= 10 Hygiea =

10 Hygiea is the fourth @-@ largest asteroid in the Solar System by volume and mass , and it is located in the asteroid belt . With somewhat oblong diameters of 350 ? 500 kilometres (220 ? 310 mi) (217 ? 310 miles) and a mass estimated to be 2 @.@ 9 % of the total mass of the belt , it is the largest of the class of dark C @-@ type asteroids with a carbonaceous surface .

= = Observation = =

Despite its size , Hygiea appears very dim when observed from Earth . This is due to its dark surface and larger @-@ than @-@ average distance from the Sun . For this reason , many smaller asteroids were observed before Annibale de Gasparis discovered Hygiea on 12 April 1849 . At most oppositions , Hygiea has a magnitude that is four magnitudes dimmer than Vesta 's , and observing it typically requires at least a 100 @-@ millimetre (4 in) telescope . However , while at a perihelic opposition , it can often be observed just with 10x50 binoculars .

= = Discovery and name = =

On 12 April 1849 , in Naples , Italy , astronomer Annibale de Gasparis (age 29) discovered Hygiea . It was the first of his nine asteroid discoveries . The director of the Naples observatory , Ernesto Capocci , named the asteroid . He chose to call it Igea Borbonica (" Bourbon Hygieia ") in honor of the ruling family of the Kingdom of the Two Sicilies where Naples was located .

In 1852 , John Russell Hind wrote that " it is universally termed Hygiea , the unnecessary appendage ' Borbonica ' being dropped " (as well as the final " ia " in favor of just " a ") . The name comes from Hygieia , the Greek goddess of health , daughter of Asclepius (Aesculapius for the Romans) . The name was occasionally misspelled Hygeia in the 19th century , for example in the Monthly Notices of the Royal Astronomical Society .

= = Physical characteristics = =

Based on spectral evidence , Hygiea 's surface is thought to consist of primitive carbonaceous materials similar to those found in carbonaceous chondrite meteorites . Aqueous alteration products have been detected on its surface , which could indicate the presence of water ice in the past which was heated sufficiently to melt . The primitive present surface composition would indicate that Hygiea had not been melted during the early period of Solar System formation , in contrast to other large planetesimals like 4 Vesta .

Hygiea is the main member of the Hygiea family and contains almost all the mass (well over 90 %) in this family . It is the largest of the class of dark C @-@ type asteroids that are dominant in the outer asteroid belt ? which lie beyond the Kirkwood gap at 2 @.@ 82 AU . Hygiea appears to have a noticeably oblate spheroid shape , with an average diameter of 444 ± 35 km and a semimajor axis ratio of 1 @.@ 11 . This is much more than for the other objects in the " big four " ? 2 Pallas , 4 Vesta and the dwarf planet Ceres . Aside from being the smallest of the four , Hygiea , like Ceres , has a relatively low density , which is more comparable to the icy satellites of Jupiter or Saturn than to the terrestrial planets or the stony asteroids .

Although it is the largest body in its region , due to its dark surface and larger @-@ than @-@ average distance from the Sun , Hygiea appears very dim when observed from Earth . In fact , it is the third dimmest of the first twenty @-@ three asteroids discovered , with only 13 Egeria and 17 Thetis having lower mean opposition magnitudes . At most oppositions , Hygiea has a magnitude of around + 10 @.@ 2 , which is as much as four orders fainter than Vesta , and observation calls for at least a 4 @-@ inch (100 mm) telescope to resolve . However , at a perihelic opposition , Hygiea can reach + 9 @.@ 1 and may just be resolvable with 10x50 binoculars , unlike the next two largest asteroids in the asteroid belt , 704 Interamnia and 511 Davida , which are always beyond binocular visibility .

At least 5 stellar occultations by Hygiea have been tracked by Earth @-@ based astronomers , but all with few independent observers so that little was learned of its shape . The Hubble Space Telescope has resolved the asteroid and ruled out the presence of any orbiting companions larger than about 16 kilometres (9 @.@ 9 mi) in diameter .

= = Orbit and rotation = =

Generally , Hygiea 's properties are the most poorly known out of the " big four " objects in the asteroid belt . Its orbit is much closer to the plane of the ecliptic than those of Ceres , Pallas or Interamnia , but is less circular than Ceres or Vesta with an eccentricity of around 12 % . Its perihelion is at a quite similar longitude to those of Vesta and Ceres , though its ascending and descending nodes are opposite to the corresponding ones for those objects . Although its perihelion is extremely close to the mean distance of Ceres and Pallas , a collision between Hygiea and its larger companions is impossible because at that distance they are always on opposite sides of the ecliptic . In 2056 , Hygiea will pass 0.025AU from Ceres , and then in 2063 , Hygiea will pass 0.020AU from Pallas . At aphelion Hygiea reaches out to the extreme edge of the asteroid belt at the perihelia of the Hilda family which is in 3 : 2 resonance with Jupiter . Hygiea is used by the Minor Planet Center to calculate perturbations .

Hygiea is an unusually slow rotator , taking 27 hours and 37 minutes for a revolution , whereas 6 to 12 hours are more typical for large asteroids . Its direction of rotation is not certain at present , due to a twofold ambiguity in lightcurve data that is exacerbated by its long rotation period ? which makes single @-@ night telescope observations span at best only a fraction of a full rotation ? but it is believed to be retrograde . Lightcurve analysis indicates that Hygiea 's pole points towards either ecliptic coordinates (? , ?) = (30 ° , 115 °) or (30 ° , 300 °) with a 10 ° uncertainty . This gives an axial tilt of about 60 ° in both cases .

= = Gallery = =