



3. Explain how astronomers can determine the mass of a binary star system like Albireo.

### **How does gravity work?**

by [Julia Layton](#)

Every time you jump, you experience gravity. It pulls you back down to the ground. Without gravity, you'd float off into the atmosphere -- along with all of the other matter on [Earth](#).

You see gravity at work any time you drop a book, step on a scale or toss a ball up into the air. It's such a constant presence in our lives, we seldom marvel at the mystery of it -- but even with several well-received theories out there attempting to explain why a book falls to the ground (and at the same rate as a pebble or a couch, at that), they're still just theories. The mystery of gravity's pull is pretty much intact.

So what do we know about gravity? We know that it causes any two objects in the universe to be drawn to one another. We know that gravity assisted in forming the universe, that it keeps the moon in orbit around the Earth, and that it can be harnessed for more mundane applications like [gravity-powered motors](#) or [gravity-powered lamps](#).

As for the science behind the action, we know that Isaac Newton defined gravity as a force -- one that attracts all objects to all other objects. Although many people had already noted that gravity exists, Newton was the first to develop a cohesive explanation for gravity, so we'll start there.

Newton publicized his Theory of Universal Gravitation in the 1680s. It basically set forth the idea that gravity was a predictable force that acts on all matter in the universe, and is a function of both mass and distance. The theory states that each particle of matter attracts every other particle (for instance, the particles of "[Earth](#)" and the particles of "you") with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

So the farther apart the particles are, and/or the less massive the particles, the less the gravitational force.

The standard formula for the law of gravitation is:

$$\text{Gravitational force} = (G * M1 * M2) / (A^2)$$

where **G** is the gravitational constant, **m1** and **m2** are the masses of the two objects for which you are calculating the force, and **A** is the distance between the centers of gravity of the two masses.

Some years before, Johannes Kepler had discovered a simple relationship between the average distance of a planet from the Sun (called its semi-major axis, **A**, measured in Astronomical Units) and the amount of time it takes a planet to orbit the Sun once (called its orbital period, **P**, measured in years). For objects orbiting the Sun, the semi-major axis to the third power equals the period squared:

$$A^3 = P^2$$

There were two problems with this relation. First, Kepler did not know how it worked, he just knew it did. Second, the relation does not work for objects which are not orbiting the Sun, for example, the Moon orbiting the Earth. Isaac Newton solved both these problems with his Theory of Gravity, and discovered that the masses of the orbiting bodies also play a part. Newton developed a more general form of what was called Kepler's Third Law that could apply to any two objects orbiting a common center of mass. This is called Newton's Version of Kepler's Third Law:

$$M_1 + M_2 = A^3 / P^2$$

This relation allows us to measure the mass of any two bodies in orbit around each other: a planet and its moon, two stars orbiting each other – even the sun orbiting the Milky Way galaxy (although we make some assumptions there.)

How does it work? Or do we have to accept this as something that just is, like the existence of matter, and move on? Update: Please, no tautological bowling balls on the trampoline! The bowling ball sags the trampoline and other objects roll towards it because of....gravity of the earth. If gravity is because of gravity, that doesn't help. Answer. Save.Â Scientists, however, have been very clever about how gravity works even though they have no real idea what is IS! The person who is attributed with "discovering" gravity is Sir Isaac Newton. Many people are familiar with the story of his great realization when an apple fell on his head.