Algorithm for Describing Spherically Symmetric Metrics of a Gravitational Field — Using Space, Time & Angle Metric Components & Metric Coefficients

By
Robert Louis Kemp

Super Principia Mathematica
The Rage to Master Conceptual & Mathematical Physics

www.SuperPrincipia.com

www.Blog.Superprincipia.com

Flying Car Publishing Company
P.O Box 91861
Long Beach, CA 90809
January 25, 2013

Abstract

This paper described a new algorithm, for "generalized mathematical formalism" of a "Spherically Symmetric Metric" (ds^2), that describes the ***Euclidean Metric, Minkowski Metric, Einstein Metric, or the Schwarzschild Metric***; using ***Three (3) Metric Components & Three (3) Metric Coefficients***; and likewise using a general algorithm which is composed of, ***Two (2) Metric Components & Two (2) Metric Coefficients***.

In this paper a general introduction to basic mathematical concepts for the geometric description of Euclidean "Flat-Space" Geometry and Non-Euclidean "Curved-Space" Geometry, and Spherically Symmetric Metric equations which are used for describing the causality and motion of the "Gravitational" interaction between mass with vacuum energy space, and the mass interaction with mass.

This paper gives a conceptual and mathematical description of the differential geometry, of flat and curved space, space-time, or gravitational fields, using the "metric theory" mathematics of Euclidean, Minkowski, Einstein, and Schwarzschild, Spherically Symmetric metrics, and geodesic line elements.

Keywords: General Relativity, Special Relativity, Einstein Field Equation, Gravitational Field, Black Hole Event Horizon, Spherically Symmetric Metric, Euclidean Geometry, Non-Euclidean Geometry, Minkowski Metric, Einstein Metric, Schwarzschild Metric, Physical Singularity, Coordinate Singularity, Perfect Fluid Vacuum Energy, Aether, Gravity, Space-time Curvature, Flat Space-time, Curved Space-time, Geodesic, Metric Theory of Gravitation,

Contents

- ***1.0*** ***Introduction***

- ***1.1*** ***Algorithm for Describing Spherically Symmetric Metrics of a Gravitational Field Using – Three (3) Metric Components & Three Metric Coefficients***

- ***1.2*** ***Euclidean "Flat Space" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm***

- ***1.3*** ***Minkowski "Flat Space-Time" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm***

- ***1.4*** ***Schwarzschild "Curved Space-Time" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm***

- ***1.5*** ***Einstein "Curved Space-Time" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm***

- ***1.6*** ***"New" Algorithm for Describing Spherically Symmetric Metrics of a Gravitational Field Using – Two (2) Metric Components & Two (2) Metric Coefficients***

1. Introduction

This work is written to physicists that are interested in understanding from a conceptual view, the description of "Flat Geometry" Euclidean Space, or "Curved Geometry" Non-Euclidean Space, for describing causality for gravity motion, and the "Gravitational" interaction between mass with vacuum energy space, and the mass interaction with mass.

In this paper, I do weave ***some of my own theory, ideas, and mathematics*** into these well established physics concepts and mathematics; therefore, this work is written for those that have a very good basis and understanding, of the concepts of differential geometry, and General Relativity; to be able to distinguish what is newly proposed, and what is being discussed in general throughout this paper.

In this work I have limited the discussion only to the: Euclidean, Minkowski, Einstein, and Schwarzschild Spherically Symmetric Metrics, and geodesic line elements, of space, space-time, or the gravitational field, however there are many other geometric "metric" equations, and theories of gravitation, that are accepted by the mainstream physics. And there are many "Spherically Symmetric Metrics" that are in use in physics today.

In a paper written by M.S.R. Delgaty and Kayll Lake (1998) "**Physical Acceptability of Isolated, Static, Spherically Symmetric, Perfect Fluid Solutions of Einstein's Equations**"[1], they describe various "Spherically Symmetric Metrics" (ds^2) equations.

M.S.R. Delgaty and Kayll Lake "[1], state,

> "It is fair to say then that most of the spherically symmetric perfect fluid "exact solutions" of Einstein's field equations that are in the literature are of no physical interest."

And likewise in a paper by, Petarpa Boonserm, Matt Visser, and Silke Weinfurtner (2005) "**Generating perfect fluid spheres in general relativity**" [2], they describe that there are over 127 solutions to the "Spherically Symmetric Metrics".

But only nine (9) of those "metric" equations satisfy the criteria for predicting actual physical measurable results.

The various ***"Spherically Symmetric Metric"*** (ds^2), equations which are either Euclidean or Non-Euclidean, describes physical and observable results of gravitational interaction between mass and space, and between mass and mass, predicts that the vacuum energy, and inertial matter in motion interact, through a ***space, space-time, or gravitational field, that is either flat or curved, and surrounding a localized gravity source, that is either matter dependent, or matter independent***, is described in the following sections of this paper.

The "Spherically Symmetric Metric" (ds^2), and the "Geodesic Line Element" (ds), are used for describing the "flat" or "curved" **Differential Geometry of Space, Time, & Surfaces**, of spherically symmetric space, space-time, or gradient gravitational field, in the presence or absence of condensed mass, matter, or energy.

Furthermore, the ***"Spherically Symmetric Metric"*** (ds^2) can describe the space, space-time or a gravitational field, of or surrounding the: universe, stars, planets, galaxies, quasars, electrons, protons, neutrons, atoms, molecules, photons, etc…

In this work, a new algorithm, for "generalized mathematical formalism" of a "Spherically Symmetric Metric" (ds^2), that describes the ***Euclidean Metric, Minkowski Metric, Einstein Metric, or the Schwarzschild Metric***; using one general equation which is composed of, ***Three (3) Metric Components & Three (3) Metric Coefficients***.

And likewise there is a general algorithm which is composed of, ***Two (2) Metric Components & Two (2) Metric Coefficients***.

In future works, a new algorithm, that describes the ***Euclidean Metric, Minkowski Metric, Einstein Metric, or the Schwarzschild Metric*** using a general equation which is composed of:

- ***Four (4) Metric Components & Four (4) Metric Coefficients***

The ***Four (4) Metric Components & Four (4) Metric Coefficients*** algorithm is the current model used by the mainstream literature, and physics community; today.

1.1. *Algorithm for Describing Spherically Symmetric Metrics of a Gravitational Field Using – Three (3) Metric Components & Three (3) Metric Coefficients*

A "Spherically Symmetric Metric" (ds^2) is used for describing the "gravitational interaction" of a "flat" or "curved" **Differential Geometry of Space, Time, & Surfaces**, of spherically symmetric space, space-time, or gravitational field, in the presence or absence of condensed mass, matter or energy.

Next, a new algorithm, for "generalized mathematical formalism" of a "Spherically Symmetric Metric" (ds^2), that describes the ***Euclidean Metric, Minkowski Metric, Einstein Metric, or the Schwarzschild Metric***; using one general equation which is composed of, ***Three (3) Metric Components & Three (3) Metric Coefficients***.

In the modern literature of General Relativity (GR), it is common mathematical formalism, to use a Einstein tensor mathematical expression, in order to describe, a generalized Spherically Symmetric (ds^2).

Using the Einstein tensor mathematical expression of General Relativity, it also can satisfy the, ***Three (3) Metric Components & Three (3) Metric Coefficients***, algorithm, for "generalized mathematical formalism" of a "Spherically Symmetric Metric" (ds^2).

Spherically Symmetric Metric – Einstein "Tensor" Metric Expression

1.1

$$ds^2 = g_{\mu\nu} \cdot dx^{\mu} \cdot dx^{\nu} \rightarrow m^2$$

The "Metric "Tensor" Coefficient" terms (μ & ν; $= [1,\ 2,\ 3,\ 4]$), can take on values of one (1) to four (4), in this algorithm:

- Metric Coefficient (1) represents "space" – (g_{11})
- Metric Coefficient (2) represents "angular" "surface space" "latitude & longitude direction space" – ($g_{23} = g_{32}$)
- Metric Coefficient (3) represents "time" – (g_{44})

For starters, let's consider the following space, angle, and metric mathematical relations for a perfect fluid spherically symmetric gravitational field.

Differential Geometry "Individual" Cartesian & Spherical Coordinates, Radial Space, Latitude Space, and Longitude Space Metrics

1.2

$$\begin{bmatrix} dr^2 & = & dx^2 + dy^2 + dz^2 & \rightarrow & m^2 \\ dr_\theta^2 & = & r^2 \cdot d\theta_{Latitude}^2 & \rightarrow & m^2 \\ dr_\phi^2 & = & r^2 \cdot \sin^2(\theta_{Latitude}) \cdot d\phi_{Longitude}^2 & \rightarrow & m^2 \end{bmatrix}$$

Differential Geometry – Cartesian & Spherical Coordinates, Surface Metrics

1.3

$$\begin{bmatrix} d\Omega_{Map\,\theta\phi}^2 & = & \left(d\theta_{Latitude}^2 + \sin^2(\theta_{Latitude}) \cdot d\phi_{Longitude}^2\right) & & \rightarrow & radians^2 \\ ds_{Map\,\theta\phi}^2 & = & r^2 \cdot d\Omega_{Map\,\theta\phi} & = & \left[dr_\theta^2 + dr_\phi^2\right] & \rightarrow & m^2 \\ ds_{Map\,\theta\phi}^2 & = & r^2 \cdot d\Omega_{Map\,\theta\phi} & = & dx_{Map\,\theta\phi}^2 + dy_{Map\,\theta\phi}^2 + dz_{Map\,\theta\phi}^2 & \rightarrow & m^2 \end{bmatrix}$$

Black Hole Event Horizon - Schwarzschild Semi-Major Radius

1.4

$$r_{Schwarzschild} = \frac{2 \cdot m_{Net} \cdot G}{c_{Light}^2} = \frac{m_{Net}}{\mu_{L\_Black\text{-}Hole}} \rightarrow m$$

Space-Time – Isotropic "square" Speed of Light

1.5

$$c_{Light}^2 = \left(\frac{dr_{Light}^2}{dt^2}\right) = \left(\frac{dr^2}{d\tau^2}\right) = -\left(\frac{ds^2}{d\tau'^2}\right) = \text{Constant} \rightarrow m^2/s^2$$

Space-time – Square of the Speed of Space (Vacuum Energy Velocity)

1.6

$$(v(r,t))^2 = \left(\frac{dr^2}{dt^2}\right) = c_{Light}^2 \cdot \left(\frac{d\tau^2}{dt^2}\right) \rightarrow m^2/s^2$$

Next, we will present a new algorithm with a "classical mathematical" description of "generalized mathematical formalism" for describing the **Spherically Symmetric Metric** (ds^2) that describes **Differential Geometry of Space, Time, & Surfaces**, of a perfect fluid, spherically symmetric space, space-time, or gravitational field.

Using either the ***Euclidean Metric, Minkowski Metric, Einstein Metric, or the Schwarzschild Metric***, a ***Three (3) Metric Components & Three (3) Metric Coefficients***, algorithm, for "generalized mathematical formalism" of a "Spherically Symmetric Metric" (ds^2), is discussed below.

Three (3) Components & Three (3) Metric Coefficients Mathematical Form

The ***"Metric Coefficients"*** of the generalized **Spherically Symmetric Metric** (ds^2), are given by the symbols ($\boldsymbol{F}$, $\boldsymbol{G}$, $\boldsymbol{H}$).

The ***"Space"*** metric coefficient is given by the symbol ($\boldsymbol{F}$).

The ***"Angular"*** metric coefficient is given by the symbol ($\boldsymbol{G}$).

The ***"Time"*** metric coefficient is given by the symbol ($\boldsymbol{H}$).

