Re: a relative question

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- *From*: "harry" <harald.vanlintelButNotThis@xxxxxxx>
- *Date*: Wed, 8 Aug 2007 15:12:58 +0200

<curiouseeker@xxxxxxxxxxx> wrote in message
news:1186576559.819088.64440@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
A physicist on Wikipedia suggested I post here. He also said I would
get flamed, but such is life.

I had a thought, which I'm told is wrong, but no one has told me why
and where the problems in my logic/understandings lie. I would like to
learn and see if I can develop this line of thought in a more informed
manner.

Sorry about the length, but here it is:

When calculating the total energy of a moving object, physicists use
the equation E^2=m^2c^4+p^2c^2.

E is the total energy
m is the rest mass
p is the relativistic momentum
c is the speed of light.

This equation suggests that an object will gain energy as its relative
speed increases.

p is defined as ?mv where ? is the relativistic element called the
Lorentz factor, defined to be 1/the square root of 1−v^2/c^2, v is the
relative velocity to the observer. This means that as v approaches the
value of c, ? will approach infinity. This takes the total energy
towards infinity.

The implication of this equation is that if a massive object is near a
relative speed of c, an impact with an object in the same inertial
frame as the observer could potentially release nearly an infinite
amount of energy. Equally, to accelerate an object to c would take an
infinite amount of energy.

Is it possible that this is not be the case?

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Harald writes:
Anything is possible. However, accelerator experiments up to collossal energies do agree.
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An object moving relative to the observer will be observed to have slower processes in accordance with the special theory of relativity. Time, and thus an objects ability to express energy, appears to slow down within any moving object. This means that if we accelerate an object at a steady rate (according to the observer), the acceleration within the observed object will be experienced as a steadily increasing rate of acceleration.

For example, if the steady acceleration is 9.8 m/s^2 to the outside observer, once time appears to be running at 1 second inside the observed object for every 100 seconds for the observer, those within the observed object will experience the acceleration at 980 m/s^2. As the observer attempts to accelerate the object to a relative speed of c, the acceleration experienced inside the observed object will be nearly instantaneous.

This is why circular particle accelerators take so much power. As objects approach very high relative speeds, any acceleration is going to take more energy because we are effectively increasing the acceleration. However, I must wonder whether the view that an object is increasing its mass is the most accurate way of viewing this event.

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Mass increase is a convenient way to look at it. But that has more to do with customs and philosophy than with accuracy: people still use the same mathematics.
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So what about the first law of thermodynamics? Regardless of what is going on within the observed object (the normality within) we, the observers, are pouring in enormous amounts of energy to accelerate even the tiniest particles to a large fraction of c. What work is possibly being accomplished? Where is the energy going?

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For an electron some explain it as follows: the energy goes into building up its magnetic "field". The increase of its relativistic mass measures its increased field energy.
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My suggestion is the work being done is changing the inertial frame.

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It costs no energy at all to change the reference: you are free to choose any inertial "frame" for your calculation, just as in Newtonian mechanics.

Good luck with the flames. :−)

Harald

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