There's Four Fundamental forces in our universe:

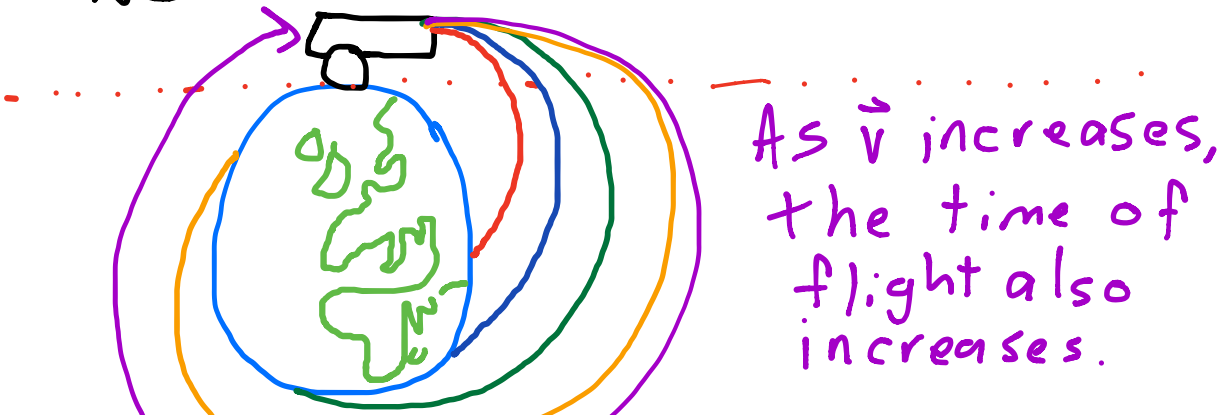
1. Gravitation - affects masses
2. Electromagnetism - affects charges
3. Strong Nuclear force - holds the nucleus together + bonds protons + neutrons.
4. Weak Nuclear force - causes radioactive decay

These forces do not require contact.

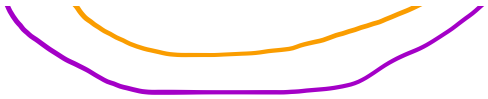
Newton's Law of Universal Gravitation

- Newton wants to know what keeps the moon orbiting the Earth.

Newton's Cannon - thought experiment



As $\vec{v}$ increases, the time of flight also increases.



The moon could be orbiting due to the same force as the force that causes projectile motion. (1st time anyone suggested physics works on Earth and "in the heavens.")

Newton says gravity must

- be proportional to the masses of the objects
  - No lower limit to mass
- be proportional to the inverse squared of the distance.
- there must be a Universal Gravitational Constant that determines the strength.

$$G = 6.67 \times 10^{-11} \frac{N \cdot m^2}{kg^2}$$

$$F_G = \frac{G m_1 m_2}{r^2}$$