The ***"Metric Components"*** of the generalized **Spherically Symmetric Metric** (ds^2), are given by the symbols ($d\mathrm{r}^2$, $d\Omega^2_{Map\,\theta\phi}$, $d\mathrm{t}^2$).

The ***"Space"*** metric component is given by the symbol ($d\mathrm{r}^2$).

The ***"Angular"*** metric component is given by the symbol ($d\Omega^2_{Map\,\theta\phi}$).

The ***"Time"*** metric component is given by the symbol ($d\mathrm{t}^2$).

The **Spherically Symmetric Metric** (ds^2) describes **Differential Geometry of Space, Time, & Surfaces**, of a perfect fluid, spherically symmetric space, space-time, or gravitational field; given in its generalized ***three (3) components & three (3) metric coefficients*** mathematical forms, below:

Three (3) Components & Three (3) Metric Coefficients Mathematical Forms

Spherically Symmetric Metric – function of **(space, surface space, time)** **– (** $ds^2\left(dr^2,\ ds^2_{Map\,\theta\phi}\ ,\ dt^2\right)$ **)**

1.7

$$ds^2 = \left[\boldsymbol{F}\cdot dr^2 + \boldsymbol{G}\cdot ds^2_{Map\,\theta\phi} + \boldsymbol{H}\cdot dt^2\right] \rightarrow m^2$$

Spherically Symmetric Metric – function of **(space, surface angle, time)** **– (** $ds^2\left(dr^2,\ d\Omega^2_{Map\,\theta\phi}\ ,\ dt^2\right)$ **)**

1.8

$$ds^2 = \left[\boldsymbol{F}\cdot dr^2 + \boldsymbol{G}\cdot\left(r^2\cdot d\Omega^2_{Map\,\theta\phi}\right) + \boldsymbol{H}\cdot dt^2\right] \rightarrow m^2$$

Spherically Symmetric Metric – function of **(space, surface space, time)** **– (** $ds^2\left(dr^2,\ dr^2_\theta\ ,\ dr^2_\phi\ ,\ dt^2\right)$ **)**

1.9

$$ds^2 = \left[\boldsymbol{F}\cdot dr^2 + \boldsymbol{G}\cdot\left(dr^2_\theta + dr^2_\phi\right) + \boldsymbol{H}\cdot dt^2\right] \rightarrow m^2$$

Spherically Symmetric Metric – function of **(space, angle, time)** **– (** $ds^2\left(dr^2,\ d\theta^2_{Latitude}\ ,\ d\phi^2_{Longitude}\ ,\ dt^2\right)$ **)**

1.10

$$ds^2 = \left[\boldsymbol{F}\cdot dr^2 + \boldsymbol{G}\cdot r^2\cdot\left(d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right)\cdot d\phi^2_{Longitude}\right) + \boldsymbol{H}\cdot dt^2\right]$$

Spherically Symmetric Metric – function of **(Cartesian (x, y, & z) space, time)** **– (** $ds^2\left(dx^2,\ dy^2\ ,\ dz^2\ ,\ dt^2\right)$ **)**

1.11

$$ds^2 = \left[\boldsymbol{F}\cdot\left(dx^2 + dy^2 + dz^2\right) + \boldsymbol{G}\cdot\left(dx^2_{Map\,\theta\phi} + dy^2_{Map\,\theta\phi} + dz^2_{Map\,\theta\phi}\right) + \boldsymbol{H}\cdot dt^2\right]$$

Below is a table of various ***metric coefficients***, which satisfy the **Spherically Symmetric Metric** (ds^2) equations and theories of gravitation given by: Euclidean "Flat Space", Minkowski "Flat Space-Time", Schwarzschild "Curved Space-time", & Einstein "Curved Space-time"

Spherically Symmetric Metric Coefficients

–

Three (3) Components & Three (3) Metric Coefficients Math Form

–

"Super Principia" Metric Theory of Gravitation

$$ds^2 = \left[\boldsymbol{F} \cdot dr^2 + \boldsymbol{G} \cdot ds^2_{Map\ \theta\phi} + \boldsymbol{H} \cdot dt^2 \right]$$

$$ds^2 = \left[\boldsymbol{F} \cdot dr^2 + \boldsymbol{G} \cdot r^2 \cdot \left(d\theta^2_{Latitude} + \sin^2(\theta_{Latitude}) \cdot d\phi^2_{Longitude} \right) + \boldsymbol{H} \cdot dt^2 \right]$$

Metric Coefficients	Space Coefficient ($\boldsymbol{F}$)	Angular Coefficient ($\boldsymbol{G}$)	Time Coefficient ($\boldsymbol{H}$)
Euclidean Metric (Euclidean) (Flat Space)	$\mathbf{1}$	$\mathbf{1}$	$\mathbf{0}$
Minkowski Metric (Pseudo-Euclidean) (Flat Space-Time)	$\mathbf{1}$	$\mathbf{1}$	$-\mathbf{c}^2_{\mathbf{Light}}$
Schwarzschild Metric (Non-Euclidean) (Curved Space-Time)	$\dfrac{\mathbf{1}}{\left(\mathbf{1} - \left(\dfrac{\mathbf{r}_{\mathbf{Schwarzschild}}}{\mathbf{r}}\right)\right)}$	$\mathbf{1}$	$-\left(\mathbf{1} - \left(\dfrac{\mathbf{r}_{\mathbf{Schwarzschild}}}{\mathbf{r}}\right)\right) \cdot \mathbf{c}^2_{\mathbf{Light}}$
Einstein Metric (Non-Euclidean) (Static) (Curved Space-Time)	$\dfrac{\mathbf{1}}{\left(\mathbf{1} - \left(\dfrac{\mathbf{r}_{\mathbf{Schwarzschild}}}{\mathbf{r}}\right)\right)}$	$\mathbf{1}$	$-\mathbf{c}^2_{\mathbf{Light}}$

The Square of the ***Speed of Light*** "Space-Time" Invariant, equation:

1.12

$$c_{\text{Light}}^2 = \left(\frac{dr_{\text{Light}}^2}{dt^2}\right) = \left(\frac{dr^2}{d\tau^2}\right) = -\left(\frac{ds^2}{d\tau'^2}\right) \rightarrow m^2/s^2$$

Spherically Symmetric Metrics – Three (3) Metric Components & Three (3) Metric Coefficients Math Form – "Super Principia" Metric Theory of Gravitation	
	$ds^2 = \left[\boldsymbol{F}\cdot dr^2 + \boldsymbol{G}\cdot ds^2_{Map\ \theta\phi} + \boldsymbol{H}\cdot dt^2\right]$
Euclidean Metric **(Euclidean)** **(Flat Space)**	$ds^2 = \left[dr^2 + r^2\cdot\left(d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right)\cdot d\phi^2_{Longitude}\right)\right]$
Minkowski Metric **(Pseudo-Euclidean)** **(Flat Space-Time)**	$ds^2 = \left[dr^2 - c^2_{\text{Light}}\cdot dt^2 + r^2\cdot\left(d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right)\cdot d\phi^2_{Longitude}\right)\right]$
Einstein Metric **(Non-Euclidean)** **(Static)** **(Curved Space-Time)**	$ds^2 = \left[\left[\frac{dr^2}{\left(1 - \left(\frac{r_{\text{Schwarzschild}}}{r}\right)\right)} - c^2_{\text{Light}}\cdot dt^2\right] + r^2\cdot\left[d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right)\cdot d\phi^2_{Longitude}\right]\right]$
Schwarzschild Metric **(Non-Euclidean)** **(Curved Space-Time)**	$ds^2 = \left[\left[\frac{dr^2}{\left(1 - \left(\frac{r_{\text{Schwarzschild}}}{r}\right)\right)} - \left(1 - \left(\frac{r_{\text{Schwarzschild}}}{r}\right)\right)\cdot c^2_{\text{Light}}\cdot dt^2\right] + r^2\cdot\left[d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right)\cdot d\phi^2_{Longitude}\right]\right]$

1.2. Euclidean "Flat Space" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm

Next we will describe the ***Euclidean "Flat Space" Metric***, its three (3) components and three (3) metric coefficients.

The Euclidean Metric Coefficients - Defined

1.13

$$\begin{bmatrix} \boldsymbol{F} & = & 1 \\ \boldsymbol{G} & = & 1 \\ \boldsymbol{H} & = & 0 \end{bmatrix}$$

Euclidean Metric - Spherically Symmetric Metric (ds^2)

1.14

$$ds^2 = \left[\boldsymbol{F} \cdot dr^2 + \boldsymbol{G} \cdot ds^2_{Map\ \theta\phi} + \boldsymbol{H} \cdot dt^2\right]$$

$$ds^2 = \left[\boldsymbol{F} \cdot dr^2 + \boldsymbol{G} \cdot ds^2_{Map\ \theta\phi}\right]$$

$$ds^2 = \left[\boldsymbol{F} \cdot dr^2 + \boldsymbol{G} \cdot \left(dr^2_{\theta} + dr^2_{\phi}\right)\right] \rightarrow m^2$$

Substituting the metric coefficients

1.15

$$ds^2 = \left[dr^2 + r^2 \cdot \left(d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right) \cdot d\phi^2_{Longitude}\right)\right]$$

$$ds^2 = \left[dr^2 + r^2 \cdot d\Omega^2_{Map\ \theta\phi}\right]$$

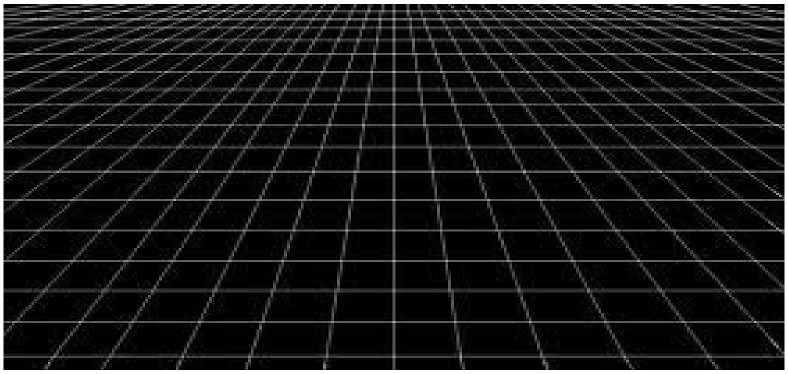
$$ds^2 = -c^2_{\text{Light}} \cdot d\tau'^2 = \left[c^2_{\text{Light}} \cdot d\tau^2 + r^2 \cdot d\Omega^2_{Map\ \theta\phi}\right] \rightarrow m^2$$

