An Open Letter to the Scientific Community on Gravitational Free Fall

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Abstract/Introduction

For over 30 years I have been thinking about gravity. This exercise has led to the formation of the IWPD Research Center, Inc in 2001 and the publication of the book: "Energime, A Theory of Everything, Yet, almost Nothing at All" in 2005. During the course of this 30 year adventure it has become apparently clear that often times in scientific inquiry the path that leads us to a new understanding is not necessarily the best path to take in describing one's ideas and findings. The path to discovery is often scattered and filled with advances and failures with pieces coming together here and there. Putting these pieces together in a coherent fabric is nearly as challenging as the discovery of each new piece of knowledge itself. To see something in one's mind and to express it coherently to others are two distinct challenges that require two unique skill sets.

The intent of this letter is to provide a complete, logical and sequential argument for a physical explanation of gravity. I will be referring to this as IWPD Scale Metrics (ISM) theory. The appealing aspect of ISM is that it is not an alternative theory to General Relativity, but rather a unique graphical representation that is equivalent to General Relativity. Why pursue a new approach? Because as good as General Relativity has been, it has some problems – most notably in its inability to be unified with Quantum Theory.

A Preoccupation with Four-Dimensional Spacetime

One must start this journey with an understanding of the difference between reality and intellectual models that provide answers in close agreement with observation. Four-dimensional spacetime is clearly such an area. We have become very complacent with the notion that we live in a four-dimensional space-time. However, all we really know is that the curvature of four-dimensional spacetime provides us with a model that provides results that closely match gravitational observations. That, in and of itself, does not make four-dimensional spacetime a guaranteed reality.

This point can be clearly demonstrated by the spherical model often used to introduce the concept of curved spacetime. As the story goes, if two individuals start at the equator and both walk along their respective meridian toward the North Pole, they will move closer to each other as they walk northward toward the pole. If they are unaware of the curvature of their space they might conclude that a force was acting on them causing them to move together. Hence, this type

of reasoning is often presented as a way of documenting how gravitation is not a true force but rather a curvature of spacetime. However, one can state with equal confidence that if the two were unaware of a force acting on them within a flat space, that they might conclude that their geometry was curved. The point being that it is not possible to determine which of the two above statements is correct. Therefore, four-dimensional spacetime is simply a convention used that may or may not have any close association with what is truly real.

We (the scientific community) must logically be open to other possible models that also closely agree with observation. While there are other theories of gravitation, such as Brans-Dicke, these theories also are generally based on a curvature of spacetime. It is the extent of curvature and the relationship between curved spacetime and the curvature of space itself that provides the distinction between these various theories.

ISM is a new look at gravitation using a logical development that is firmly based upon agreement with observation. We start this adventure with the basic concept of a worldline. The path traced out by an object in spacetime. Several key points to make: The 4-velocity is always equal to unity and is tangent to the worldline at any point. The reflection of the 4-Velocity onto the x-axis provides an observed 3-Velocity and the reflection of the 4-Velocity on the y-axis is equal to a proper time interval. Now, General Relativity states that our 3-dimensions of space are moving at a constant speed of c in a 4^{th} dimension of time which is orthogonal to the three spatial dimensions. We are unaware of this, because we also move along this 4^{th} dimension at the speed of c. This is what allows a very small curvature in spacetime to be manifested within our spatial dimensions as a rather significant deviation from a straight line, hence – a perceived force.

ISM states that it is possible to describe gravity in a manner that is equivalent to the geometry of General Relativity using only three spatial dimensions. This can be easily shown as follows:

