ESSAY TEN: THE COVARIANT MASS RATIO

In classical physics the concept of mass is an ideal. In a very rough description it is a point in space at which the mass is concentrated. So the mass of a perfect solid sphere is concentrated at its centre of mass, the origin of the sphere. In an object of any shape, its mass is also concentrated at its centre of mass. In special relativity the mass is also considered to be a constant, because it is a scalar that remains the same in any frame of reference. It is said to be invariant under the Lorentz transformation. In some of the older textbooks can be found the concept of varying mass in special relativity, but this concept was quickly abandoned, the mass stays the same in any frame. In special relativity the rest mass is referred to now as the mass of an object in a frame of reference in which that object is not moving. This is called the rest frame. Every object, including the photon or corpuscle of light, has mass. Otherwise that object must move at c, the maximum velocity allowed in standard special relativity. If so, it has no rest frame, and there is conceptual trouble and self contradiction of the type that pervaded and later saturated the old standard physics. The latter forced the photon to have no mass in order to suite its preconceptions. This is always a bad idea, it is better to look at data first, and build a theory on data as advocated by Francis Bacon. Then we would not have had those multiple dimensions, an expensive pastime.

In general relativity, all is geometry, the idea of point mass has to be abandoned because there is always finite, geometrical, volume. There is no geometry in which volume is zero. There is no singularity in nature. The mass is replaced by mass density in general relativity. For example in the old Einstein theory, now known to have used the wrong connection symmetry, there appeared concepts such as density of dust, or fluid continua. The density of dust in general relativity is still unsatisfactory because it leaves aside the question of what volume each dust particle must occupy. ECE theory was designed from the beginning to improve the old Einstein theory, which is why it was named the Einstein Cartan Evans (ECE) theory. The old general relativity was based axiomatically on curvature only. It seems that the mathematics used by Einstein from 1905 to 1915 did not have the concept of torsion in it at all. This was pointed out to Einstein by Cartan in the nineteen twenties, but Einstein and all others of the old general relativity continued to set torsion to zero quite deliberately. This meant that they used a three index object known as the geometrical connection that was randomly asserted to be symmetric in its lower two indices. In late 2002 I came across a book by Carroll, in which the torsion was developed correctly and rigorously from the action of the commutator on any tensor. It follows that this method must mean a connection that is antisymmetric in its lower two indices. I realized that the old general relativity was meaningless, and I developed ECE to base physics on a correct relativity, a physics based on torsion combined with curvature.

In 2003 I used this correct geometry to rewrite the most fundamental theorem of Cartan=s differential geometry as given in Carroll=s third chapter. This theorem means essentially that differential geometry is independent of the coordinate system used to describe it. The theorem is known, very obscurely, as the tetrad postulate. Without it there could be no vector analysis for example, because a complete vector field in Cartesian coordinates would not be the same as in another coordinate system. So it is hardly a postulate, it is very fundamental, so much so that no physicist would bother to question it, only the most abstruse of pure mathematicians unable to contribute anything to physics. I could see that the tetrad postulate leads straightforwardly to the ECE wave equation in which the d=alembertian added to a quantity R (eigenvalues) operates on the tetrad as eigenfunction to give zero. From that I deduced, generalized, and improved the Dirac equation for a fermion with finite mass, and also the Proca equation for a boson with finite mass. In so doing I gained an insight into

what is meant by mass itself in this improved and corrected general relativity which I named ECE theory. The quantity R is expressed in terms of geometry, namely the tetrad and spin connection, and is made up of both torsion and curvature. The ECE wave equation reduces to the Proca or Dirac equations only in a limit in which R becomes R0. The latter is the square of m0 c / h bar where m0 is the quantity usually known as classical mass, and h bar is the reduced Planck constant. The covariant mass ratio is the square root of R divided by R0, or alternatively m divided by m0. Here m is defined by R, and so m is a property of geometry and may vary with geometrical parameters. In contrast the old m0 is fixed and does not vary as mentioned already.

In October 2010 the theory of scattering and absorption suddenly collapsed completely as described in UFT 158 to 163 and in essay nine. This has given an opportunity of working the CMR into the physical sciences, and we are at that point now. As far as I can see at present this is the only way forward without abandoning all that has been built up in several hundred years of natural philosophy and falling back on pure empiricism. So we are at a major turning point with plenty of opportunity for new discovery. The CMR is being worked at present into scattering theory, one of the most frequently used theories in physics. I am an inductive and positive scientist, alway out to improve and discover new things, new ideas. I prefer to keep as much of the old physics intact as is possible, and to improve it to give it more ability to describe nature. After all, natural philosophy is the attempt of the feeble human intellect to describe the workings of nature and therefore of ourselves.