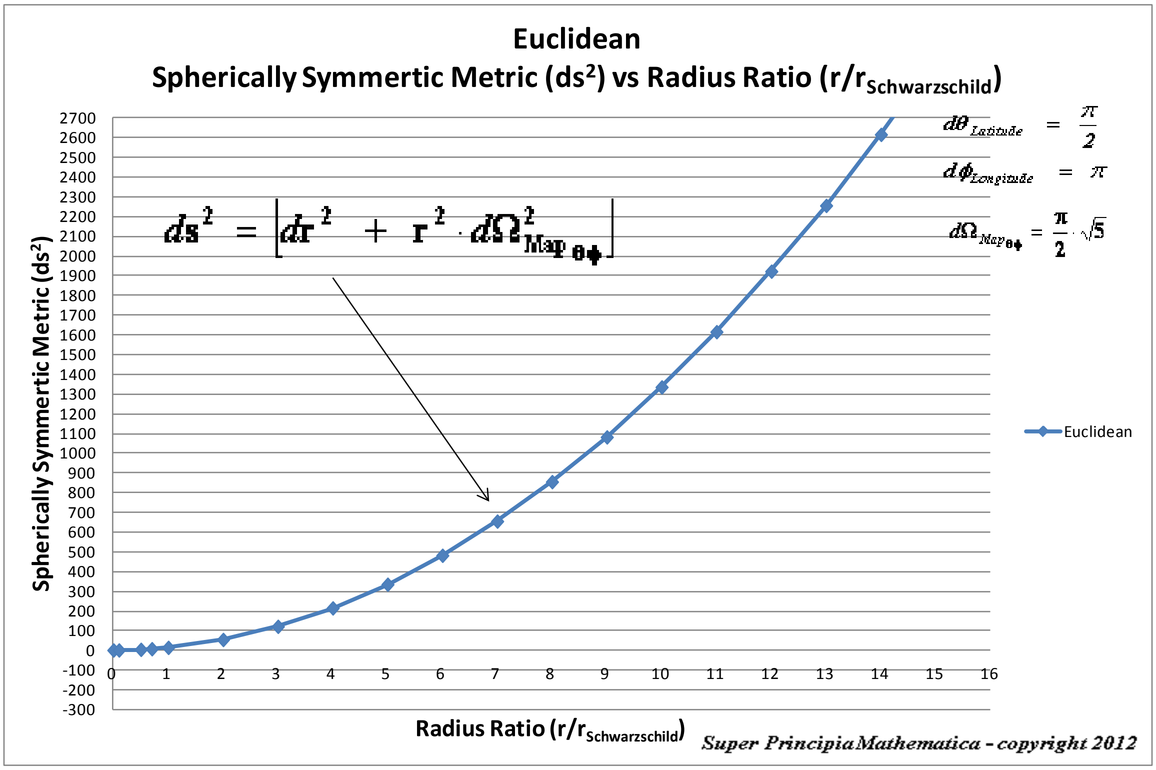
The ***Euclidean Space*** in three-dimensional Cartesian vector space, with signature (+, +, +), (x, y, z).

1.16

$$ds^2 = \left[dr^2 + r^2 \cdot d\Omega^2_{Map\,\theta\phi}\right] \rightarrow m^2$$

$$\left[dx'^2 + dy'^2 + dz'^2\right] = \begin{bmatrix} \left[dx^2 + dy^2 + dz^2\right] \\ + \left[dx^2_{Map\,\theta\phi} + dy^2_{Map\,\theta\phi} + dz^2_{Map\,\theta\phi}\right] \end{bmatrix} \rightarrow m^2$$





1.3. Minkowski "Flat Space-Time" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm

Next we will describe the ***Minkowski "Flat Space-Time" Metric***, its three (3) components and three (3) metric coefficients.

The Minkowski Metric Coefficients - Defined

1.17

$$\left[\begin{array}{l} \boldsymbol{F} = 1 \\ \boldsymbol{G} = 1 \\ \boldsymbol{H} = -\mathrm{c}_{\mathrm{Light}}^2 = -\left(\dfrac{d\mathrm{r}_{\mathrm{Light}}^2}{d\mathrm{t}^2}\right) = -\left(\dfrac{d\mathrm{r}^2}{d\tau^2}\right) = -\left(\dfrac{d\mathrm{s}^2}{d\tau'^2}\right) \end{array}\right]$$

Minkowski Metric - Spherically Symmetric Metric (ds^2)

1.18

$$ds^2 = \left[\boldsymbol{F}\cdot d\mathrm{r}^2 + \boldsymbol{G}\cdot d\mathrm{s}_{Map\,\theta\phi}^2 + \boldsymbol{H}\cdot d\mathrm{t}^2\right]$$

$$ds^2 = \left[\boldsymbol{F}\cdot d\mathrm{r}^2 + \boldsymbol{H}\cdot d\mathrm{t}^2 + \boldsymbol{G}\cdot\left(d\mathrm{r}_\theta^2 + d\mathrm{r}_\phi^2\right)\right] \rightarrow m^2$$

Substituting the metric coefficients

1.19

$$ds^2 = \left[d\mathrm{r}^2 - \mathrm{c}_{\mathrm{Light}}^2\cdot dt^2 + \mathrm{r}^2\cdot\left(d\theta_{Latitude}^2 + \sin^2\left(\theta_{Latitude}\right)\cdot d\phi_{Longitude}^2\right)\right]$$

$$ds^2 = -\mathrm{c}_{\mathrm{Light}}^2\cdot d\tau'^2 = \left[d\mathrm{r}^2 - \mathrm{c}_{\mathrm{Light}}^2\cdot d\mathrm{t}^2 + \mathrm{r}^2\cdot d\Omega_{Map\,\theta\phi}^2\right]$$

$$ds^2 = -\mathrm{c}_{\mathrm{Light}}^2\cdot d\tau'^2 = \left[\mathrm{c}_{\mathrm{Light}}^2\cdot d\tau^2 - \mathrm{c}_{\mathrm{Light}}^2\cdot d\mathrm{t}^2 + \mathrm{r}^2\cdot d\Omega_{Map\,\theta\phi}^2\right] \rightarrow m^2$$

From the above the Euclidean Metric is derived

Euclidean Metric - Spherically Symmetric Metric (ds^2)

1.20

$$\mathrm{c}_{\mathrm{Light}}^2\cdot\left(d\mathrm{t}^2 - d\tau'^2\right) = \left[d\mathrm{r}^2 + \mathrm{r}^2\cdot d\Omega_{Map\,\theta\phi}^2\right]$$

The Euclidean and the Minkowski “Metrics” (ds^2) and geodesic “line elements” ($d\mathrm{s}$), are ***“mass independent”*** equations that describe the causality of “flat” space, space-time, or the gravitational field.

Spherically Symmetric Metric – Euclidean Metric

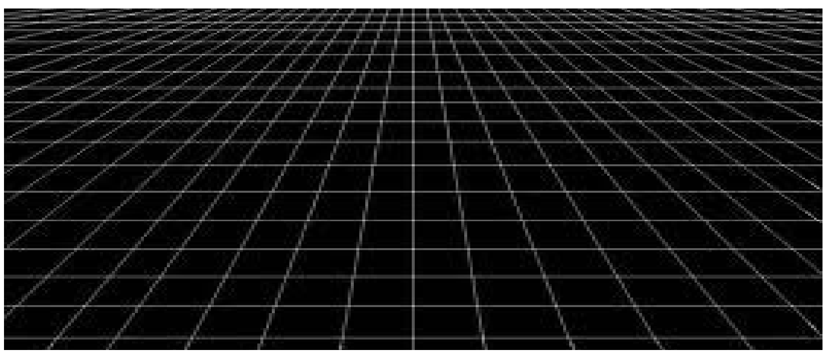
1.21

$$ds^2 = \left\lfloor d\mathrm{r}^2 + \mathrm{r}^2 \cdot d\Omega^2_{Map\,\theta\phi} \right\rfloor \rightarrow m^2$$

Spherically Symmetric Metric – Minkowski “Pseudo-Euclidean” Metric

1.22

$$d\mathrm{s}^2 = -\mathrm{c}^2_{\mathrm{Light}} \cdot d\tau'^2 = \left[\left(1 - \left(\frac{\mathrm{c}^2_{\mathrm{Light}}}{\left(\mathrm{v}(\mathrm{r},\mathrm{t})\right)^2}\right)\right) \cdot d\mathrm{r}^2 + \mathrm{r}^2 \cdot d\Omega^2_{Map\,\theta\phi}\right] \rightarrow m^2$$



The limits of integration for the Euclidean and the Minkowski “Metrics” and geodesic “line elements” ($d\mathrm{s}$) is described below.

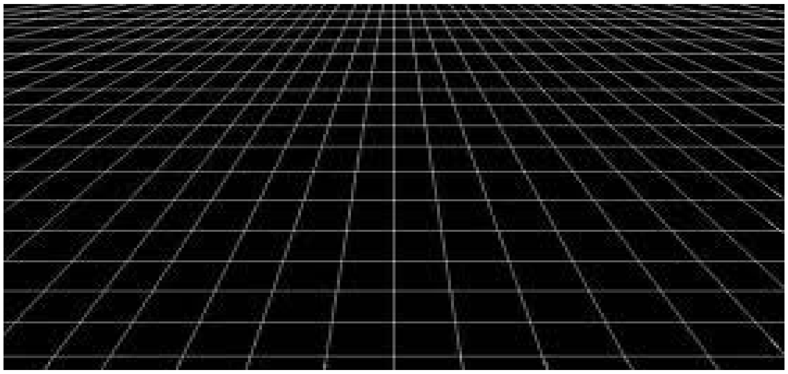
$$0 \leq \mathrm{r} < \infty$$

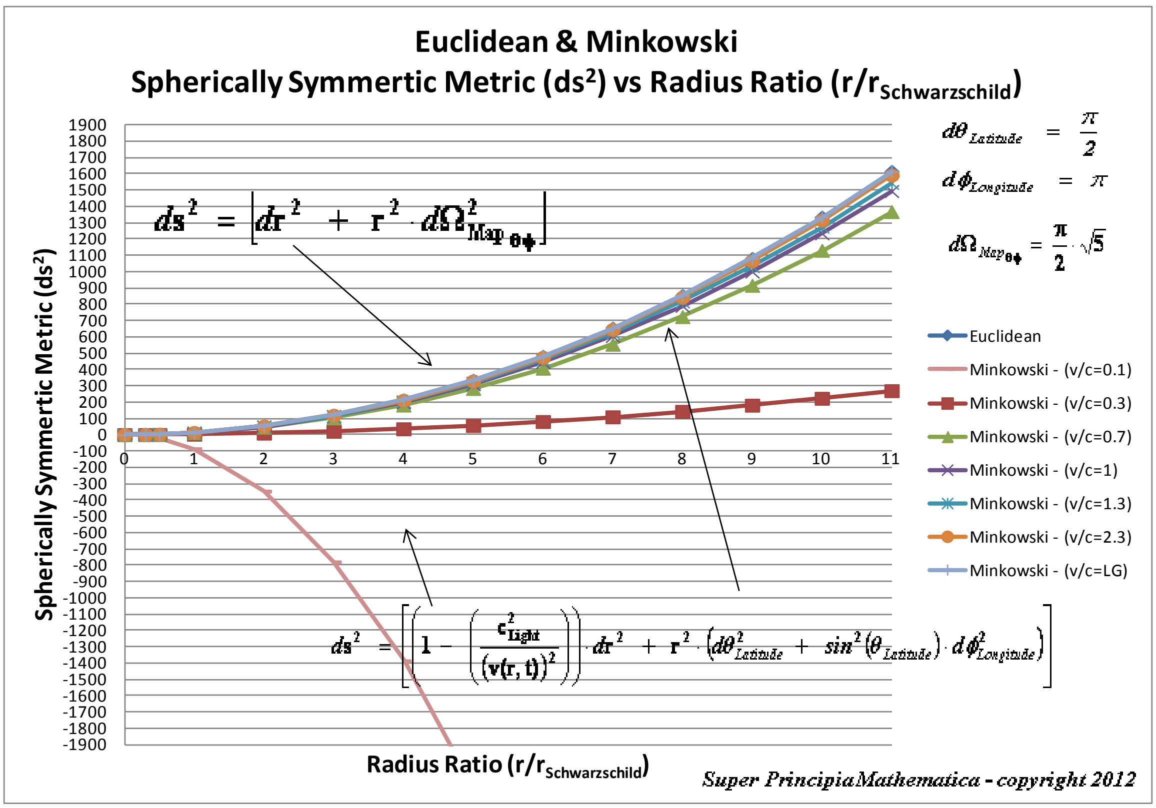
On an orthonormal basis the ***Minkowski Space*** is also a four-dimensional Cartesian vector space with signature (−, +, +, +), (-t, x, y, z).

