Essay 105: Angular Relations in Three Dimensional Orbits

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In thought of the past four hundred years the theory of orbits has been based on a mirage, the illusion of orbits in a plane. It is obvious that orbits are planar, or are they? Why should they be planar in a three dimensional classical space? As usual there is no answer from the dogmatists, those who seek to impose the human mind on nature, never a good idea. Observations in the solar system can now be complemented by a myriad of others, notably galaxies. The only vaguely planar galaxy is the whirlpool galaxy, most galaxies are manifestly and self evidently three dimensional structures of stars orbiting the centre of the galaxy. At the centre there is thought to be a very large mass. Black hole fogma is ruled out by advances in ECE theory.

The great elegance of universal gravitation meant that it became very difficult to let go of it. This is typical of the human mind, it seeks the familiar and is disturbed by the new. Universal gravitation meant to most people for a very long time that everything is known, the inverse square law of Robert Hooke accounted for elliptical orbits and the apocryphal apple of Isaac Newton. The inverse square law has always been attributed to Newton, but according to my ancestral cousin John Aubrey, it was made known to the younger Newton by Robert Hooke as a test of Newton's analytical powers. Probably it was inferred intuitively by Hooke and developed by Newton and Leibniz by inventing the mathematics of differentiation and integration. The inverse square law of attraction produces a planar orbit because the mathematics assumes a planar orbit and the use of the plane polar coordinates.

It is now known that the tiny precessions of planets and other objects in the solar system and elsewhere in the universe are due to three dimensional mathematics. The plane polar are replaced by the spherical polar coordinates in the kinetic energy. The potential energy remains the same. The inverse square law is retained intact, but the kinetic energy is worked out in three dimensions instead of two. This is obvious and things are always obvious in retrospect, looking backwards at the inference. The precessions are explained very simply as the ratio of the total angular momentum magnitude L to its Z component L sub Z. The precession is the fly in the ointment of universal gravitation, which cannot explain it classically. The reason is now known at last, after four hundred years of fogma or groupthink. All orbits in a three dimensional space are three dimensional. Blazingly obvious in retrospect.

The supreme elegance of Nature is that it reduces all this to a simple ratio.

The theory of three dimensional orbits in its full glory is very complicated, (UFT269 ff) because the kinetic energy becomes a complicated function of the two angles phi and theta of the spherical polar coordinates system . This complicated combination of theta and phi also involves the square of time derivatives, and it can be expressed as the square of the time derivative of an angle beta. The orbit can then be expressed as a conic section in the angle beta, but the latter must be expressed in terms of theta and phi in order to obtain the physically meaningful orbit. In order to do this a lagrangian analysis is needed, with Euler Lagrange equations in r, phi, theta and beta. This procedure gives differential relations between the angles beta, theta and phi. These must be integrated by computer and fortunately the result is analytical, resulting in equations that express beta in terms of phi, and beta in terms of theta. So the beta conic section can be translated into a physically observable orbit. The latter consists of r as a function of phi, r as a function of theta or r as a function of both theta and phi. The beta conic section can also be translated into Cartesian functions, giving the sixteen classification of UFT275.

Many different kinds of vivid graphics are possible, and some of these, by Horst Eckardt, are given in recent UFT papers and on the diary or blog of www.aias.us. They are

already well known around the world.

The precession of the planets in the solar system is in general a complicated function of phi, but for small angles this reduces to the simple ratio L divided by L sub Z as shown in UFT276. The solar system precessions are only a few arc seconds per orbit, or revolution of 360 degrees, so this ratio is an excellent approximation. It dispels with the complexity of the mathematics, and can be used routinely by any astronomer. The entire subject of orbit theory must now be changed systematically, because it is known that orbits precess on the classical level. They are never the perfect illusion of universal gravitation.