

= Amalthea ( moon ) =

Amalthea ( / æm?l?i?? / am @-@ ?l @-@ THEE @-@ ? ; Greek : ????????? ) is the third moon of Jupiter in order of distance from the planet . It was discovered on 9 September 1892 , by Edward Emerson Barnard and named after Amalthea , a nymph in Greek mythology . It is also known as Jupiter V.

Amalthea is in a close orbit around Jupiter and is within the outer edge of the Amalthea Gossamer Ring , which is formed from dust ejected from its surface . From its surface , Jupiter would appear 46 @. @ 5 degrees in diameter . Amalthea is the largest of the inner satellites of Jupiter . Irregularly shaped and reddish in color , it is thought to consist of porous water ice with unknown amounts of other materials . Its surface features include large craters and ridges .

Amalthea was photographed in 1979 by the Voyager 1 and 2 spacecraft , and later , in more detail , by the Galileo orbiter in the 1990s .

= = History = =

= = = Discovery = = =

Amalthea was discovered on 9 September 1892 , by Edward Emerson Barnard using the 36 inch ( 91 cm ) refractor telescope at Lick Observatory . It was the last planetary satellite to be discovered by direct visual observation ( as opposed to photographically ) and was the first new satellite of Jupiter since Galileo Galilei 's discovery of the Galilean satellites in 1610 .

= = = Name = = =

Amalthea is named after the nymph Amalthea from Greek mythology , who nursed the infant Zeus ( the Greek equivalent of Jupiter ) with goat 's milk . Its Roman numeral designation is Jupiter V. The name " Amalthea " was not formally adopted by the IAU until 1976 , although it had been in informal use for many decades . The name was initially suggested by Camille Flammarion . Before 1976 , Amalthea was most commonly known simply as Jupiter V. The adjectival form of the name is Amalthean .

= = Orbit = =

Amalthea orbits Jupiter at a distance of 181 000 km ( 2 @. @ 54 Jupiter radii ) . The orbit of Amalthea has an eccentricity of 0 @. @ 003 and an inclination of 0 @. @ 37 ° relative to the equator of Jupiter . Such appreciably nonzero values of inclination and eccentricity , though still small , are unusual for an inner satellite and can be explained by the influence of the innermost Galilean satellite , Io : in the past Amalthea has passed through several mean @-@ motion resonances with Io that have excited its inclination and eccentricity ( in a mean @-@ motion resonance the ratio of orbital periods of two bodies is a rational number like m : n ) .

Amalthea 's orbit lies near the outer edge of the Amalthea Gossamer Ring , which is composed of the dust ejected from the satellite .

= = Physical characteristics = =

The surface of Amalthea is very red ( that is , its reflectivity increases with the wavelength from the green to near @-@ infrared ) . The reddish color may be due to sulfur originating from Io or some other non @-@ ice material . Bright patches of less red tint appear on the major slopes of Amalthea , but the nature of this color is currently unknown . The surface of Amalthea is slightly brighter than surfaces of other inner satellites of Jupiter . There is also a substantial asymmetry between leading and trailing hemispheres : the leading hemisphere is 1 @. @ 3 times brighter than the trailing one .

The asymmetry is probably caused by the higher velocity and frequency of impacts on the leading hemisphere, which excavate a bright material ? presumably ice ? from the interior of the moon .

Amalthea is irregularly shaped, with the best ellipsoidal approximation being  $250 \times 146 \times 128$  km . From this, Amalthea's surface area is likely between 88 @, @ 000 and 170 @, @ 000 square kilometers, or somewhere near 130 @, @ 000 . Like all other inner moons of Jupiter it is tidally locked with the planet, the long axis pointing towards Jupiter at all times . Its surface is heavily scarred by craters, some of which are extremely large relative to the size of the moon : Pan, the largest crater, measures 100 km across and is at least 8 km deep . Another crater, Gaea, measures 80 km across and is likely twice as deep as Pan . Amalthea has several prominent bright spots, two of which are named . They are Lyctos Facula and Ida Facula, with width reaching up to 25 km . They are located on the edge of ridges .