1.23

$$ds^2 \;=\; \left[dr^2 \;-\; c_{\text{Light}}^2 \cdot dt^2 \;+\; r^2 \cdot \left(d\theta_{Latitude}^2 \;+\; \sin^2\left(\theta_{Latitude}\right) \cdot d\phi_{Longitude}^2\right)\right] \;\to m^2$$

$$\left[dx'^2 \;+\; dy'^2 \;+\; dz'^2\right] \;=\; \begin{bmatrix} \left[dx^2 \;+\; dy^2 \;+\; dz^2\right] \;-\; c_{\text{Light}}^2 \cdot dt^2 \\ +\; \left[dx_{Map\,\theta\phi}^2 \;+\; dy_{Map\,\theta\phi}^2 \;+\; dz_{Map\,\theta\phi}^2\right] \end{bmatrix} \to m^2$$





1.4. Schwarzschild "Curved Space-Time" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm

Next we will describe the ***Schwarzschild Metric (Dynamic Vacuum Energy Condition)***, its three (3) components and three (3) metric coefficients.

The Schwarzschild Metric Coefficients - Defined

1.24

$$\left[\begin{array}{l} \boldsymbol{F} \;=\; \dfrac{1}{\left(1 \;-\; \left(\dfrac{\mathrm{r_{Schwarzschild}}}{\mathrm{r}}\right)\right)} \\ \boldsymbol{G} \;=\; 1 \\ \boldsymbol{H} \;=\; -\left(1 \;-\; \left(\dfrac{\mathrm{r_{Schwarzschild}}}{\mathrm{r}}\right)\right)\cdot \mathrm{c}^2_{\mathrm{Light}} \end{array}\right]$$

Schwarzschild Metric - Spherically Symmetric Metric (ds^2)

1.25

$$ds^2 \;=\; \left[\boldsymbol{F}\cdot d\mathrm{r}^2 \;+\; \boldsymbol{G}\cdot ds^2_{Map\;\theta\phi} \;+\; \boldsymbol{H}\cdot d\mathrm{t}^2\right]$$

$$ds^2 \;=\; \left[\boldsymbol{F}\cdot d\mathrm{r}^2 \;+\; \boldsymbol{G}\cdot\left(d\mathrm{r}^2_{\theta} \;+\; d\mathrm{r}^2_{\phi}\right) \;+\; \boldsymbol{H}\cdot d\mathrm{t}^2\right]$$

$$ds^2 \;=\; \left[\boldsymbol{F}\cdot d\mathrm{r}^2 \;+\; \boldsymbol{G}\cdot \mathrm{r}^2\cdot\left(d\theta^2_{Latitude} \;+\; \sin^2\left(\theta_{Latitude}\right)\cdot d\phi^2_{Longitude}\right) \;+\; \boldsymbol{H}\cdot d\mathrm{t}^2\right]$$

Substituting the metric coefficients

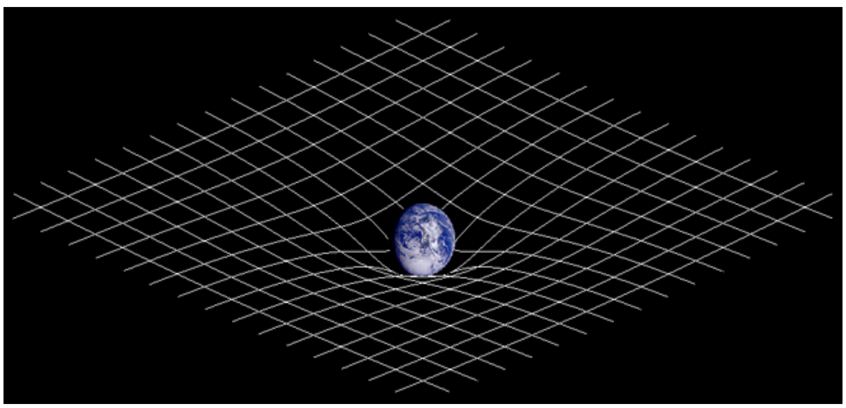
$$d\Omega^2_{Map\;\theta\phi} \;=\; \left[d\theta^2_{Latitude} \;+\; \sin^2\left(\theta_{Latitude}\right)\cdot d\phi^2_{Longitude}\right] \;\rightarrow radians^2$$

$$ds^2 \;=\; -\,\mathrm{c}^2_{\mathrm{Light}}\cdot d\tau'^2 \;=\; \left[\begin{array}{r}\left[\dfrac{d\mathrm{r}^2}{\left(1 \;-\; \left(\dfrac{\mathrm{r_{Schwarzschild}}}{\mathrm{r}}\right)\right)} \;-\; \left(1 \;-\; \left(\dfrac{\mathrm{r_{Schwarzschild}}}{\mathrm{r}}\right)\right)\cdot \mathrm{c}^2_{\mathrm{Light}}\cdot dt^2\right] \\ +\;\; \mathrm{r}^2\cdot d\Omega^2_{Map\;\theta\phi}\end{array}\right] \rightarrow m^2$$

On an orthonormal basis the ***Schwarzschild "Dynamic" Space*** is also a four-dimensional Cartesian vector space with signature (−, +, +, +), (-t, x, y, z).

1.26

$$\left[dx'^2 + dy'^2 + dz'^2\right] = \left[\begin{array}{l} \dfrac{\left[dx^2 + dy^2 + dz^2\right]}{\left(1 - \left(\dfrac{r_{\text{Schwarzschild}}}{r}\right)\right)} \\ \qquad - \left(1 - \left(\dfrac{r_{\text{Schwarzschild}}}{r}\right)\right) \cdot c^2_{\text{Light}} \cdot dt^2 \\ \qquad + \left[dx^2_{Map\ \theta\phi} + dy^2_{Map\ \theta\phi} + dz^2_{Map\ \theta\phi}\right] \end{array}\right] \to m^2$$



The ***"Schwarzschild" Spherically Symmetric Metric*** (ds^2) ***"Dynamic Space-time"*** condition, corresponds to a gradient gravitational vortex system, where the, "Refraction/Condensing Pressure" $(\Delta P_{\text{Rarefaction-Pressure}} = 0)$ on the exterior surface, of the Black Hole Event Horizon, is zero; $(\bar{r} = \bar{r}_{\text{Schwarzschild}})$.

1.27

$$\Delta P_{\text{Rarefaction-Pressure}} = \left[\begin{array}{l} P_{\text{Aether-Gravity-Pressure}} \\ \quad - 2 \cdot P_{\text{Inertial-Gravity-Pressure}} \end{array}\right] = \frac{1}{3} \cdot \left(\rho_{\text{Net}} \cdot \bar{c}^2_{\text{Light}}\right) \cdot \left(1 - \frac{\bar{r}_{\text{Schwarzschild}}}{\bar{r}}\right) = 0$$

The ***"Schwarzschild" Spherically Symmetric Metric*** (ds^2) for a **"Static Vacuum Energy Space-time"** predicts a ***"Physical Singularity"*** located at zero radius $(r = 0)$, and a ***"Coordinate Singularity"*** located at the Black Hole Event Horizon, Schwarzschild Radius $(r = r_{\text{Schwarzschild}})$, of the gradient gravitational field.

To avoid this problem the mainstream physics community has reject the ***"Schwarzschild" Spherically Symmetric Metric*** (ds^2), in favor of: Kruskal–Szekeres coordinates, Eddington–Finkelstein coordinates, and Rindler coordinate; and which neither have a ***"Coordinate Singularity"***.

The ***"Coordinate Singularity"*** is not a natural artifact for any Non-Euclidean metric. My goal is to find a solution to the ***"Coordinate Singularity"*** located at the Black Hole Event Horizon, Schwarzschild Radius ($\mathrm{r} = \mathrm{r}_{\mathrm{Schwarzschild}}$), of the ***"Schwarzschild" Spherically Symmetric Metric*** (ds^2).

If this ***"Coordinate Singularity"*** problem is resolved, the Schwarzschild metric is considered a valid description for the physical description of the curvature of space, space-time, or gradient gravitation field, surrounding, and in the presence of a condensed mass, matter, or energy of an isolated system mass body.

The ***Schwarzschild Metric*** (ds^2) predicts the ***"Physical Singularity"*** located at zero radius, is a value that approaches zero, as the radius approaches zero. The ***"Physical Singularity"*** is a natural artifact for any Non-Euclidean metric.

1.28

$$ds^2 = -\mathrm{c}_{\mathrm{Light}}^2 \cdot d\tau'^2 = g_{\mu\nu} \cdot dx^{\mu} \cdot dx^{\nu}$$

$$ds^2 = -\mathrm{c}_{\mathrm{Light}}^2 \cdot d\tau'^2 = \left[\left[\frac{d\mathrm{r}^2}{\left(1 - \left(\frac{\mathrm{r}_{\mathrm{Schwarzschild}}}{\mathrm{r}}\right)\right)} - \left(1 - \left(\frac{\mathrm{r}_{\mathrm{Schwarzschild}}}{\mathrm{r}}\right)\right) \cdot \mathrm{c}_{\mathrm{Light}}^2 \cdot dt^2\right] + \mathrm{r}^2 \cdot d\Omega_{Map\,\theta\phi}^2\right] \to m^2$$

1.29

$$\left[\begin{array}{l}
ds^2 = \infty \quad \text{when} \quad \mathrm{r} = 0 \qquad \textbf{\textit{Physical Singularity}} \\
ds^2 = \infty \quad \text{when} \quad \mathrm{r} = \mathrm{r}_{\mathrm{Schwarzschild}} \qquad \textbf{\textit{Coordinate Singularity}} \\
\\
ds^2 = \textbf{\textit{Exterior Solution}} \quad \text{when} \quad \mathrm{r} > \mathrm{r}_{\mathrm{Schwarzschild}} \\
ds^2 = \textbf{\textit{Interior Solution}} \quad \text{when} \quad \mathrm{r} < \mathrm{r}_{\mathrm{Schwarzschild}} \\
\\
ds^2 = \left[\left[d\mathrm{r}^2 - \mathrm{c}_{\mathrm{Light}}^2 \cdot d\mathrm{t}^2\right] + \mathrm{r}^2 \cdot d\Omega_{Map\,\theta\phi}^2\right] \quad \text{when} \quad \mathrm{r} \Rightarrow \infty
\end{array}\right]$$

The ***Schwarzschild Metric*** (ds^2) "describes" a fluid dynamic vacuum, condition "Rarefaction/Condensing Pressure" of space, where the "Inertial Mass Gravitational Force of Attraction" and the "Isotropic Space-time Aether Gravitational Force of Attraction" interact, and where there is *zero* Rarefaction Pressure ($\Delta \mathrm{P}_{\text{Rarefaction-Pressure}} = 0$), on the surface of the Black Hole Event Horizon, for any isolated net inertial mass system body.

