Introduction

A theory of gravity has to explain:

- The force of gravity
  - Why the force is proportional to the mass of the source of gravity
  - Why the force is proportional to the mass of the object being attracted
  - Why it obeys an inverse square law
- The slowing of clocks by gravitational potential
- The delay in the transit times of radio signals passing close to the sun
- The bending of the path of light passing close to a star or black hole
- Gravitational redshift
- The missing 43 arc seconds per century in the advance of the perihelion of Mercury

It must start with the fact that matter is composed of elementary charged particles.

Many attempts have been made to unify the force of gravity with the electric properties of matter. The discovery of the neutron in 1932 put an end to such speculation, and it was not until the development of quark theory in 1964 that theories based on electric interactions once more became tenable. By that time, thinking had moved on and forces were thought to be exerted by the exchange of virtual particles.

The theory we shall advance here is based on the assertion that the electric fields of all the individual elementary charged particles coexist in space. When a mass falls under the action of gravity, it accelerates gaining kinetic energy. It is customary to say that the increase in kinetic energy results form a decrease in gravitational potential energy, but what is gravitational potential energy?

We assert that the energy released when a mass falls under the action of gravity comes from the energy stored in the electric fields of its elementary charged particles. The total energy in a mass m is $E = mc^2$ consisting of electric energy and kinetic energy. Three-quarters of the electric energy is stored in the electric fields of the elementary charged particles and a quarter exists as potential energy due to the separation of positive and negative charges. The kinetic energy of a body is stored in the magnetic fields generated by the motion of its elementary charged particles.

We assert that in each other's presence, the coexisting electric fields exert an influence on each other reducing their ability to store energy. The primary effect is on the two properties called the permittivity and permeability of space. The change in the value of these properties influences many things including the separation of atoms in matter, the energy levels within atoms, inertial mass and the rate of time dependent processes.

As matter is added to a planet or star, each additional elementary charged particle results in a reduction in the energy contained in the electric fields of all the other particles subtracting a further portion of energy. This is not a subtraction process as in 1, 0.9, 0.8, 0.7, 0.6, … but a multiplicative process such as 1, 0.9, 0.81, 0.729, 0.6561, … The exponential function e^{-x} describes this form of repeated multiplicative action when a very large number of multiplications by a fraction slightly less than 1 take place. It is defined as:

$$e^{-x} = \lim_{n \to \infty} \left(1 - \frac{x}{n}\right)^n$$

The gravitational potential Φ at a point is defined as the work which must be done to slowly remove a unit mass from that point to an infinite distance. It is a negative quantity. We shall show that the influence of gravitational potential is described by the function $e^{\frac{\Phi}{c^2}}$.

In the weak gravitational fields of our solar system $\frac{\Phi}{c^2}$ is very small and we can use the approximation $e^{\frac{\Phi}{c^2}} = \left(1 - \frac{|\Phi|}{c^2}\right)$ mostly resulting in the same equations as those of Einstein's theory.

The predictions of this theory differ from Einstein's in that we assert that the contraction in the length of rulers does not depend on their orientation. Neither does this theory predict the existence of event horizons where $2|\Phi| = c^2$. However sufficiently massive neutron stars are greatly reduced in size relative to Euclidean space and the extreme magnitude of gravitational potential makes them appear very much like black holes.

Einstein's General Theory of Relativity is based on the assumption that there is a physical entity called space-time which is curved by the presence of mass to produce the effects of gravity.

Our theory is a physical explanation of the force of gravity and the effects of gravitational potential on matter and electromagnetic fields. Gravitational potential exists as a physical property of the electric fields of the elementary charged particles.

While there is a considerable overlap in the resulting equations, the two theories are both physically and philosophically very different. In particular, our understanding of time is very different. We assert that time exists in nature only in the infinitesimal element *dt*, with the whole universe existing in the moment of now. Time to us is a way of classifying our memories of previous states of the universe. The finite speed of light means that we see the world as it was, seeing objects at different distances as they were at different times in the past! We take this into account in our theories of relativity, but Einstein's world view reverses the causality of nature. His reality is space time and he derives his physics from its nature. Our reality is the physical world and from an understanding of its physical processes, we derive the effects on measurements of space and time.

The General Theory of Relativity states that in the presence of a massive body, space time is curved. This may be a beautiful piece of mathematics, but as physics, it is nonsense. Matter and electromagnetic fields are affected by the gravitational field. That includes the body itself which if sufficiently dense and massive, will take on the appearance of a black hole. The space around such an object remains Euclidean and time remains Newtonian. The gravitational field affects material objects causing rulers to contract by a factor $e^{\frac{\Phi}{c^2}}$ and clocks to slow by the same factor because the time between ticks increases by a factor $e^{-\frac{\Phi}{c^2}}$. These physical effects apply equally to light which, because speed is distance divided by time, is slowed by a factor $e^{2\frac{\Phi}{c^2}}$. These are physical effects described relative to Euclidean space and Newtonian time.

Although we assert that there is no such physical entity as space-time, nature does enact some of the the geometrical properties attributed to the R3 component of space-time. This is because physical length is a property of electric potential fields. These are physical entities and they are physically affected by gravitational potential. When we observe that the ruler has contracted, it is because the physical presence of all the coexisting electric fields has contracted. Nature acts within that reality.

We will use the term "Euclidean" to describe the geometry of space which mathematicians refer to as R3. Space is infinite. We can imagine it spanned by a Cartesian co-ordinate system of unit 10^{30} *m* at which scale our universe is lost somewhere in the middle of a grid cube. As we zoom in, we have to keep dividing our base vectors into 10 smaller units and grid cubes into a 1000 smaller cubes. After doing this 20 times, we end up with a grid cube which most of our solar system would fill. Another 10 times and we have a Euclidean cube with sides 1 long. Now remember, this is a mathematical artefact. We are drawing these grid lines squares and cubes in our imagination. The metre unit we are using has the same definition in terms of the

wavelength of light, but with one extra stipulation. The light must be emitted from a atom way out in space far beyond our universe where its gravitational potential has no influence. We can likewise define a Newtonian second from the frequency. As creatures of this universe, we and everything in it are subject to the effects of gravitational potential. Our metre rulers are shorter than a Euclidean metre and the seconds which are ticked off on our atomic clocks are longer than the Newtonian second. Unfortunately, we can at best guess by how much because we do not yet know the mass of the universe, or of our galactic core.

Einstein's general theory of relativity does not admit to the existence of Euclidean geometry and Newtonian time scale. Its exponents will go so far as to say that time and space do not exist outside of our universe. We assert that this a nonsense. That the effects of gravitational potential on rulers and clocks can be described against the background of Euclidean space and Newtonian time. Even if they are only mathematical concepts which would need a God [who can hold the universe in the palm of his hand as if it were no bigger than a acorn] to draw the grid lines and enumerate the passing of time; they are never the less meaningful concepts.