Amalthea's irregular shape and large size led in the past to a conclusion that it is a fairly strong, rigid body, where it was argued that a body composed of ices or other weak materials would have been pulled into a more spherical shape by its own gravity . However, on 5 November 2002, the Galileo orbiter made a targeted flyby that came within 160 km of Amalthea and the deflection of its orbit was used to compute the moon's mass ( its volume had been calculated previously ? to within 10 % or so ? from a careful analysis of all extant images ) . In the end, Amalthea's density was found to be as low as  $0.86 \text{ g / cm}^3$ , so it must be either a relatively icy body or very porous " rubble pile " or, more likely, something in between . Recent measurements of infrared spectra from the Subaru telescope suggest that the moon indeed contains hydrous minerals ( or organic materials ), indicating that it cannot have formed in its current position, since the hot primordial Jupiter would have melted it . It is therefore likely to have formed farther from the planet or to be a captured Solar System body . Unfortunately, no images were taken during this flyby ( Galileo's cameras had been deactivated due to radiation damage in January 2002 ), and the resolution of other available images is generally low .

Amalthea radiates slightly more heat than it receives from the Sun, which is probably due to the influence of Jovian heat flux (  $< 9 \text{ kelvin}$  ), sunlight reflected from the planet (  $< 5 \text{ K}$  ), and charged particle bombardment (  $< 2 \text{ K}$  ) . This is a trait shared with Io, although for very different reasons .

= = = Named geological features = = =

There are four named geological features on Amalthea : two craters and two faculae ( bright spots ) . The faculae are located on the edge of a ridge on the anti @-@ Jupiter side of Amalthea .

= = Relationship with Jupiter's rings = =

Due to tidal force from Jupiter and Amalthea's low density and irregular shape, the escape velocity at its surface points closest to and furthest from Jupiter is no more than  $1 \text{ m / s}$  and dust can easily escape from it after, e.g. micrometeorite impacts ; this dust forms the Amalthea Gossamer Ring .

During its flyby of Amalthea, the Galileo orbiter's star scanner detected nine flashes that appear to be small moonlets near the orbit of Amalthea . Because they were sighted only from one location, their true distances could not be measured . These moonlets may be anywhere in size from gravel to stadium @-@ sized . Their origins are unknown, but they may be gravitationally captured into current orbit or they may be ejecta from meteor impacts on Amalthea . On the next and final orbit ( just an hour before destruction ), Galileo detected one more such moonlet . However, this time Amalthea was on the other side of the planet, so it is probable that the particles form a ring around the planet near Amalthea's orbit .

= = Views to and from Amalthea = =

From Jupiter's surface ? or rather, from just above its cloudtops ? Amalthea would appear very bright, shining with a magnitude of ? 4 @. @ 7, similar to that of Venus from Earth . At only 8 arcminutes across, its disc would be barely discernible . Amalthea's orbital period is only slightly

longer than its parent planet 's day ( about 20 % in this case ) , which means it would cross Jupiter 's sky very slowly . The time between moonrise and moonset would be over 29 hours .

From the surface of Amalthea , Jupiter would look enormous : 46 degrees across , it would appear roughly 92 times larger than the full moon . Because Amalthea is in synchronous rotation , Jupiter would not appear to move , and would not be visible from one side of Amalthea . The Sun would disappear behind Jupiter 's bulk for an hour and a half each revolution , and Amalthea 's short rotation period gives it just under six hours of daylight . Though Jupiter would appear 900 times brighter than the full moon , its light would be spread over an area some 8500 times greater and it would not look as bright per surface unit .

= = Exploration = =

During 1979 , the unmanned Voyager 1 and Voyager 2 space probes made the first images of Amalthea , which resolved its surface . They also measured the visible and infrared spectra and surface temperature . Later , the Galileo orbiter completed the imaging of Amalthea 's surface . Amalthea provided the final satellite fly @-@ by for Galileo on 5 November 2002 , at a distance from the moon 's center of approximately 244 km ( 152 mi ) ( height about 160 ? 170 km ) , permitting the moon 's mass to be accurately determined , while changing Galileo 's trajectory so that it would plunge into Jupiter in September 2003 , having finished its mission . In 2006 Amalthea 's orbit was refined by New Horizons spacecraft 's instruments .

= = In fiction = =

Amalthea is the setting of several works of science fiction , including stories by Arthur C. Clarke and James Blish .