The ***Schwarzschild Metric*** (ds^2) is a Spherically Symmetric Metric that is considered *"Non-Euclidean".* The ***Schwarzschild Metric*** (ds^2) describes the differential geometry of a "curved/warped" space-time or gravitational fields, in the presence of condensed mass and energy, for the following forces, energies, densities, and pressures:

$$ds^2 \;=\; \left[\left[\left(\textbf{Dark Energy}\right)\cdot d\mathrm{r}^2 \;-\; \begin{pmatrix}\textbf{Dark Matter}\\ \textbf{Dynamic}\end{pmatrix}\cdot d\mathrm{t}^2\right] \;+\; \begin{pmatrix}\textbf{Angular}\\ \textbf{Momentum}\end{pmatrix}\cdot d\Omega^2_{Map\,\theta\phi}\right]$$

"Dynamic" Inhomogeneous Gradient Gravitational Field – Volume Mass Density

$$\frac{\Delta \mathrm{P}_{\text{Rarefaction-Pressure}}}{\bar{\mathrm{c}}^2_{\text{Light}}} \;=\; \frac{\Delta \mathrm{F}_{\text{Rarefaction-Force}}}{\bar{\mathrm{c}}^2_{\text{Light}}\cdot \oint dA_{Area}} \;=\; \frac{1}{3}\cdot \rho_{\text{Net}}\cdot\left(1 \;-\; \frac{\bar{\mathrm{r}}_{\text{Schwarzschild}}}{\bar{\mathrm{r}}}\right) \;\rightarrow\; {kg}/{m^3}$$

- **Dark Matter "Dynamic" – Rarefaction Mass Density, Force & Pressure**

  (Time Dependence) – ($\left(1 \;-\; \dfrac{\bar{\mathrm{r}}_{\text{Schwarzschild}}}{\bar{\mathrm{r}}}\right)\cdot dt^2$**)**

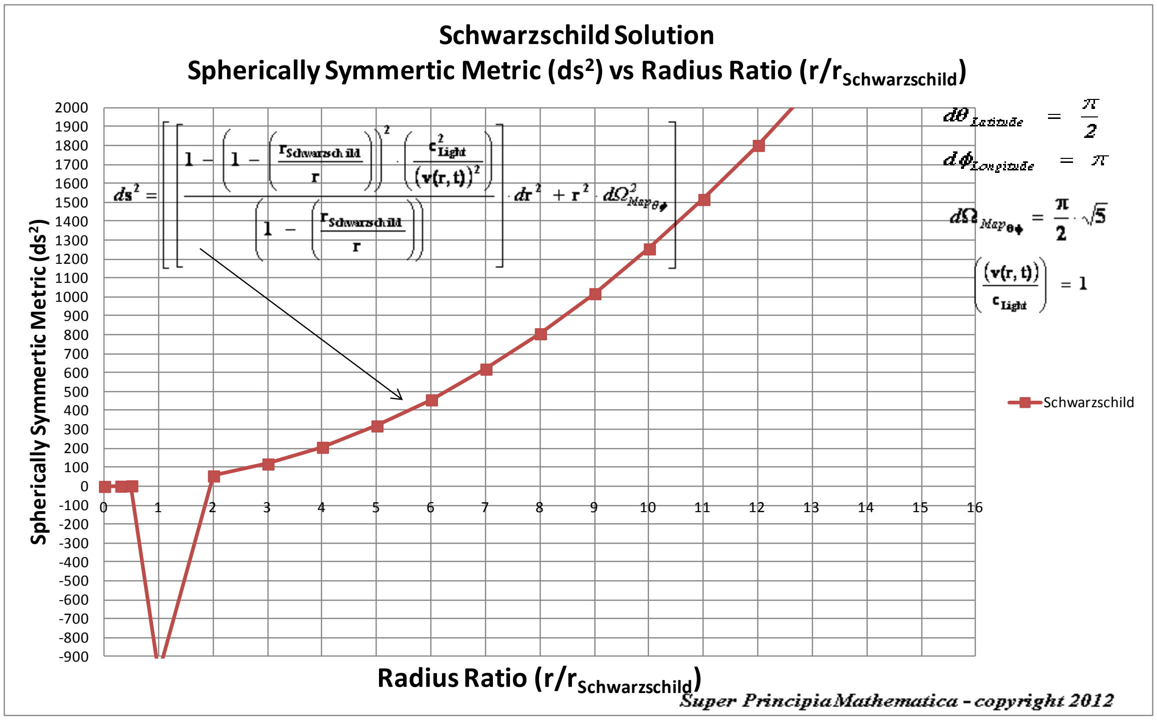
- **Dark Energy – Space Expansion & Gravitational Redshift**

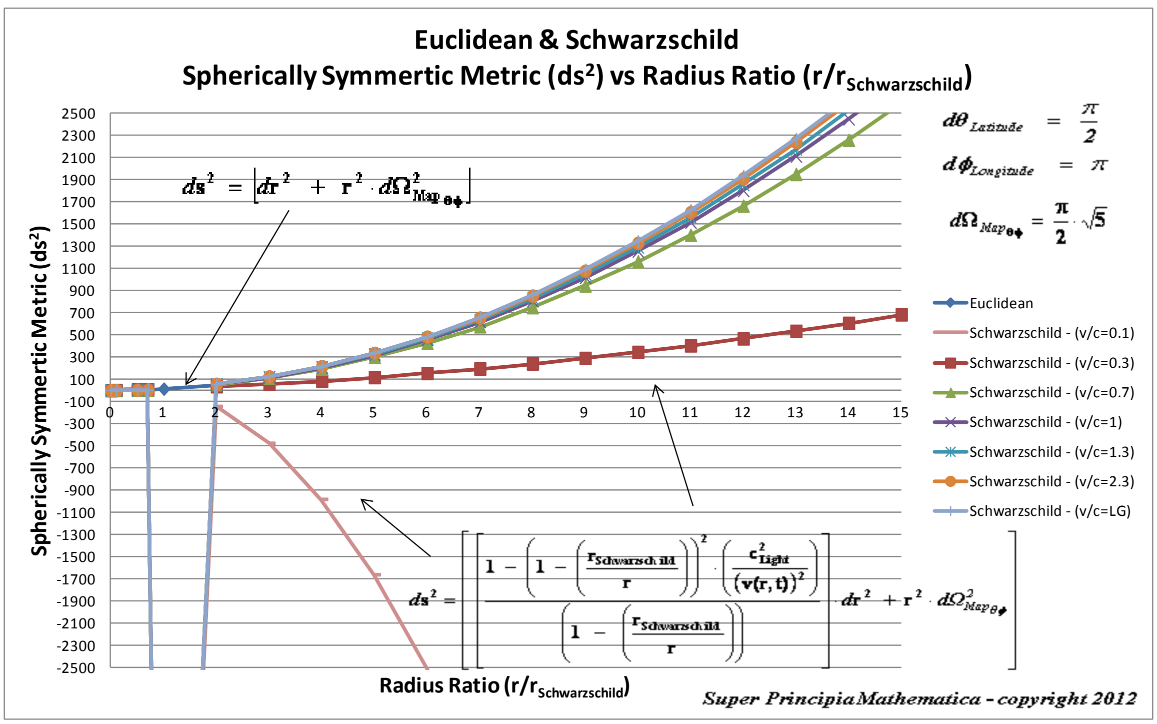
  (Space Dependence) – ($\dfrac{d\mathrm{r}^2}{\left(1 \;-\; \left(\dfrac{\mathrm{r}_{\text{Schwarzschild}}}{\mathrm{r}}\right)\right)}$**)**

- **Centrifugal/Centripetal Curvature/Rotation – Angular Momentum & Angular Velocity**

  (Angle & Space Invariance or Covariance) – ($\mathrm{r}^2\cdot d\Omega^2_{Map\,\theta\phi}$**)**

$$(r \to 0 \;\; ; \;\; ds^2 \to 0) \quad \text{Then} \quad (r = 0 \;\; ; \;\; ds^2 = \infty) \quad \text{And} \quad \left(\frac{c_{Light}^2}{(v(r,t))^2} \right) = 1$$





1.5. Einstein "Curved Space-Time" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm

Next we will describe the ***Einstein Metric (Static Vacuum Energy Condition)***, its three (3) components and three (3) metric coefficients.

The Einstein Metric Coefficients - Defined

1.30

$$\begin{bmatrix} \boldsymbol{F} = \dfrac{1}{\left(1 - \left(\dfrac{\mathrm{r_{Schwarzschild}}}{\mathrm{r}}\right)\right)} \\ \boldsymbol{G} = 1 \\ \boldsymbol{H} = -\mathrm{c}^2_{\mathrm{Light}} \end{bmatrix}$$

Einstein Metric - Spherically Symmetric Metric (ds^2)

1.31

$$ds^2 = \left[\boldsymbol{F} \cdot d\mathrm{r}^2 + \boldsymbol{G} \cdot d\mathrm{s}^2_{Map\,\theta\phi} + \boldsymbol{H} \cdot d\mathrm{t}^2\right]$$

$$ds^2 = \left[\boldsymbol{F} \cdot d\mathrm{r}^2 + \boldsymbol{G} \cdot \left(d\mathrm{r}^2_\theta + d\mathrm{r}^2_\phi\right) + \boldsymbol{H} \cdot d\mathrm{t}^2\right]$$

$$ds^2 = \left[\boldsymbol{F} \cdot d\mathrm{r}^2 + \boldsymbol{G} \cdot \mathrm{r}^2 \cdot \left(d\theta^2_{Latitude} + \sin^2(\theta_{Latitude}) \cdot d\phi^2_{Longitude}\right) + \boldsymbol{H} \cdot d\mathrm{t}^2\right]$$

Substituting the metric coefficients

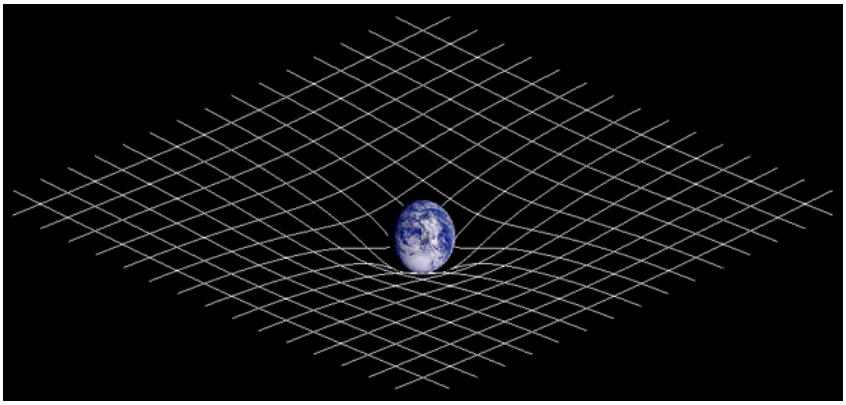
$$d\Omega^2_{Map\,\theta\phi} = \left[d\theta^2_{Latitude} + \sin^2(\theta_{Latitude}) \cdot d\phi^2_{Longitude}\right] \rightarrow radians^2$$

$$ds^2 = -\mathrm{c}^2_{\mathrm{Light}} \cdot d\tau'^2 = \left[\left[\frac{d\mathrm{r}^2}{\left(1 - \left(\dfrac{\mathrm{r_{Schwarzschild}}}{\mathrm{r}}\right)\right)} - \mathrm{c}^2_{\mathrm{Light}} \cdot d\mathrm{t}^2\right] + \mathrm{r}^2 \cdot d\Omega^2_{Map\,\theta\phi}\right] \rightarrow m^2$$

On an orthonormal basis the ***Einstein "Static" Space*** is also a four-dimensional Cartesian vector space with signature (−, +, +, +), (-t, x, y, z).

1.32

$$\left[dx'^2 + dy'^2 + dz'^2\right] = \left[\begin{array}{l} \dfrac{\left[dx^2 + dy^2 + dz^2\right]}{\left(1 - \left(\dfrac{r_{\text{Schwarzschild}}}{r}\right)\right)} - c_{\text{Light}}^2 \cdot dt^2 \\ \quad + \left[dx_{Map\,\theta\phi}^2 + dy_{Map\,\theta\phi}^2 + dz_{Map\,\theta\phi}^2\right] \end{array}\right] \rightarrow m^2$$



The ***"Einstein" Spherically Symmetric Metric*** (ds^2) corresponds to a gradient gravitational vortex system, where the, ***Isotropic Aether Gravitational Field Pressure*** $(P_{\text{Aether-Gravity-Pressure}})$ is equal to twice (2) the ***"Inertial Mass towards Mass Gravitational Attraction"*** $(2 \cdot P_{\text{Aether-Gravity-Pressure}})$, on the exterior surface, of the Black Hole Event Horizon, and is non zero; $(\bar{r} = \bar{r}_{\text{Schwarzschild}})$.

