Relativity for Young People

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Something weighs more when it's moving than when at rest! Everything is shorter when it is moving than when at rest!! Finally, clocks run slower when moving than when at rest!!! All of these statements seem absurd to most non-scientists today and, slightly over 100 years ago, would also have seemed absurd to the complete scientific community. However, all three statements are true. The statements have been verified experimentally over and over again. They are unquestionably true. The statements have been accepted as true by the scientific community. We will show you now why they are true.

First we will tell you what all material things are made of. The universe is filled with a gas of very small spherical particles. The gas is called the "ether." "Tornado-like" assemblages of these particles spontaneously form from random fluctuations of flow of this gas. These assemblages all translate at the speed of light. They vary in mass over a broad range, and they have long lifetimes – billions of years. These assemblages of the ether particles are called neutrinos.

There are at least two particles of different mass which can form circular orbits about a fixed center, and these two masses are the masses of the proton and electron. When at rest these particles take circular paths.

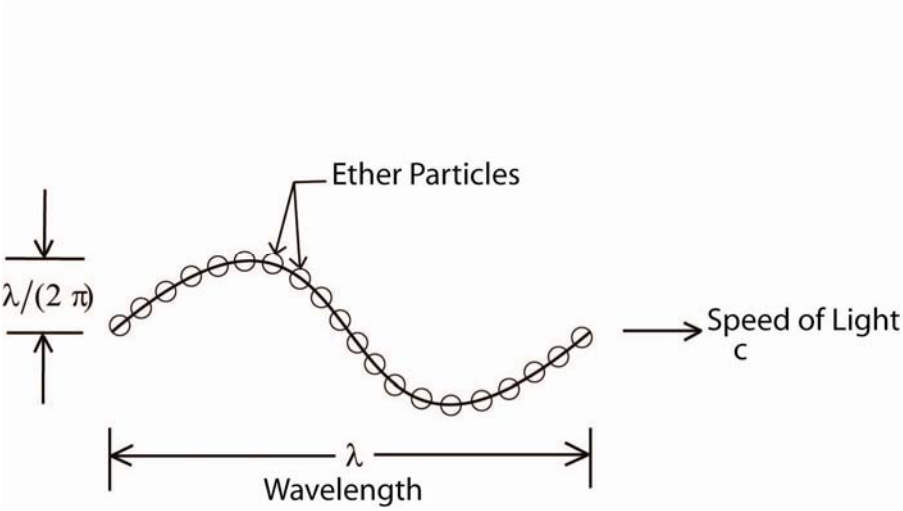
The particles orbiting in these circular paths "stir" the background, and this stirred background is called the "electromagnetic force field." The field can transmit particles and thus they are carried by a wave.

First we will tell you what all material things are made of. Each and every piece of matter in the universe is made up of an orbiting piece of mass that is moving at the speed of light. Since the mass is moving at the speed of lights, its energy is the magnitude of the mass times the square of the speed of light. Thus, all matter has energy, and the amount of energy is given by the famous formula

$$E = Mc^2$$

When matter is at rest, each of the basic constituent particles making up matter move in circular paths. In order for a matter particle to move it must be impacted by mass. The mass required to make things move is almost always in the form of a photon.

A photon is a "string" of ether particles stretching along one sine wave, see the figure.



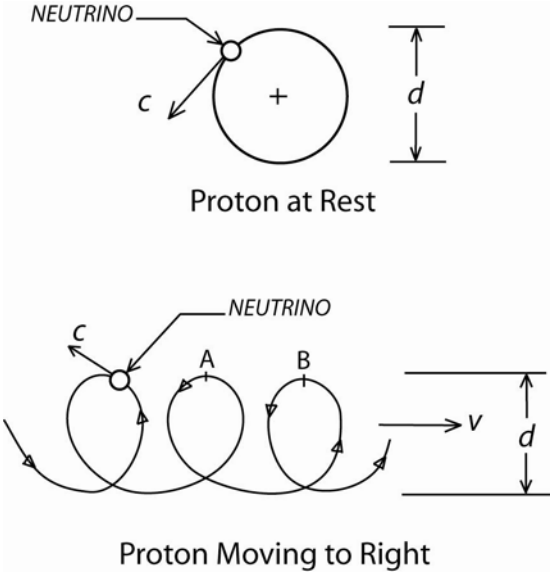
The more massive the photon is the more ether particles it has. If the number of particles is doubled then the photon has twice the mass, but surprisingly, it has half the length. The number of ether particles per unit length of the more massive photon, therefore, is four times as great as for the less massive photon. When a photon impacts matter, part of the photon particles are captured by the matter, and part bounces off. When photons have impacted and changed the velocity from zero (i.e., from rest) to the value v the mass increases so that its value is given by

$$M_v = \frac{M_0}{\sqrt{1 - (v/c)^2}}$$

In this expression M_v is the mass when moving at velocity v, M_0 is its mass when at rest, and c is the velocity of light.

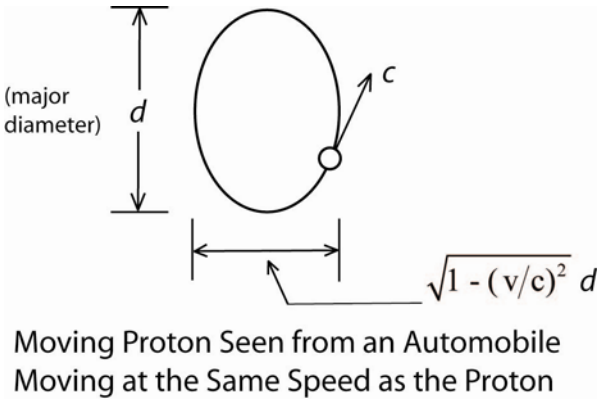
We will now investigate the mechanism by which matter moves. All ordinary matter is made up of atoms, and all atoms are made up of elementary matter particles which consist entirely of neutrinos in orbital paths. Consider the proton which is one of

these elementary particles. When the proton is at rest, its neutrino takes a circular path. When a photon impacts it, the neutrino takes a spiral path.



The figure shows the proton at rest and moving at velocity v to the right. The neutrino in either case always moves at the speed of light.

If one views the moving proton from an automobile, for example, which is moving to the right at velocity v, then the spiral path shown above appears as an ellipse. The ellipse has the same major diameter as the proton at rest. However the minor diameter is decreased by the factor $\sqrt{1 - (v/c)^2}$, see the figure.



Thus, the proton shrinks in the direction of motion. Every elementary particle in a solid moving at velocity v shrinks by this same amount. Thus, the length of the solid in the direction of v shrinks by this same amount: $\sqrt{1 - (v/c)^2}$.

The distance traveled by the neutrino in one cycle in the moving proton, such as from A to B, is larger than the distance around the circle for the proton at rest. The velocity of the neutrino is the same in both cases (it is the speed of light). Thus, the time required for one cycle is greater for the moving proton. The time for one cycle while moving T_v is related to the time for one cycle when at rest T_0 is

$$T_v = \frac{T_0}{\sqrt{1-(v/c)^2}}$$

Most clocks, as all material things, are made up of elementary particles, and their mechanisms are governed by the behavior of the elementary particles. Thus, a moving clock runs slower than a clock at rest.