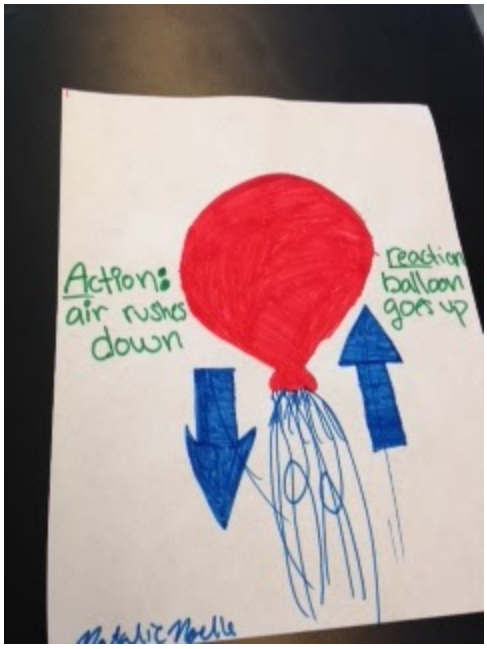
Laws of Motion and Relativity

"To me there has never been a higher source of earthly honor or distinction than that connected with advances in science."
-Isaac Newton

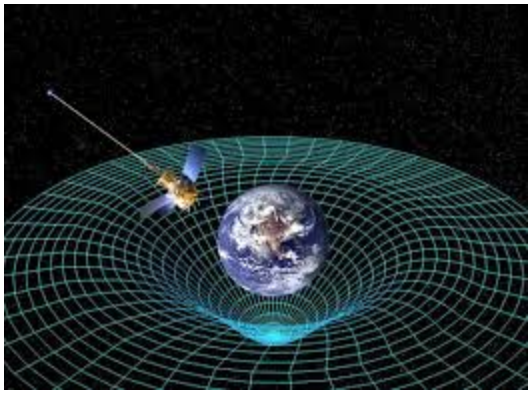
Everyone knows about Newtons three laws of motion, the laws of physics that explains, well, motion. The first law, often known as the law of inertia is: *An object that is at rest will stay at rest unless an external force acts upon it*. An object that is in motion will not change its velocity unless an external force acts upon it. The key point here is that if there is no net force resulting from unbalanced forces acting on an object (if all the external forces cancel each other out), then the object will maintain a constant velocity. If that velocity is zero, then the object remains at rest. And if an additional external force is applied, the velocity will change because of the force. The amount of the change in velocity is determined by Newton's second law of motion. *Acceleration is produced when a force acts on a mass. The greater the mass (of the object being accelerated) the greater amount of force needed (to accelerate the object).* The equation for this is F=ma, force= mass x acceleration. Newtons third law is undeniably the most well known: *For every action there is an equal and opposite reaction*.

Click here to view a video demonstrating this process



These laws were discovered by Sir Isaac Newton, the tale goes that, he was inspired by a single apple falling from a tree. For hundreds of years people took these laws of motion as the only explanation to the universe and everything about it, these laws were the law. But these laws start breaking down at the speed of light. Until a fine gentleman by the name of Albert Einstein came around. Einstein had a new theory of gravity, a new theory of the universe. Most everyone with a good education has heard of E = mc^2, the one inch equation that explains the universe. Objects move because they are pushed, not because they are pulled, so why does something fall to the floor if you drop it? You haven't 'pushed' it to the floor, so what has? Isaac Newton didn't know, so he invented something called gravitational pull. Albert Einstein reasoned, "No, this can't be right!" One day, Einstein was looking out the window in his patent office and he saw some men working on the roof, he wondered what would happen if one of those men were to fall off the roof. He had a vision, the man would not actually be feeling his own weight, he would be weightless. And then he imagined: if you're in an elevator and somebody cuts the cord, what happens to you? You fall, but the elevator falls at the same rate you do so you are weightless inside. So then Einstein got it, there is no gravitational pull! The earth is curving space around us and space is pushing us on the ground, space is pushing me to this chair as I type. Space itself, can be curved. Why does the earth circle around the sun? Some would say, "Well the Sun's gravity is yanking the Earth in a circle." Wrong, the earth is

going around the Sun because the Sun has warped the space around the Earth and space is pushing the Earth towards the Sun.



General Theory of Relativity and Newton's Laws of Motion are two of the greatest achievements of the human mind, they are both beautiful and simple and profound and the best theories of the universe are just that.

"Time travel used to be thought of as just science fiction, but Einstein's general theory of relativity allows for the possibility that we could warp space-time so much that you could go off in a rocket and return before you set out."

-Stephen Hawking