1.33

$$P_{\text{Aether-Gravity-Pressure}} = 2 \cdot P_{\text{Inertial-Gravity-Pressure}} = \frac{1}{3} \cdot \left(\rho_{\text{Net}} \cdot \bar{c}_{\text{Light}}^2\right) \rightarrow {kg}/{m \cdot s^2}$$

The ***"Einstein" Spherically Symmetric Metric*** (ds^2) for a **"Static Vacuum Energy Space-time"** predicts a ***"Physical Singularity"*** located at zero radius $(r = 0)$, and a ***"Coordinate Singularity"*** located at the Black Hole Event Horizon, Schwarzschild Radius $(r = r_{\text{Schwarzschild}})$, of the gradient gravitational field.

To avoid this problem the mainstream physics community has reject the ***"Einstein" Spherically Symmetric Metric*** (ds^2), in favor of: Kruskal–Szekeres coordinates, Eddington–Finkelstein coordinates, and Rindler coordinate; and which neither have a ***"Coordinate Singularity"***.

The ***"Coordinate Singularity"*** is not a natural artifact for any Non-Euclidean metric. My goal is to find a solution to the ***"Coordinate Singularity"*** located at the Black Hole Event Horizon, Schwarzschild Radius ($\mathrm{r} = \mathrm{r}_{\mathrm{Schwarzschild}}$), of the ***"Einstein" Spherically Symmetric Metric*** (ds^2).

If this ***"Coordinate Singularity"*** problem is resolved, the Einstein metric is considered a valid description for the physical description of the curvature of space, space-time, or gradient gravitation field, surrounding, and in the presence of a condensed mass, matter, or energy of an isolated system mass body.

The ***Einstein Metric*** (ds^2) predicts the ***"Physical Singularity"*** located at zero radius, is a value that approaches zero, as the radius approaches zero. The ***"Physical Singularity"*** is a natural artifact for any Non-Euclidean metric.

1.34

$$ds^2 = -\mathrm{c}_{\mathrm{Light}}^2 \cdot d\tau'^2 = g_{\mu\nu} \cdot dx^{\mu} \cdot dx^{\nu}$$

$$ds^2 = -\mathrm{c}_{\mathrm{Light}}^2 \cdot d\tau'^2 = \left[\left[\frac{d\mathrm{r}^2}{\left(1 - \left(\frac{\mathrm{r}_{\mathrm{Schwarzschild}}}{\mathrm{r}}\right)\right)} - \mathrm{c}_{\mathrm{Light}}^2 \cdot d\mathrm{t}^2\right] + \mathrm{r}^2 \cdot d\Omega_{Map\,\theta\phi}^2\right] \to m^2$$

1.35

$$\left[\begin{array}{l} ds^2 = \infty \quad \text{when} \quad \mathrm{r} = 0 \quad \textbf{\textit{Physical Singularity}} \\ ds^2 = \infty \quad \text{when} \quad \mathrm{r} = \mathrm{r}_{\mathrm{Schwarzschild}} \quad \textbf{\textit{Coordinate Singularity}} \\ \\ ds^2 = \textbf{\textit{Exterior Solution}} \quad \text{when} \quad \mathrm{r} > \mathrm{r}_{\mathrm{Schwarzschild}} \\ ds^2 = \textbf{\textit{Interior Solution}} \quad \text{when} \quad \mathrm{r} < \mathrm{r}_{\mathrm{Schwarzschild}} \\ \\ ds^2 = \left[\left[d\mathrm{r}^2 - \mathrm{c}_{\mathrm{Light}}^2 \cdot d\mathrm{t}^2\right] + \mathrm{r}^2 \cdot d\Omega_{Map\,\theta\phi}^2\right] \quad \text{when} \quad \mathrm{r} \Rightarrow \infty \end{array}\right]$$

The ***Einstein Metric*** (ds^2) "describes" a fluid dynamic vacuum, condition "Rarefaction/Condensing Pressure" of space, where the "Inertial Mass Gravitational Force of Attraction" and the "Isotropic Space-time Aether Gravitational Force of Attraction" interact, and where there is *non-zero* Rarefaction Pressure ($\Delta \mathrm{P}_{\text{Rarefaction-Pressure}} \neq 0$), on the surface of the Black Hole Event Horizon, for any isolated net inertial mass system body.

The ***Einstein Metric*** (ds^2) is a Spherically Symmetric Metric that is considered *"Non-Euclidean".* The ***Einstein Metric*** (ds^2) describes the differential geometry of a "curved/warped" space-time or gravitational fields, in the presence of condensed mass and energy, for the following forces, energies, and pressures:

$$ds^2 = \left[\left[\left(\textbf{Dark Energy}\right)\cdot d\mathrm{r}^2 - \begin{pmatrix}\textbf{Dark Matter}\\ \textbf{Static}\end{pmatrix}\cdot dt^2\right] + \begin{pmatrix}\textbf{Angular}\\ \textbf{Momentum}\end{pmatrix}\cdot d\Omega^2_{Map\,\theta\phi}\right]$$

"Static" Inhomogeneous Gradient Gravitational ~~Field~~ Volume Mass Density

$$\frac{\mathrm{P}_{\text{Aether-Gravity-Pressure}}}{\bar{\mathrm{c}}^2_{\text{Light}}} = \frac{\mathrm{F}_{\text{Light-Force}}}{\bar{\mathrm{c}}^2_{\text{Light}} \cdot \oint dA_{Area}} = \frac{1}{3}\cdot \rho_{\text{Net}} \rightarrow {kg}/{m^3}$$

- **Dark Matter "Static" Aether "Light" Isotropic Pressure – Inhomogeneous Volume Mass Density (Time Dependence) – ($d\mathrm{t}^2$)**

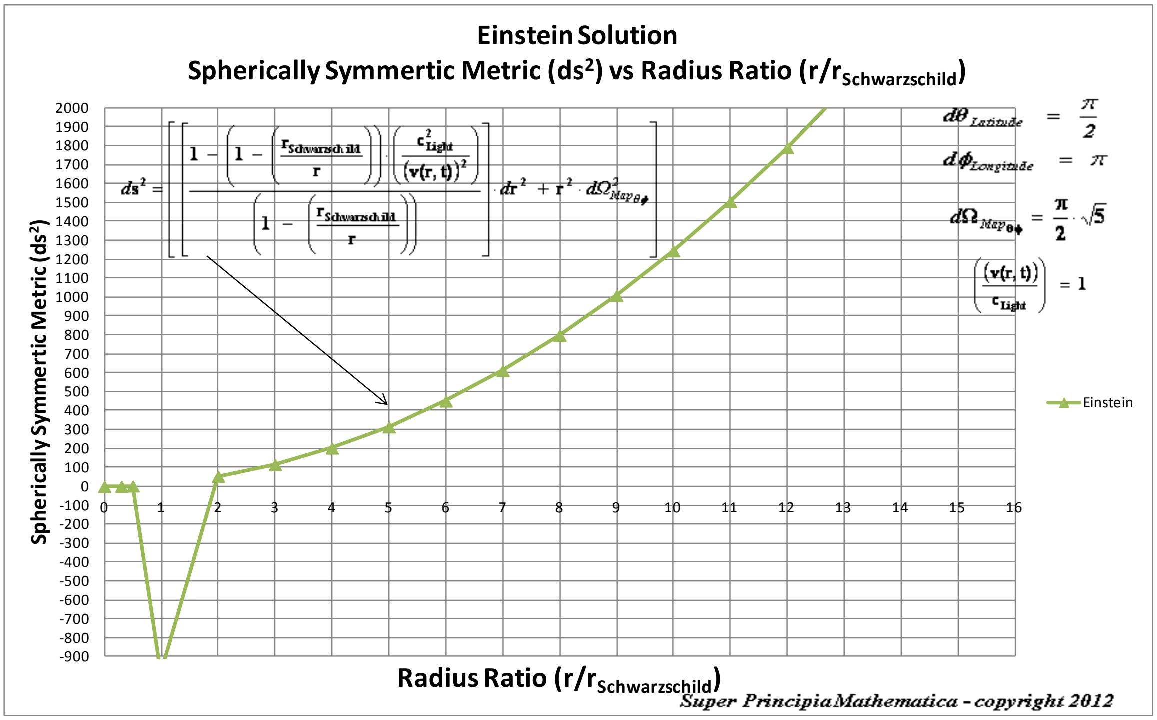
- **Dark Energy – Space Expansion & Gravitational Redshift**

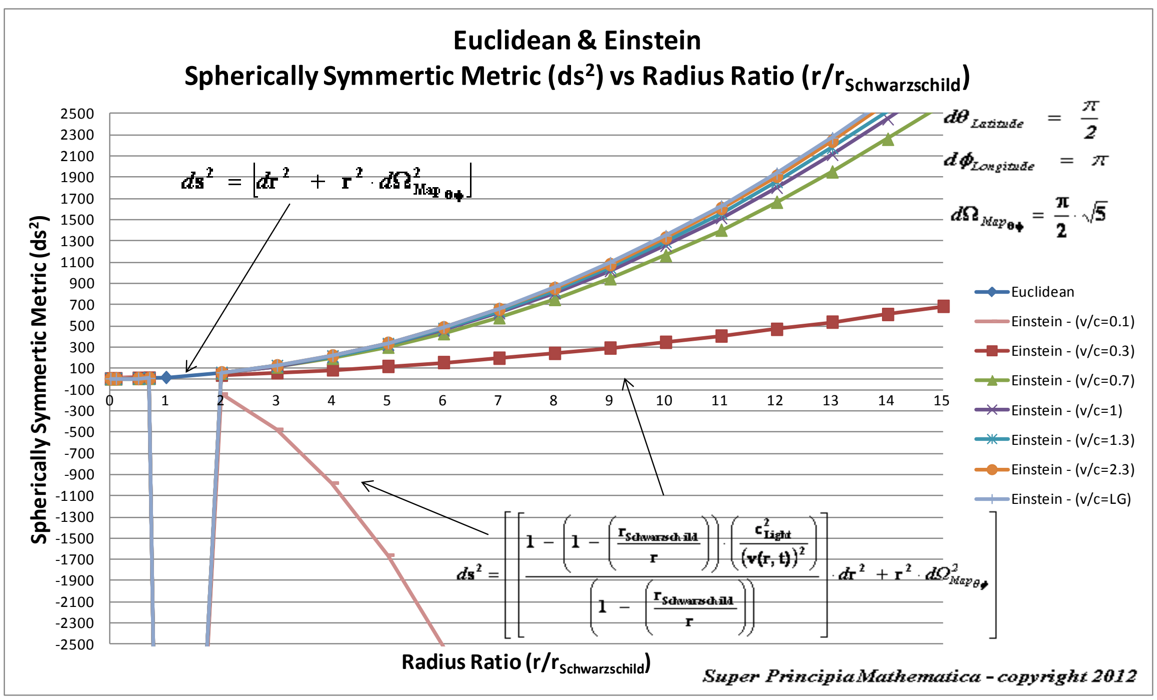
  (Space Dependence) – ($\dfrac{d\mathrm{r}^2}{\left(1 - \left(\dfrac{\mathrm{r}_{\text{Schwarzschild}}}{\mathrm{r}}\right)\right)}$)

- **Centrifugal/Centripetal Angular/Rotation – Angular Momentum & Angular Velocity**

  (Angle & Space Invariance or Covariance) – ($\mathrm{r}^2 \cdot d\Omega^2_{Map\,\theta\phi}$)

$$(r \rightarrow 0 \quad ; \quad ds^2 \rightarrow 0) \quad \text{Then} \quad (r = 0 \quad ; \quad ds^2 = \infty) \quad \text{And} \quad \left(\frac{c_{Light}^2}{(v(r,t))^2}\right) = 1$$





1.6. *"New" Algorithm for Describing Spherically Symmetric Metrics of a Gravitational Field Using – Two (2) Metric Components & Two (2) Metric Coefficients*

Next, we will describe "new" two (2) components mathematical formalism for describing the **Spherically Symmetric Metric** (ds^2), which describes the **Differential Geometry of Space, Time, & Surfaces**, of a perfect fluid spherically symmetric space, space-time, or gravitational field; and where there are gravitational interaction in consideration.

