ESSAY 54: New Concepts in Relativity

Usually in the textbooks we are told that Newton inferred the inverse square law of gravitational attraction at Woolsthorpe Manor in 1665 while Cambridge was closed for the plague, and in the popular image an apple is supposed to have struck Newton on his head. Usually this is about all that the general public knows about physics, apart from E equals m c squared if they really want to show off. After the apple bounced off it is assumed that Newton inferred his third law of action and reaction are equal and opposite, or he may have been knocked out and inferred nothing until he came around, when he realized that gravitation is universal, it being a full moon. All this is a fantasy. The boring truth is that Robert Hooke inferred the inverse square law and sent Newton a question - what is the force of attraction that gives the ellipse? Newton got the answer wrong but he did do brilliant work in developing differentiation and integration. The boring truth is told by my own ancestor John Aubrey in the literary classic "Brief Lives", now online. I was shown a second edition of the Principia (first edition 1687) by Mansel Davies, who told me that he, a Cambridge man, did not understand a word of it. It seems as if no one else did either. The problem is to describe an orbit with a force of attraction that acts along a line joining the apple and Newton's wig, assuming he had one at such a young age. As described in essay fifty one this is not possible, a theory of direct attraction does not produce an orbit. In order to produce an orbit a centrifugal force has to be introduced, and this is not a force. Something is introduced that does not exist, and that is really a dream.

So being a chemist and an Aberystwyth / Oxford man I decided to apply common sense. This was done in UFT 196, Section 3, to find that the inverse square law of attraction, so called, is just another way of expressing the functional dependence of an ellipse. Given a constant total angular momentum, a basic property of a planar orbit, the ellipse differentiated twice is what has always been known as Newton's force of attraction, the inverse square law. There is no centrifugal force. The latter indeed does not exist. In coming to this conclusion I used nothing except differentiation in cylindrical polar coordinates, and did not use the concept of potential energy at all. The result was exactly what is needed, an elliptical orbit in a plane, with constant total angular momentum, is equivalent to an inverse square law with a negative sign. To be precise, which is always a good idea, the linear acceleration is a negative valued inverse square law that is always directed along the line joining a mass m orbiting a mass M. The concept of force is mass m multiplied by this acceleration. It is doubtful in real history whether Newton inferred this definition (the second law) chanted by thousands of terminally bored pupils, force is mass times acceleration. Some scholars attribute it elsewhere. Koestler in "The Sleepwalkers" attributes the idea of force to Kepler.

In casting around for a completely new theory of relativity this key finding of UFT 196 must be put in terms of Cartan geometry and ECE theory, where everything is expressed in terms of spacetime torsion - orbital torsion and spin torsion. After trying out various ideas in notes for UFT 197, upon which I am working now, I decided in note 197(5) to use dimensional analysis to find the relation between spacetime angular momentum and spacetime torsion. In their full glory both are vector valued two - forms of Cartan geometry. This means exactly nothing to the huge majority, which is the trouble with physics. The essence of what I found is much simpler to explain: the torsion is an inverse square law for constant angular momentum. The details of this can be developed. So the object known in all textbooks as "the force of attraction", is proportional to the torsion, and in its full glory force is also a vector valued two - form. So having found the origin of the inverse square law in the dimensional relation between angular momentum and torsion, it

becomes possible to reverse the procedure of UFT 196 and to deduce that this inverse square law gives the elliptical orbit. It does this without potential energy and with a non existent centrifugal force. The orbit of m around M is stable and lasts forever if it is not disturbed. The torsion is governed by the correct Cartan and Evans identities, so gives the field equations. In this new idea the torsion is not constant, but the angular momentum is constant. The torsion is directly proportional to the angular velocity.

If for any reason the object m is stopped, it falls directly into M through an inverse square law due to orbital torsion. The apple falls on to Newton's ahead and he awakes to find that the moon is still full. We proceed towards a new relativity.