Diagram A: a worldline that is curved due to the influence of a massive object

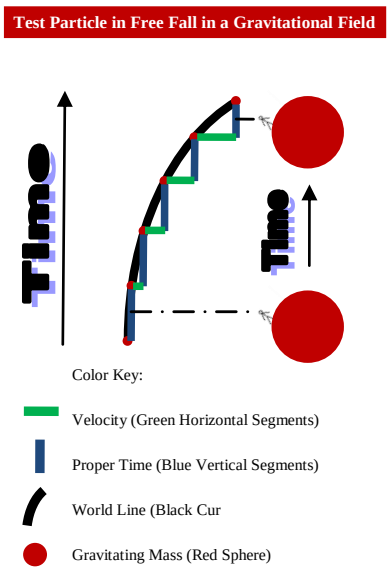


Diagram B: the worldline as observed by an individual on the massive object

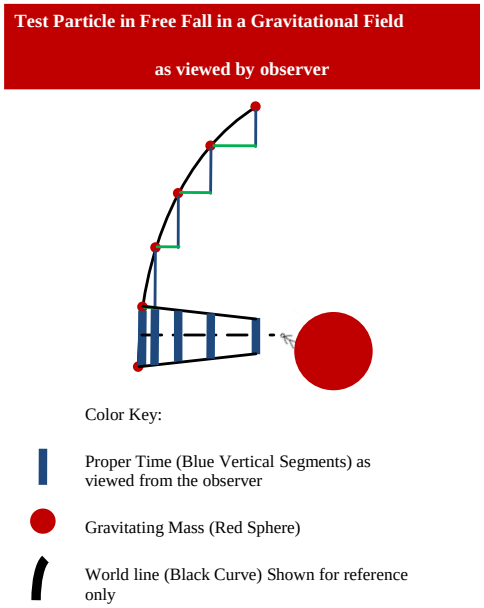


Diagram C: suggests that perhaps the time dimension does not really exist and the effects of gravitation can be depicted by a density distribution within the three spatial dimensions.

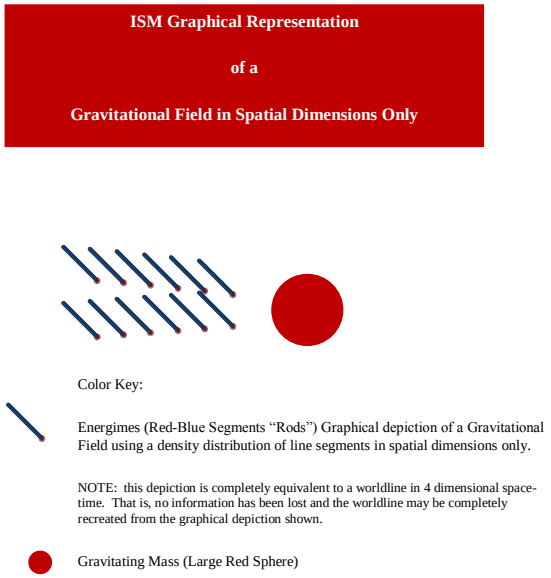


Diagram C is completely equivalent to Diagram A. What do I mean when I state that the ISM depiction is equivalent to a four-dimensional worldline? Simply that no information has been lost. If one is provided with Diagram C they can reconstruct the exact worldline shown in Diagram A with only the information provided in Diagram C. ISM changes the focus from the geometry of four-dimenional spacetime to a density distribution within three spatial dimensions. Why is this of interest? Because all other fundamental forces are defined via an exchange of virtual particles. ISM theory positions gravity in a manner that much more closely resembles the other fundamental forces.

However, Diagram C has little benefit unless it is possible to develop a construct that given specific conditions will provide the appropriate density distribution.

The Formalism of the ISM Theory of Gravity

ISM looks at the pattern of Diagram C and asks a simple question: What might cause this pattern to occur? An obvious place to start is to suggest that the gravitating mass is emitting something that alters the density distribution that weakens as you move further away. Therefore, I pursued the idea that gravitation may be due to a decay process in which energy is emitted by a gravitating mass with said energy being manifested as free space. I have named the decay "particle" the energime. The word particle was placed in parenthesis in the previous sentence because the energime actually has dimensionality to it and is better described as a line segment or "rod." However, a decay process alone cannot explain the pattern. The density distribution changes far too slowly to be due to a decay process alone. There appears to be a background field that is overlayed upon the decay process that "buffers" the change in density due to the decay of the gravitating mass. The source of the background field is the decay of all other masses within the visible universe. Therefore, ISM gravity is due to the decay of a gravitating mass in conjunction with the total energime density due to the decay of all matter within the visible universe. The field created by the mass of the universe is referred to as the Background Energime Field (BEF). The field due to a gravitating mass at a given radius is determined by both the decay of the gravitating mass and the effects of the BEF and is called the Local Energime Field (LEF). The strength of the LEF can be determined by a ratio of the BEF to the combined effects of the BEF and the locally decaying gravitating mass. This effect may be quantified as follows:

$$LEF = \frac{BEF}{BEF + \left(\frac{GM}{R}\right)}$$ where GM/R provides the contribution of the gravitating mass.