The "new" forms of the "Spherically Symmetric Metrics" that produce physical and observable results, of matter in motion, through a space or space-time, that is either flat or curved; or has matter present or absent, in that space or space-time.

Thus, we will consider only the following Spherically Symmetric Metrics:

- **Euclidean Metric** – "Flat Space or Flat Space-time"
- **Minkowski Metric** – "Flat Space-time" (Pseudo-Euclidean)
- **Schwarzschild Metric** – "Dynamic Curved Space-time" (Non-Euclidean)
- **Einstein Metric** – "Static Curved Space-time" (Non-Euclidean)

Using the Einstein tensor mathematical expression of General Relativity, it also can satisfy the, ***Two (2) Metric Components & Two (2) Metric Coefficients***, algorithm, for "generalized mathematical formalism" of a "Spherically Symmetric Metric" (ds^2).

Spherically Symmetric Metric – Einstein "Tensor" Metric Expression

1.36

$$ds^2 = g_{\mu\nu} \cdot dx^{\mu} \cdot dx^{\nu} \rightarrow m^2$$

The "Metric "Tensor" Coefficient" terms (μ & ν; $= [1, 2, 3, 4]$), can take on values of one (1) to four (4), in this algorithm:

- Metric Coefficient (1) represents "space-time" – ($g_{14} = g_{41}$)
- Metric Coefficient (2) represents "surface space" "latitude & longitude direction space" – ($g_{23} = g_{32}$)

The "new" **Spherically Symmetric Metric** (ds^2) algorithm, describes the **Differential Geometry of Space, & Surfaces** for either the ***Euclidean Metric, Minkowski Metric, Einstein Metric, or the Schwarzschild Metric***, with two (2) components & two (2) metric coefficients.

Two (2) Components & Two (2) Metric Coefficients Mathematical Form

The ***"Metric Coefficients"*** of the "new" **Spherically Symmetric** (ds^2) **Metric**, are given by the symbols ($\boldsymbol{E}$, $\boldsymbol{G}$).

The ***"Space-time"*** metric coefficient is given by the symbol ($\boldsymbol{E}$).

The ***"Angular"*** metric coefficient is given by the symbol ($\boldsymbol{G}$).

The ***"Metric Components"*** of the generalized **Spherically Symmetric Metric** (ds^2), are given by the symbols ($d\mathrm{r}^2$, $d\Omega^2_{Map\,\theta\phi}$, $d\mathrm{t}^2$).

The ***"Space-time"*** metric component is given by ($d\mathrm{r}^2$, $d\mathrm{t}^2$).

The ***"Angular"*** metric component is given by the symbol ($d\Omega^2_{Map\,\theta\phi}$).

The ***"Space-time"*** metric coefficient is given by the symbol ($\boldsymbol{E}$), is a unit-less quantity that describes the amount of curvature in a localized region of space, space-time, or the gravitational field. The curvature is given by the ***"Metric Coefficient"*** ($\kappa_{Curvature} = \boldsymbol{E}$)

If there is "curvature" in a space, space-time, or the gravitational field, then the "flat-space" "Euclidean" geometry is modified and becomes "Non-Euclidean"; and this is described mathematically by varying the value of the ***"Metric Coefficient"*** ($\kappa_{Curvature} = \boldsymbol{E}$), and multiplying by the differential Radial ($d\mathrm{r}^2$) component; to get ($\kappa_{Curvature} \cdot d\mathrm{r}^2$).

By varying the ***"Metric Coefficient"*** ($\kappa_{Curvature} = \boldsymbol{E}$) value, the Spherically Symmetric Metric (ds^2) is generalized, and can be used to describe the various metrics: Euclidean Metric, Minkowski Metric, Einstein Metric, Schwarzschild Metric, etc…

The "new" **Spherically Symmetric Metric** (ds^2) describes **Differential Geometry of Space, & Surfaces**, of a perfect fluid, spherically symmetric space, space-time, or gravitational field; and is given in its generalized ***two (2) components & two (2) metric coefficients***, mathematical forms below:

Two (2) Components & Two (2) Metric Coefficients Mathematical Form

Spherically Symmetric Metric – function of **(space, surface angle)**
– $\left(ds^2\left(dr^2,\ \ ds^2_{Map\,\theta\phi}\right)\right)$

1.37

$$ds^2 = \left[\boldsymbol{E}\cdot dr^2 + \boldsymbol{G}\cdot ds^2_{Map\,\theta\phi}\right] \rightarrow m^2$$

Spherically Symmetric Metric – function of **(space, surface angle)**
– $\left(ds^2\left(dr^2,\ \ d\Omega^2_{Map\,\theta\phi}\right)\right)$

1.38

$$ds^2 = \left[\boldsymbol{E}\cdot dr^2 + \boldsymbol{G}\cdot\left(r^2\cdot d\Omega^2_{Map\,\theta\phi}\right)\right] \rightarrow m^2$$

Spherically Symmetric Metric – function of **(space, surface space, time)**
– $\left(ds^2\left(dr^2,\ \ dr^2_\theta\ ,\ dr^2_\phi\ ,\ dt^2\right)\right)$

1.39

$$ds^2 = \left[\boldsymbol{E}\cdot dr^2 + \boldsymbol{G}\cdot\left(dr^2_\theta + dr^2_\phi\right)\right] \rightarrow m^2$$

Spherically Symmetric Metric – function of **(space, surface angle)**
– $\left(ds^2\left(dr^2,\ \ d\theta^2_{Latitude}\ ,\ d\phi^2_{Longitude}\right)\right)$

1.40

$$ds^2 = \left[\boldsymbol{E}\cdot dr^2 + \boldsymbol{G}\cdot r^2\cdot\left(d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right)\cdot d\phi^2_{Longitude}\right)\right] \rightarrow m^2$$

Spherically Symmetric Metric – function of **(Cartesian (x, y, & z) space)**
– $\left(ds^2\left(dx^2,\ \ dy^2\ ,\ dz^2\right)\right)$

1.41

$$ds^2 = \left[\boldsymbol{E}\cdot\left(dx^2 + dy^2 + dz^2\right) + \boldsymbol{G}\cdot\left(dx^2_{Map\,\theta\phi} + dy^2_{Map\,\theta\phi} + dz^2_{Map\,\theta\phi}\right)\right]$$

Space-time Invariant – Square of the Speed of Light

$$c^2_{\text{Light}} = \left(\frac{dr^2_{\text{Light}}}{dt^2}\right) = \left(\frac{dr^2}{d\tau^2}\right) = -\left(\frac{ds^2}{d\tau'^2}\right) = \text{Constant} \rightarrow m^2/s^2$$

Space-time – Square of the Speed of Space (Vacuum Energy Velocity)

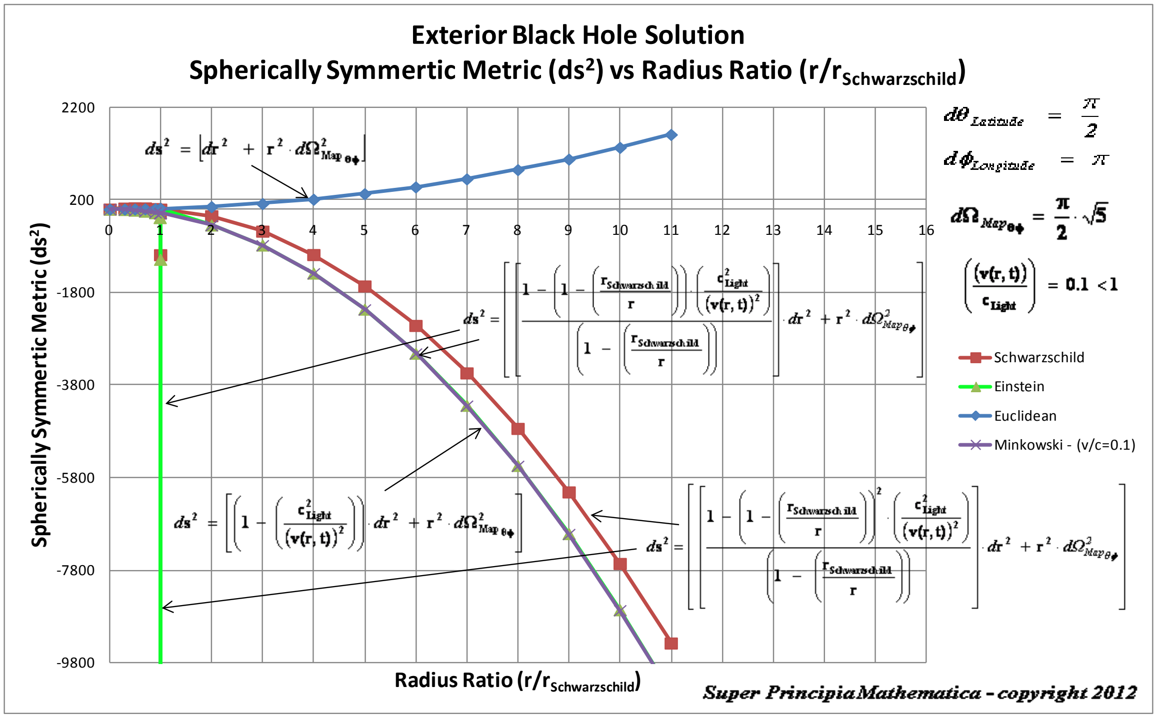
$$(v(r,t))^2 = \left(\frac{dr^2}{dt^2}\right) = c^2_{\text{Light}} \cdot \left(\frac{d\tau^2}{dt^2}\right) \rightarrow m^2/s^2$$

