

ASTRONOMY

Gravity synchronizes planets, moons in their orbital dance

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As kids, we learned the names and the order of the planets in our solar system. Mercury circles the sun in the tightest orbit, Venus is farther out, then Earth, and so on.

We learned that the sun's gravity holds the planets in their orbits and that each travels its own path, independent of the others.

Well ... sort of.

The orbits of the planets aren't really independent. Gravity is a universal force, so every planet pulls on one another. This leads to some beautiful and subtle examples of cosmic synchrony.

The distant planets Neptune and Pluto, for example, are in a 3:2 orbital resonance with each other. In the time it takes Neptune to orbit the sun three times, Pluto goes around twice.

Jupiter's large moons Io, Europa and Ganymede are in a 4:2:1 resonance. For every orbit of Ganymede, Europa circles Jupiter twice and Io goes around four times.

There are other kinds of resonance. The planet Mercury rotates on its axis three times for every two orbits around the sun. More familiar, Earth's moon rotates once for every orbit around the Earth, keeping the same side always pointed at us.

How did these planetary dances get started? The key is that our solar system, the planets and their orbits have changed over time.

Our moon is gradually spiraling away from Earth. Uranus and Neptune formed much closer to the sun than they are now. When orbits change, planets and moons can get trapped in resonances.

The same thing has happened in planetary systems around other stars. Nearly 200 stars are known to have at least one planet orbiting them.

Planetary scientists are taking this as evidence that planets "migrate" soon after they are formed, sweeping inward toward their parent stars and trapping each other in resonances.

Resonances also remind us that basic mathematical concepts are a fundamental part of our universe. The universe itself is mathematical.

Unfortunately, it's trendy now for people to distance themselves from mathematics. But saying you're "not a math person" is like saying you're "not an oxygen person." It's part of what you are. You can be annoyed by math if you want. But deny its importance and you'll never be in resonance with the universe.

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