Note, the BEF in ISM theory is equivalent in scale to the 4-Velocity and is defined as unity. Therefore, the LEF equation may be further simplified to:

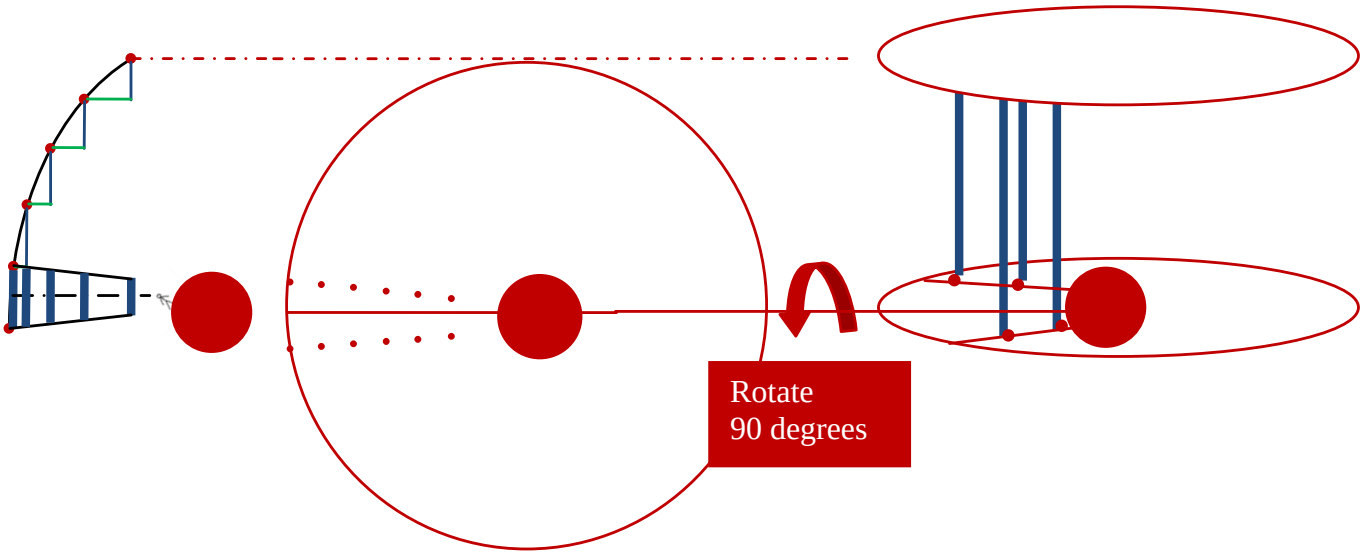
$$LEF = \frac{1}{1+\left(\frac{GM}{R}\right)}$$

Once the LEF is know it is possible to determine the free fall velocity of a test particle from infinity to a given radius for any gravitating mass:

$$v = \sqrt{1-\left[\frac{1}{1+GM/R}\right]^2}$$

The Dimensionality of the Energime

The energime decay of a gravitating mass is captured by the expression GM/R. This provides strong observational support for the concept that the energime is not a "point" but rather a "rod" that extends with dimensionality within a spatial dimension. A decay process in which points are emitted would be expected to change in density with the radius squared. That is, the density would change with the surface area of a sphere as the radius changes. Instead, the observational data supports a process that changes with the radius and therefore changes in density with a circle as the radius changes. One clear explanation of this observation is that the energime has dimensionality and that this dimensionality represents the passage of proper time. This can be shown as follows:



Energime dimensionality is not shown in the diagram directly above because it lies directly perpendicular to each energime "point" on the page

By rotating 90 degrees, the energime dimensionality is seen in the diagram directly above. It is portrayed as a line segment or "rod" that represents the passage of time. It is equivalent to the total passage of proper time as depicted by the worldline in the diagram at the far left.

The dimensionality of the energime serves a purpose in ISM theory that is very similar to the role of time in four dimensional spacetime. In General Relativity, the time dimension serves to intensify the effects of curvature. The path of motion as observed in three spatial dimensions is much more pronounced than the much buffered curvature of four-dimensional spacetime. This is due to the motion of time at the speed of c. Likewise, in ISM theory the time segment buffers the decaying effect of mass into free space. As such, spacetime in ISM Theory is defined by the dimensionality of the energime.

