Explaining Relativity for The Laymen

"When forced to summarize the general theory of relativity in one sentence: Time and space and gravitation have no separate existence from matter" - Albert Einstein (1879 - 1955)

Note: The following arises from a questioning email received from my sister, Beth, about Relativity Science Calculator and my answer in return:

Dearest Beth!

It's just Algebra.

And diagrams.

But truthfully it does defy ordinary common sense.

Think of it this way:

You're standing on the sidewalk. Ok? Ok.

Then you see someone going past you real, real fast! I mean speedily!!

Ok.

So?

Well, what do you see?

You see a guy being squeezed small, right?

Right.

Why?

'Cuz of the effects of inertia.

You know that.

You've experienced being pushed back into the car seat when speeding. Right? Right!

Ok.

But what about his watch on his wrist?

Well just like him, his watch also gets squeezed, no? Yes.

How so?

Well his watch on his wrist as you view him is not only getting squeezed smaller, but also because of the force of inertia the very hands of his watch are getting squeezed and they also don't move as fast as they do normally. Compared to you, of course. Your watch, silly. Right? Right. That is, the minute and hour hands of his watch are under stress and will not move normally and in fact will move much, much more slowly than before. Right? Right. Of course, how much slower and how much it gets squeezed is directly related to his/its speed relative to the speed of light itself.
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A little digression:

So what's inertia? Inertia is what you feel when you go speeding around in your car and get pushed to the opposite side of your seat as the car drives and turns, turns and drives. You feel the effects of inertia just like you feel the effects of gravity in other circumstances. Right? Right.

This isn't exactly saying what inertia is, not anymore than saying exactly what gravity is, but rather it's an "operational definition" for both. This is what mathematical science does all the time. Gives operational definitions, that is. In mathematics, of course. It's a language, no? Read: 'Thumbnail History of Religions and Science' .

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In other words, General Relativity is all about inertia's effects of pushing and pulling, pulling and pushing, on an object ... or, a guy whizzing past you.

This "watch - time" thing is obvious when you think about. Oh, your watch on your wrist and the other guy's watch on his wrist at the very, very beginning just at the moment of his speeding past you are first set to the same exact time. This is something which I'm asking you to imagine. Ok? Ok!

Then as this other guy speeds past, you will see him and his watch squeezed into a smaller and smaller shape and both he and his watch will considerably slow down. From your [relative] stationary view point on the sidewalk, yes!

So, there!

I've just basically explained General Relativity Theory to you.

But in Special Relativity because of the predominant role of the finite speed of light in bringing messages to our eyes, there's a time lag in viewing that guy's watch speeding off with him attached, so to speak. Light to your eyes in other words is lagging behind. If the speed of light was instantaneous, then there'd be no time difference(s). Right? Right!

Therefore, because of the finite speed of light, time coming from the speeding guy's watch will inevitably be lagging behind what you see on your own watch. Remember both watches [your's and his - why not a girl?] were originally coordinated to the same exact moment, even though "Speedo guy/gal" passed you by while you're standing [relatively speaking] stationary on the sidewalk. This apparent "slowing of time" in Special Relativity as measured by the relatively stationary observer seeing time pass as shown on Speedo's watch is called "time expansion" or *time dilation* .

You've got to use some thought or mind imagination here, Bethie!

So, just like when you look up at the stars, what you're really doing is looking way, way back in time as to what was coming from that star some [relative] time ago. Or planet. Whatever. But it's got to be something really, really far, far away and traveling at really, really high [relative] speeds away from you. Or me. Ha!

Got it? That's why astronomers measure distance in "light years"! And not in miles or baby steps!!

Same thing with Speedo guy's/gal's watch on his/her wrist as he/she goes whizzing by.

Got it now?

The other thing about Special Relativity is the shortening of lengths of guys and gals, measuring rods and other things as they go whizzing by you at speeds approaching the speed of light. Not at speeds you go when you're late for school or something. Relativity for slimming - down or dieting, anyone? Ha!

This latter concept of Special Relativity is more difficult to explain as it involves "some jiggering" by some mathematics to explain why the speed of light is always the same in whatever direction you measure it and in fact wherever you measure it - here in Connecticut, USA or out there in far, far off space. Therefore, at this point, don't even think of asking about this! If you want, you can visit Relativity Science Calculator web site at Albert Michelson Part I .

and continuing on successive pages in order to understand the jiggering mathematics involved.

Thought it couldn't be done, eh?

Oh, in the next lesson, I'll explain the $E=mc^2$ thing.

Not hard. Not really.

Just some simple words, that's all.

But what's harder is to write this all out in precise mathematics. The ultimate language of science!

But the essential ideas are not that difficult to understand.

Love ya!
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