Essay 13: THE MEANING OF THE COVARIANT MASS RATIO

The covariant mass ratio originates in the eigenvalues of the ECE wave equation, the most fundamental equation of differential geometry and therefore the most fundamental statement of the philosophy of relativity, that all physics is geometry. The denominator in the covariant mass ratio is the rest mass, the mass that appears in the standards laboratories and tables of elementary particle masses. Until October 2010 it was thought that this is the only type of mass in nature, constant mass being a cornerstone of both special and general relativity. In that month the old physics disintegrated as described in previous essays, notably essay twelve, and in UFT papers 158 to 163 to date. The ECE wave equation was inferred in 2003 and has the format of the wave equations of physics notably the Klein Gordon equation for a particle without spin and the Proca equation for a boson with mass. Using the SU(2) representation space the ECE wave equation can be reduced to the Dirac equation for a fermion with mass. The ECE wave equation contains the parameter R, the meaning and nature of which was inferred in 2003 by the fact that for the free particle R reduces to the quantized format of the Einstein rest energy, which is rest mass multiplied by the square of c.

More generally R is defined by the differential geometry of Cartan, the wave equation being a restatement of the tetrad postulate of differential geometry. In physics or natural philosophy R must therefore be a generalization of rest mass or rest energy. This type of inference cannot be found in the old Einsteinian general relativity, now known to be incorrect mathematically and to have been corrected by ECE theory. The need to generalize the concept of mass became dramatically clear during the weeks of October, in which emerged the October Postulates of ECE theory in UFT 161. The choice facing physics now is to develop and investigate the properties of R logically and systematically, or to abandon the basics of quantum theory and special relativity as put together by de Broglie in his complete statement of wave particle dualism. Therefore the numerator in the covariant mass ratio is defined by R, and the ratio is an expression of a new property of nature. The concept of rest energy is retained intact, because the invariant hamiltonian of general relativity is half the rest energy.

The de Broglie / Einstein equations become grossly self inconsistent when they are used rigorously in scattering, diffraction and absorption theory. The self inconsistency expresses itself through varying particle mass. In the old physics this makes no sense at all, but in ECE physics the R parameter means exactly this, a mass concept that depends on geometry. In general, R depends on the connection and tetrad. These are the basic quantities of differential geometry in terms of which are defined the torsion and curvature. The covariant mass ratio is most clearly and simply defined in elastic scattering, for example elastic electron or neutron scattering. In this case the ratio becomes the Lorentz factor, meaning that there exists in the natural philosophy of elastic scattering the dynamical mass, the product of the rest mass and the Lorentz factor. These concepts do not exist in the old physics, which did not know the catastrophic failings that lay hidden in its basic assumptions.

In the old physics, general relativity was built up from a given metric by use of a constant mass. The hamiltonian in the old general relativity was a constant and as fundamentally important as in classical non relativistic physics. The first attempt at general relativity was made by Einstein when he made the second Bianchi identity as known to him proportional to the covariant Noether Theorem. This procedure produced a field equation, and solutions to that field equation were sought using a metrical method in which mass m was the rest mass. With findings of October 2010 this method is no longer tenable. It has also been found that that early field equation of Einstein used the wrong symmetry of connection. His second Bianchi identity did not include the fundamental geometrical property of torsion.

In special relativity mass in the old physics was the first Casimir invariant, the second one being spin. These concepts were developed by Wigner when he extended the Lorentz group to the Poincare group. So by very definition as invariant, mass in the old special relativity could not vary. So the results of October 2010 (UFT 158 to163) are very profound. Mass is no longer an invariant, it is related to R. Only the rest mass can now be invariant and thus define the hamiltonian as half the rest energy. Mass also has a dynamical property or facet, the numerator in the covariant mass ratio. These radically new concepts must not be confused with the early idea in special relativity that mass could be Lorentz transformed. That idea was quickly abandoned. Under the general coordinate transformation, the tensor properties making up R behave in a well defined manner, defined by the transformation properties of any tensor.

The search is now on for the way in which the covariant mass ratio will behave in general scattering theory, in which it is a kind of spectrum that depends on scattering angle, initial and final angular frequencies. The methods used to show the limitations of twentieth century physics in October 2010 were basically simple, but the way in which the old physics collapsed was difficult to find, the first signs of an entirely new physics.