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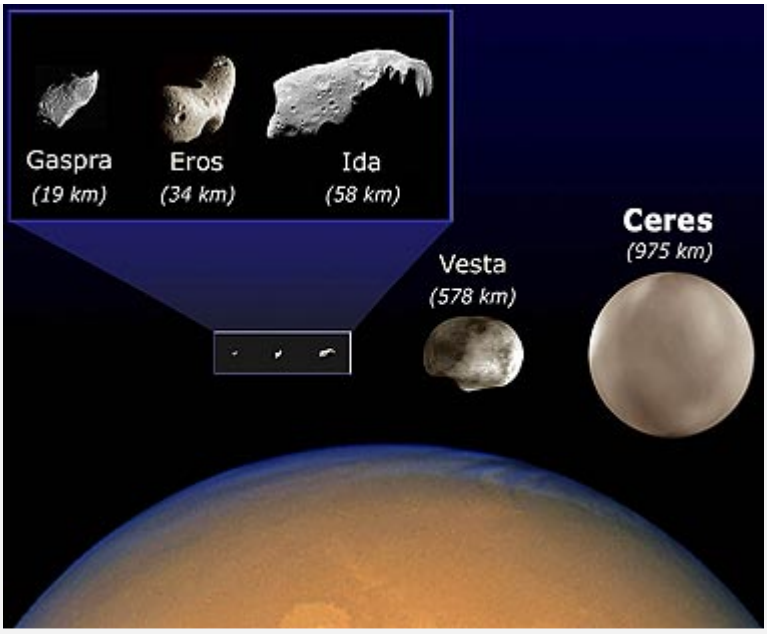
Why aren't all celestial bodies spherical?

Week 31

The heavens were divine in origin and, as a consequence, had to be perfect in structure and form; hence the astronomers of antiquity sought to discover perfect geometrical forms in the celestial bodies and their movements – spheres and circles. Today, we still look at the stars, planets and their moons as spherical bodies. But smaller celestial bodies such as asteroids and comets are often irregular in shape and tend to look more like potatoes. Why is that?



Comparison of the shapes of celestial bodies of various sizes

The form of a body is determined by the interaction between its gravity and solidity. Small asteroids and comets have little gravity, which is insufficient to force their larger rocks into a spherical distribution. But the gravity of the significantly larger moons and planets is so strong, by contrast, that it turns these celestial bodies into spheres. There are, of course, still uneven features on the surface of planets, such as mountains and valleys, but they become smaller as gravity increases. (See also the Astronomical Question from week 4: ‘What is the highest mountain in our solar system?’) Irrespective of the material composition of the celestial body, a diameter of a few hundred kilometres is sufficient to create a spherical form – the largest asteroids, Ceres and Vesta, already have a pronounced round shape.

The shape of celestial bodies – not perfect

Rotation – that is, the spin around their own axis – also plays an important role with regard to the shape of celestial bodies. The asteroid Cleopatra, for example, describes a full rotation in as little as 5.3 hours and therefore has the elongated form of a dumbbell: it is 217 kilometres long with a diameter of only about 90 kilometres. The large planets, too, are deformed through their rotation. The faster a planet rotates, the wider it becomes at the equator and the flatter at the poles. Our Earth is not a perfect sphere either. Its diameter over the poles is 42.7 kilometres smaller than at the equator.

Related Contacts
Dr.-Ing. Christian Gritzner
German Aerospace Center
Space Agency, Space Science
Tel: +49 228 447-530
Fax: +49 228 447-706
E-Mail: Christian.Gritzner@dlr.de

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