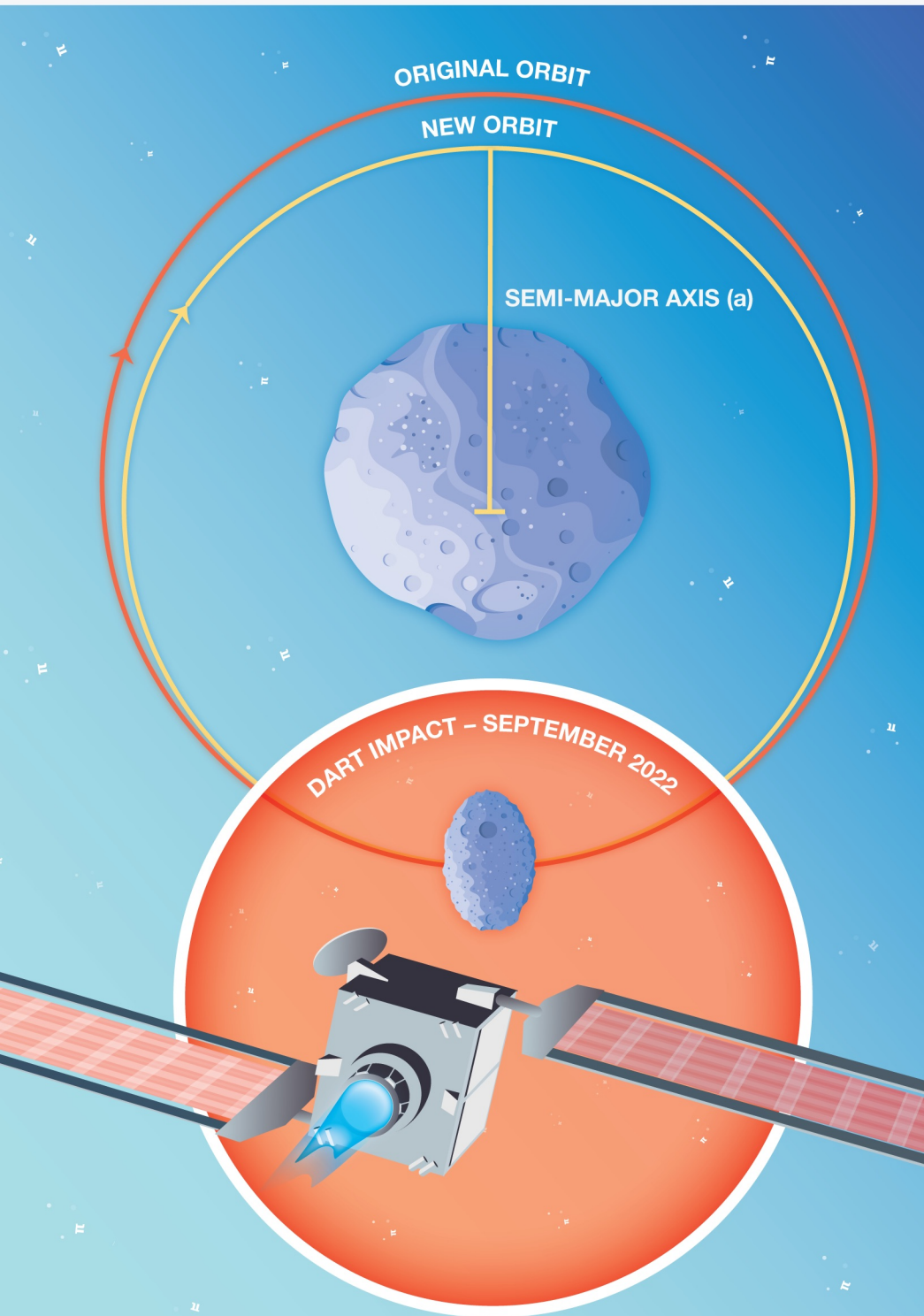




π IN THE SKY¹¹

Size up an asteroid's orbit. It's possible with pi!

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DARING DEFLECTION

The asteroid Dimorphos has a mass of about 4.3 billion kg and orbits the larger Didymos asteroid, which has a mass of 560 billion kg. In 2022, the DART spacecraft impacted Dimorphos to see if it was possible to change its orbit.

Before the impact, Dimorphos orbited Didymos every 11 hours and 55 minutes at a distance of 1.16 km in a nearly circular orbit with an eccentricity (e) of 0. After impact, Dimorphos orbited Didymos every 11 hours and 23 minutes with an eccentricity of 0.02. Use Kepler's third law to calculate the semi-major axis (a) of the new orbit, given that $T = 2\pi\sqrt{a^3/GM}$.

T = orbital period in seconds
 a = semi-major axis in meters
 G = gravitational constant ($6.674 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$)
 M = total mass of the binary system.

Use the semi-major axis and eccentricity to calculate Dimorphos' farthest distance from Didymos (apoapsis = $a(1+e)$) and closest distance to Didymos (periapsis = $a(1-e)$). How do these differ from the circular orbit?

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