STARS WOBBLE

There are many stars like our Sun. Some of these other stars also may have planets that orbit them. Even though Earth-based astronomers may not have yet seen a planet orbiting another star, they know such orbiting planets exist. How do they know? Because when a planet orbits a star, it makes the star "wobble". Astronomers can examine a star's wobble and figure out how big, how massive, and how far away from its star the planet is. At the start of the new millennium, there were nearly 60 planets that had been discovered by using the "wobble" method.

It all begins with gravity. Because of gravity, the Sun pulls on the planets, but it also means that the planets pull on the Sun (moons and planets tug at each other too). An orbiting planet exerts a gravitational force that makes the star wobble in a tiny circular (or oval) path. The star's wobbly path mirrors in miniature the planet's orbit. It's like two twirling dancers tugging at each other in circles.

Scientists use powerful space-based telescopes that orbit Earth to look for wobbling stars. Since they are outside of Earth's atmosphere, these telescopes can see the stars more clearly than telescopes on Earth's surface. Who knows? Someday scientists may use the wobble method to discover another solar system just like ours.

Laws of Planetary Motion

German astronomer Johannes Kepler (1571-1630) created a simple, precise description of planetary motion using records from Tycho Brahe, a Danish astronomer who had recorded the positions of the stars and planets with unprecedented accuracy. Kepler stated that each planet moves around the Sun in an elliptical orbit. He also started that a planet moves slower when it is farthest from the Sun, and fastest when it is closest to the Sun.

Kepler observed that each planet moves in such a way that if an imaginary line were drawn between the Sun and a particular planet, the planet "sweeps out" equal areas in equal times. This means that no matter where a planet is in its orbit around the Sun, the area of its triangular "sweep" remains the same for the same interval of time. Therefore, when a planet or satellite travels in an elliptical orbit, its orbital velocity is fastest when it is closest to the body it is orbiting, since the distance the planet must "sweep out" or cover in a given time is greatest. Its orbital velocity is slowest when it is farthest from the body it is orbiting, since the distance the planet must cover in a given time is less.

The speed at which a planet travels in its orbit is called its orbital velocity. The amount of time required by a planet to complete one solar orbit is called its orbital period (or period of revolution). Both are affected by a planet's distance from the Sun.

Newton's Law of Universal Gravitation

Newton's law of universal gravitation states that every object in the Universe attracts every other object in the Universe. The more massive the object, the stronger the gravitational pull. For example, Jupiter is larger than the Earth, so Jupiter has more moons because it is able to attract (capture) and keep more moons orbiting itself. The strength of gravity also depends on the distance of the objects. If the distance is greater, then the force is weaker. The Sun pulls less on Saturn than it does on the Earth because Saturn is farther away from the Sun than the Earth.

Reading Questions:

k) How do we know that planets circle other stars?

l) Why do Stars wobble?

m) Why does the Sun pull less on Neptune than it does on Mercury?