Source: KBhPHYS201IntroToElectrostaticsLN

1 | Let's talk about Gravitational Fields

Each object has what's called **gravitational field.** Surrounding each object has what is effectively many tiny vectors getting weaker and weaker as you move away from the Earth.

Remember, this is *not the gravitational force* between two objects. This is simply the *gravitational FIELD* of one. To calculate the force of gravity from the Gravitational Field, simply use multiply the mass of the attractee to the gravitational field of the attractor, that is, $F_{grav} = M_{obj2} * GravField_{obj1}$.

Newton's Law of Gravitation

And for actually calculating the gravitational field, you will need

Definition 1 · **(A part of) Newton's Law of Gravitation** $Grav.Field = \frac{GM_{source}}{R^2}$
where G is a constant called "Gravitational constant"

For good measure, here's the two equations combined to form the full gravitational field.

Definition 2 · **Newton's Law of Gravitation** $F_{grav} = M_{target}\frac{GM_{source}}{R^2}$

It does not actually matter which object is the target and which one is the source. Because of an magical property called the "Multiplication is Commutative", swapping attractor and attractee will have the same numerical result for gravitational force. (*note! the field vectors are still different though*)

The units for *Gravitational Field* is $\frac{N}{kg}$, which, the keen-eyed will see, equals $\frac{m}{s^2}$, which, of course, is acceleration.

And now for a old piece of news:

Definition 3 · **(Roughly) Earth's Gravitational Field** $9.8\frac{N}{kg} = 9.8\frac{m}{s^2}$

Connection to Electric Fields

Gravitational fields, w.r.t. Newton's Law of Gravitation, is actually analogous to how the KBhPHYS201ElectricFields Electric field works. See there for some info on why that's the case and how it could work.