Essay 57: A New Theorem of Geometry and General Relativity.

The origin of this new theorem can be understood by considering the simple clockwise rotation of a vector in a plane XY. It is obvious that the vector has been rotated with fixed axes. If the obvious is thought about, new discoveries are made. If the vector is kept unchanged, and the axes Y and X are rotated anticlockwise, the end result is the same. The clockwise rotation of the vector with axes fixed is known as an active rotation, and the anticlockwise rotation of the axes with a fixed vector is a passive rotation. The active rotation is equivalent to a passive rotation it is exactly the same thing. This has been well known for centuries, and appears in every textbook.

To start our train of thought, consider what is meant by an active rotation in terms of geometry. In the nineteen twenties, the great mathematician Elie Cartan developed the type of geometry that is used in the ECE theory of unified physics. In this geometry, vectors and axes can both move, and they can move in any way. The movement of the axes is described by the word “connection”, and in Cartan’s geometry this becomes the spin connection. If the axes are fixed there is no spin connection. An active rotation is therefore described by a geometry in which the spin connection is zero. The passive rotation is the rotation of axes with fixed vector. The idea of a fixed vector means that its derivative vanishes. The derivative of a constant is zero. So the rotation of the axes with fixed vector is described completely by the spin connection.

The derivative is used so often in dynamics that it too needs to be thought about. The linear velocity for example is the time derivative of the position vector in three dimensions. The idea of the derivative can be extended to any number of dimensions n. It is then called the n derivative. In four dimensions it is known as the four derivative. The use of four dimensions became centrally important with the advent of special relativity. The four dimensions became those of spacetime and space was no longer independent of time. In the dimensions of spacetime the four derivative is known as the ordinary derivative, and is expressed by the mathematical methods introduced by Minkowski. The Minkowski spacetime is flat spacetime, which is described by a geometry in which there is no connection present. So movement in this flat spacetime is described by the partial four derivative of a vector, and a vector in Minkowski spacetime is known as a four vector. Motion in Minkowski spacetime is the motion of a vector with fixed, four dimensional, frame of reference.

At this point it is suddenly realized that this movement is equivalent to the movement of the frame of reference with fixed four vector, and that ANY type of motion of a vector in any number of dimensions is equivalent to the motion of the frame of reference, and any type of motion can be described by the spin connection, keeping the vector fixed. The derivative of the vector with the spin connection included is known as the covariant derivative of the vector. This means that the covariant derivative retains its tensorial format under the most general coordinate transformation. The ordinary four derivative does not retain its tensorial format in this way. The covariant derivative is a sum of two terms: the ordinary derivative and a spin connection term. The equivalence of active and passive rotation means that these two terms are equal. This is a new theorem of geometry and general relativity valid in any mathematical space and any number of dimensions.

A rotation of a vector in the plane XY is an example of the geometry of Cartan. The active rotation of the position vector with fixed axes is described completely by a derivative, for example a time derivative to give the orbital linear velocity. The passive rotation of the axes with fixed vector is described completely by spin connection components. The passive rotation has never been considered in dynamics. When it is considered, any orbit in a plane can be described by components of the spin connection of Cartan. This means that orbital theory becomes a rigorously correct theory of general relativity to replace the failed Einstein theory. In the solar system the planar orbits of planets and all objects around the sun are described entirely by the spin connection, in other words they are described by the movement of a frame of reference, an idea of general relativity. For any kind of rotational motion in a plane, the spin connections can be evaluated quite easily. These ideas can be extended to all types of orbits observable in astronomy, and a new cosmology has been forged. From the spin connection we know the torsion and the field equations of the ECE theory of unified physics.

It is important to think about the obvious.