addressed whether it is or is not an asteroid . Indeed , the IAU has never defined the word ' asteroid ' at all , having preferred the term ' minor planet ' until 2006 , and preferring the terms ' small Solar System body ' and ' dwarf planet ' after 2006 . Lang (2011) comments " the [IAU has] added a new designation to Ceres , classifying it as a dwarf planet By [its] definition , Eris , Haumea , Makemake and Pluto , as well as the largest asteroid , 1 Ceres , are all dwarf planets " , and describes it elsewhere as " the dwarf planet ? asteroid 1 Ceres " . NASA continues to refer to Ceres as an asteroid , as do various academic textbooks .

= = Orbit = =