Two Fundamental Questions about the Planets

What are the precise paths taken by the planets as they revolve around the Sun?

Johannes Kepler (1571 - 1630)

Why do the planets follow the paths that they do?

Isaac Newton (1643 - 1727)

Newton’s Law of Gravitation

\[ F_g = \frac{GM_1M_2}{R^2} \]

- \( M_1 = \) Mass of object 1
- \( M_2 = \) Mass of object 2
- \( R = \) Distance between the CENTERS of the two objects
- \( G = \) Gravitational constant

Fundamental Forces of Nature

The basic forces that are known to exist in Nature:

- Gravity
Suppose the Earth was located twice as far from the Sun as it currently is. How would the gravitational force exerted by the Sun on the Earth at this new distance compare with its strength at its old distance?

\[ F_g = \frac{GM_1M_2}{R^2} \]

Newton's gravity law is an example of an inverse square relation: The force of gravity decreases as the inverse square of the distance separating the objects.

**Today's Class: The BIG Picture**

Isaac Newton discovered that the same force that causes an apple to fall to the Earth keeps the moon in its orbit around the Earth. He called this universal force gravity.