Relating the Universal Relatives

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http://gonitsora.com/relating-universal-relatives/

This article bears a completely non mathematical approach to relativity , and rather a philosophical viewpoint and is intended for high school students and for those who are very new to the theory.

Science, the other name for craze has led numerous people in history to come up with breathtaking breakthroughs in understanding our position in the universe. However in the whole of science nothing is as absolute and ingenious as the work of a crazy haired physicist. What I am talking about, centers the most beautiful, the most prolific, the most famous, the most ingenious equation in the whole of mathematical physics:

$$E^2 = M^2C^4 + (PC)^2$$

And the physicist is none other than “ALBERT EINSTEIN”. The theory basically is divided into two parts: THE SPECIAL and THE GENERAL. The special treats with the structure of spacetime whereas the general is all about the relativistic approach to gravity. Many of you out there must be wondering how this theory affects our daily lives or what are its advantages over classical Newtonian mechanics. Well frankly speaking, it doesn’t bring about much changes in our daily lives in contrast to its complete moveaway from Newtonian mechanics by a large extent, but it will if we are either too careful or too careless. Well, we must get to that later.

One of the most intriguing facts about nature is that the relative speed of light remains constant irrespective of the observer’s own velocity. How we get to that is beyond the scope of our discussion. But, we can obviously visualize this fact in our minds and figure out its implications. Thus, the whole of space or spacetime features two very basic phenomena- length contraction and time dilation.

The idea of time dilation of Einstein was so intuitively original that even after having understood and comprehended the theory most of the people of the then scientific community did not believe in it, it was rather considered too good to be true. The roots of the above mentioned equation started from the idea that mass contains energy, and the same realization which dawned upon Einstein in 1905.

Einstein’s curiosity on the behavior of light landed him into understanding and considering the speed of light was the cosmic speed limit and was a universal constant. It did not matter at what speed you are travelling at, the speed of light would be the same.(This was even in accordance to Maxwell’s electromagnetic equations. For instance, imagine a car travelling at the speed of c/5 and another at just 10 m/s. Since the speed of light was constant, there had to be another varying perimeter, and that exactly was time!

Einstein postulated that time was different for everyone. It must slow down or pace up to meet the requirements of the ‘principle of relativity’. Now what exactly is the ‘principle of relativity’. It is a basic assumption that the laws of nature are the same in all reference frames. You actually cannot pass a comment on whether you are at rest or in motion by simply observing things at some other reference frames. Infact, he bundled this idea of his in a wonderful manner!

$$?t\ (1 + u^2/c^2)^{1/2} = ?t_0$$

?t – time change in speeding reference frame, $?t_0$ – time change at rest

This was obvious from a set of equations given in 1904 by Lorentz in accordance to Maxwell's electromagnetic equations, but were brought into true use only by Einstein. Now the issue of length contraction crept up when Einstein considered as to how a body of similar dimension possess different time frames. This led to the idea of length contraction which implies that a speeding body does not only slow down in time but also reduces its dimension. This can again be given by Lorentz transformations as

$$x^{/}\ (1 - u^2/c^2)^{1/2} = x - ut$$

$x^{/}$ - speeding co ordinate

This two ideas were fundamental in relativity, the most outstanding theory in the history of physics, but was it all?

The theory mentioned above is the special relativity, which considers bodies at uniform speed, but what about bodies with a certain acceleration! This led Einstein to think about gravity. Since the speed of light was the cosmic barrier, gravity must also travel at the speed of light. This astounding insight led to the theory of general relativity. It basically states that the spacetime is curved and interwoven in the cosmos. A body having mass creates a dent in spacetime which then influences another body in spacetime. However extended discussion of general relativity is not done here.

Now, for some general implications of relativity.

Atomic bombs, as mentioned earlier as only possible through Einstein's relativity. The splitting of the atom in a nuclear reaction involves the conversion of about $1/10^{th}$ of the mass of the atom into energy. An uncontrolled emission of such a huge amount of energy results in atomic bombs.

GPS systems which uses general relativity to trace ones location is also common nowadays. Besides these, relativity has completely revolutioned our understanding of the universe and has opened new frontiers of research, however there is no saying as to whether relativity is absolutely accurate or is it the special case of a bigger theory? This mind boggling theory has so absurd consequences that it is hard to believe.It is however most appropriate to cherish the fact

NO THEORY IS SAFE!

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