In ISM Theory, the energimes defining the BEF further buffer the change in density of the free energime field resulting from a gravitating mass. This allows the actual path of an object in a gravitating energime field to be more extreme than the very modest change in its actual energime density. The impact of this buffering effect can be expressed as a scaling factor that is related to the mass of the universe as compared to the mass of the gravitating body. The relationships is quantitatively determined at weak gravitational fields and at low speeds to be:

$$\text{Scaling Factor} = \sqrt{\frac{8M_{Universe}}{M_{Gravitating}}\left(\frac{R}{2h}\right)}$$

This relationship can be modified to reflect the Scaling Factor for any gravitational field with a test particle at any velocity. The general form of the relationship may be expressed as:

$$\text{Scaling Factor} = \sqrt{\frac{M_{Universe}}{X^3 M_{Gravitating}}\left(\frac{R}{2h}\right)}$$ where h is Planck's Constant and X may range from 0.5 at low speeds to 1.0 at c and is quantitatively defined as the proportionality constant required to relate energy to mass x velocity squared:

$$X = \frac{E}{mv^2} \quad \text{or} \quad E = Xmv^2$$

Note, at low speeds $\frac{1}{X^3}$ is equal to 8 as is the case for the low speed, weak gravitation equation.

In ISM theory, Energy is defined as the total number of energimes contained in a mass and momentum is defined as the orientation of that energy as quantitatively defined as:

$$\text{Momentum} = XE = \frac{mv}{\text{Scaling Factor}}$$

This replaces the orthogonal relationship between energy and momentum in 4-Vectors with a linear relationship in combination with a scaling factor. The advantage of the ISM approach is

that it allows for the clear flow of momentum between objects in the same way in which energy flows from one entity to another.

The Benefits of ISM Theory

There are many benefits to ISM theory. A number of these are listed below. I wish to focus on two specific aspects of ISM that are of particular importance. ISM Gravitation converts the geometry of General Relativity to an energime density distribution that can be viewed as a decay process that overlays a background energime field. ISM theory inherently changes the focus of gravitation from geometry to particles.

Gravity can be viewed as the emission of energimes defining free space and altering the space near a gravitating mass. Or, it can also be equally viewed as the exchange of particles between two objects in a "flat" energime field. Simple stated, ISM gravitation provides a description of gravity that is completely equivalent to General Relativity in a way that describes gravity in a manner much more closely aligned with the exchange of particles that define the other fundamental forces. This alone should provide incentive to more closely explore ISM theory.

ISM Theory also provides a framework for the evolution of the universe. It inherently requires an inflation like epoch, followed by slower expansion and ultimately a universe seen as undergoing an accelerating rate of expansion consistent with what is predicted from the observation of Type Ia Supernova. These properties are required by ISM theory and are not subject to the manipulation of initial conditions or other hand set properties. Using ISM theory, the estimated age of the universe is 14.2 billion years old.

IWPD Scale Metrics (ISM) is a featured accomplishment of the IWPD Research Center. ISM uses an innovative coordinate system that allows four-dimensional space-time to be fully described using only three dimensions. This is achieved by embedding time within a spatial dimension. The resulting entity is a two-dimensional segment plotted within a three-dimensional coordinate system. ISM modeling describes time as expanding within our spatial awareness as opposed to the abstract orthogonal relationship required by General Relativity. We are highly encouraged by the success of ISM and its contribution to some of the current challenges in Cosmology.

ISM Predicts

- The age of the universe to be 14.2 billion years
- An acceleration in the rate of universal expansion consistent with Type Ia Supernova observations
- The density of matter (Baryonic and Lambda Cold Dark Matter) to be in alignment with observation

- An explanation of the large value of the Planck Mass in relationship to the much smaller mass of observed particles by defining a new fundamental mass
- The fundamental mass, the electron and the proton are all shown to have relationship to each other and to a unified background field
- Dark Energy may be shown to have physical properties through the decomposition of matter into free space
- A unification of gravitation with QED and Strong Nuclear Forces as they each play out within a unified Background Energime Field (BEF)
- A new model for the physics occurring at the Event Horizon of a Black Hole

For More Information

Please visit our website at www.iwpd.org for more information on this topic and the other research activities of the IWPD Research Center.

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