The Unified Forces of the Universe

Four forces govern and maintain the Universe. The light giving energy of the Sun, gravity, electricity, and even nuclear bombs are direct manifestations of these forces. This article explores the forces of nature and how they interact with our lives.

PRACTICAL SCIENCE WITH PHIL FREDA

Have you ever wondered what keeps matter together? Have you ever stared at the moon and wondered how it orbits around our planet?

When plugging in your cell phone to charge it at night, do you question how and what is causing the battery to charge?

There are four fundamental and unified forces that govern our universe. Every interaction in the universe is determined by them.

Gravity: *The Weakest of the Forces*
That's right, gravity is the weakest of the four forces.

I know what you're thinking: This guy has lost his mind!

Well, lets put this in context. Think about the Earth.

The amount of gravity an object has is proportional to its weight or mass. The more mass a body has, the more it gravitates other, smaller bodies toward it.

The Earth's mass, according to trueknowledge.com, is 13,169,533,693,875,800,921,604,096 pounds!
Now, I want you to do a small exercise with me.

Get out of your chair and jump, just once.

Are you back? Well, congratulations! You have just defied the Earth's gravitational pull on you, albeit briefly. The entire Earth is pulling on you and you are still able to jump in the air.

Just because gravity is the weakest of the forces does not mean it isn't important. Einstein's Theory of Relativity is mostly built around gravity. Without gravity, we would not only lose the moon, but our entire solar system would basically drift apart.

This works by distortion of space-time. Don't worry; it isn't that scary to understand.

Think about a long piece of fabric. If you want, have four friends hold the fabric at its four corners and suspend it in air. Now take a heavy marble and place it in the middle of the fabric. What do you notice? The fabric is now distorted in the middle and a depression has formed. This is essentially what our planet, or more appropriately, our sun does to space-time.

This distortion is what causes smaller bodies in space to gravitate toward a larger one.

The Weak Nuclear Force: *Decay and Balance*
This force may not be as familiar as gravity, but it is essential to keeping the universe's balance of matter and establishment of radioactive decay.

In the early universe, the vast proportion of matter was composed of hydrogen. A typical hydrogen atom is composed of 1 proton and 1 electron.

So where did all the neutrons come from?

The weak nuclear force is responsible for turning protons into neutrons and vice-versa. It is also responsible for turning one element into another via radioactive decay. The weak force is essential to the inner workings of the sun and without it, we would receive no light. This force is called weak because it works in only very short, subatomic distances, but it is still very important. (Quarked.org)

Electromagnetism: *Opposites Attract*
This is the force you can thank for your household lighting and appliances. Your computer's operation depends on electromagnetic interactions.

All of the molecules in your body are held together and form because of electrical attractions to one another. The proteins, nucleic acids, and sugars in your cells and body are held together as molecules because of attraction. Electromagnetism also regulates our brain's activity.

Without this force, molecules and life could not exist.

This force is also responsible for electricity. Electrons moving in a path create an electric current. Harnessing this current allows us to use devices in our everyday lives. Negatively charges electrons from electric conductors like metals are easily displaced from one point to another. Humans harness this movement everyday and power everything from lights to computers

This force, like gravity, has an effect at very long distances.

Strong Nuclear Force: *Source of Atomic Power*
Think back to elementary school science. Atoms are made up of negatively charged electrons, positively charged protons, and neutrons that have no charge. neutrons and protons make up the nucleus of most atoms.

We have a problem though. Since protons are positively charged and they are packed into the nucleus, shouldn't they repel each other? Well they actually do. But thanks to the Strong Nuclear Force and subatomic particles called Gluons, atoms stay together. It important that atoms stay together because without atoms-there is no organized matter.

This force is the strongest of the four forces by a large margin.

To demonstrate how powerful this force is, take the uranium fission bomb. Not literally of course (it's kind of illegal). When splitting uranium atoms, the energy of the strong nuclear force is unleashed. This is called nuclear energy, or a nuclear explosion. This energy is also harnessed in nuclear power plants.

The Forces Unified
The stability and organization of the universe stems from these known forces of nature. The unification of these forces allows for all of the manifestations of matter and energy that we require and enjoy, whether it

be the computer you are using now or the life giving energy of the sun. What would the universe be like without these forces? Think about it.