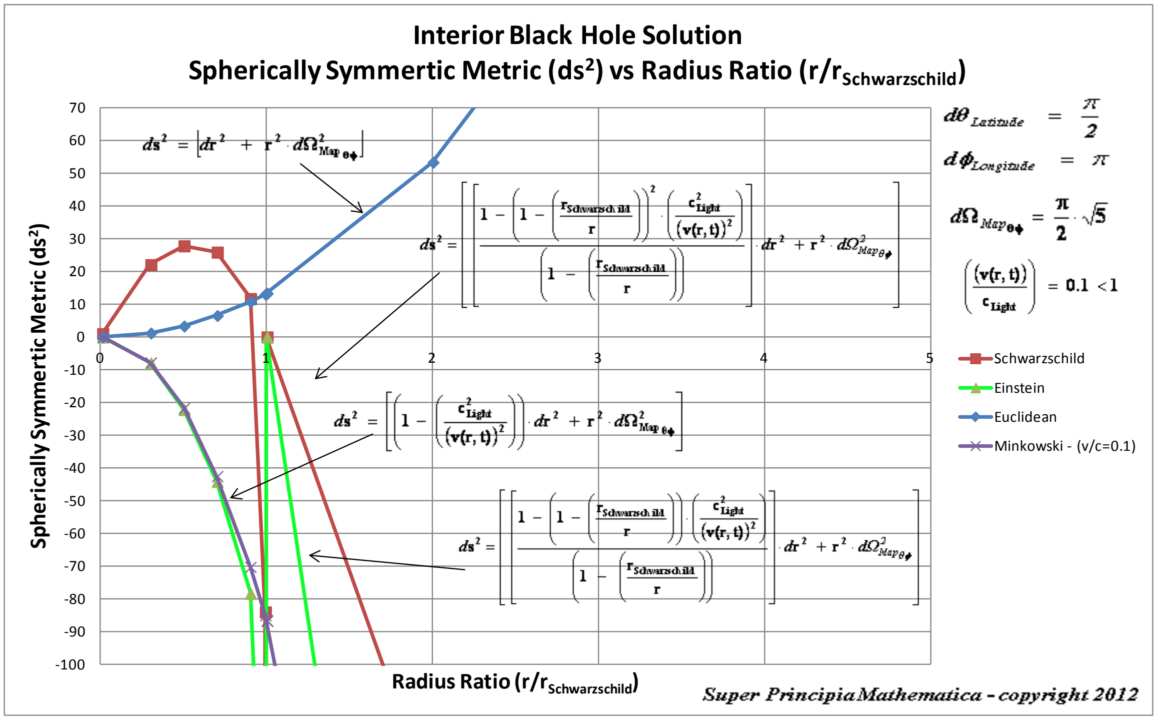
Spherically Symmetric Metric "Coefficients" – "Gaussian" Algorithm – Two (2) Components & Two (2) Metric Coefficients Math Form – "Super Principia" Metric Theory of Gravitation			
$ds^2 = \left[\boldsymbol{E} \cdot dr^2 + \boldsymbol{G} \cdot ds^2_{Map\ \theta\phi}\right]$			
Metric Coefficients	**Space Coefficient (E)**	**Angular Coefficient (G)**	**Integration Limits (r)**
Euclidean Metric (Euclidean) (Flat Space)	$\mathbf{1}$	$\mathbf{1}$	$\mathbf{0 \le r < \infty}$
Minkowski Metric (Pseudo-Euclidean) (Flat Space-Time)	$\left(\mathbf{1} - \left(\frac{\mathbf{c^2_{Light}}}{(\mathbf{v}(\boldsymbol{r},\boldsymbol{t}))^2}\right)\right)$	$\mathbf{1}$	$\mathbf{0 \le r < \infty}$
Einstein Metric (Non-Euclidean) (Static) (Curved Space-Time)	$\left[\frac{\mathbf{1} - \left(\mathbf{1} - \left(\frac{\mathbf{r_{Schwarzschild}}}{\mathbf{r}}\right)\right) \cdot \left(\frac{\mathbf{c^2_{Light}}}{(\mathbf{v}(\boldsymbol{r},\boldsymbol{t}))^2}\right)}{\left(\mathbf{1} - \left(\frac{\mathbf{r_{Schwarzschild}}}{\mathbf{r}}\right)\right)}\right]$	$\mathbf{1}$	$\mathbf{r_{Schwarzschild} < r < \infty}$
Schwarzschild Metric (Non-Euclidean) (Curved Space-Time)	$\left[\frac{\mathbf{1} - \left(\mathbf{1} - \left(\frac{\mathbf{r_{Schwarzschild}}}{\mathbf{r}}\right)\right)^2 \cdot \left(\frac{\mathbf{c^2_{Light}}}{(\mathbf{v}(\boldsymbol{r},\boldsymbol{t}))^2}\right)}{\left(\mathbf{1} - \left(\frac{\mathbf{r_{Schwarzschild}}}{\mathbf{r}}\right)\right)}\right]$	$\mathbf{1}$	$\mathbf{r_{Schwarzschild} < r < \infty}$

Spherically Symmetric Metric “Gaussian” Algorithm – Two (2) Metric Components & Two (2) Metric Coefficients Math Form – “Super Principia” Metric Theory of Gravitation	
$$ds^2 = \left[\boldsymbol{E} \cdot dr^2 + \boldsymbol{G} \cdot ds^2_{Map\ \theta\phi} \right]$$	
Euclidean Metric (Euclidean) (Flat Space)	$$ds^2 = \left[dr^2 + r^2 \cdot \left(d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right) \cdot d\phi^2_{Longitude} \right) \right]$$
Minkowski Metric (Pseudo-Euclidean) (Flat Space-Time)	$$ds^2 = \left[\left(1 - \left(\frac{c^2_{Light}}{\left(v(r,t)\right)^2} \right) \right) \cdot dr^2 + r^2 \cdot \left(d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right) \cdot d\phi^2_{Longitude} \right) \right]$$
Einstein Metric (Non-Euclidean) (Static) (Curved Space-Time)	$$ds^2 = \left[\left[\frac{1 - \left(1 - \left(\frac{r_{Schwarzschild}}{r} \right) \right) \cdot \left(\frac{c^2_{Light}}{\left(v(r,t)\right)^2} \right)}{\left(1 - \left(\frac{r_{Schwarzschild}}{r} \right) \right)} \right] \cdot dr^2 + r^2 \cdot \left[d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right) \cdot d\phi^2_{Longitude} \right] \right]$$
Schwarzschild Metric (Non-Euclidean) (Curved Space-Time)	$$ds^2 = \left[\left[\frac{1 - \left(1 - \left(\frac{r_{Schwarzschild}}{r} \right) \right)^2 \cdot \left(\frac{c^2_{Light}}{\left(v(r,t)\right)^2} \right)}{\left(1 - \left(\frac{r_{Schwarzschild}}{r} \right) \right)} \right] \cdot dr^2 + r^2 \cdot \left[d\theta^2_{Latitude} + \sin^2\left(\theta_{Latitude}\right) \cdot d\phi^2_{Longitude} \right] \right]$$

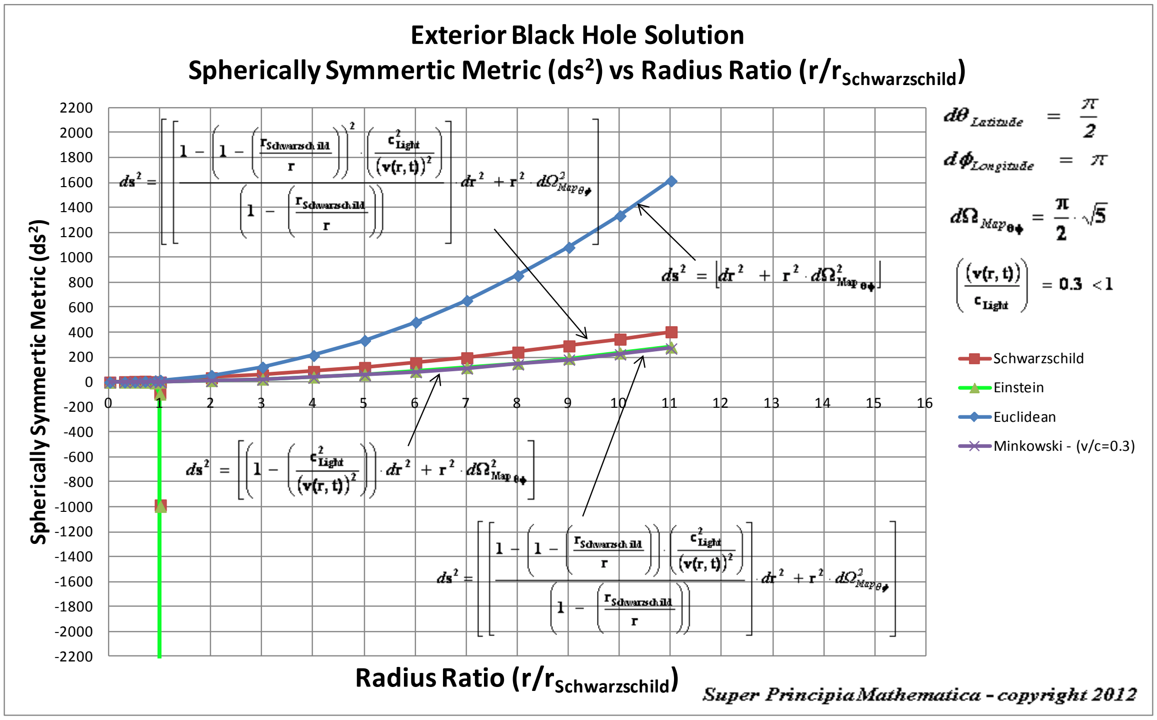
Next, is a set of graphs of the various Euclidean and Non-Euclidean Spherically Symmetric Metrics (ds^2) – Exterior & Interior Black Hole Event Horizon Solutions:

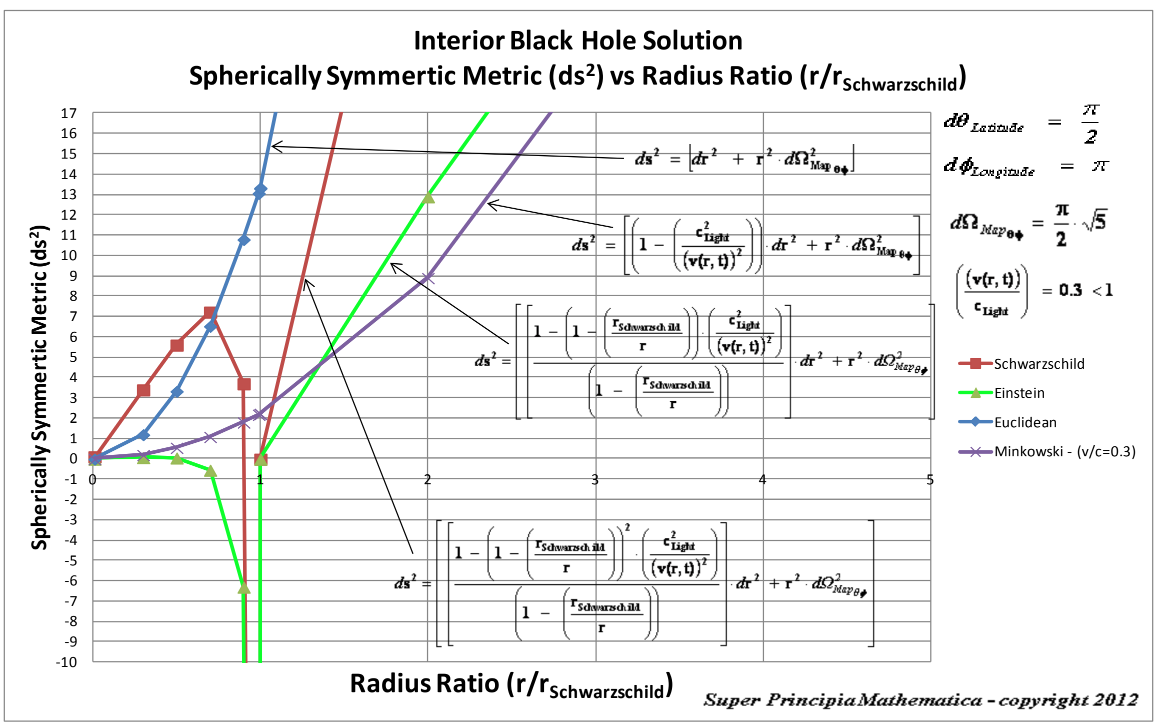
$$(r \rightarrow 0 \;\; ; \;\; ds^2 \rightarrow 0) \; ; \; (r = r_{Schwarzschild} \;\; ; \;\; ds^2 = \infty) \; ; \; \left(\left(\frac{c_{Light}^2}{(v(r,t))^2}\right) = \frac{1}{0.1}\right)$$



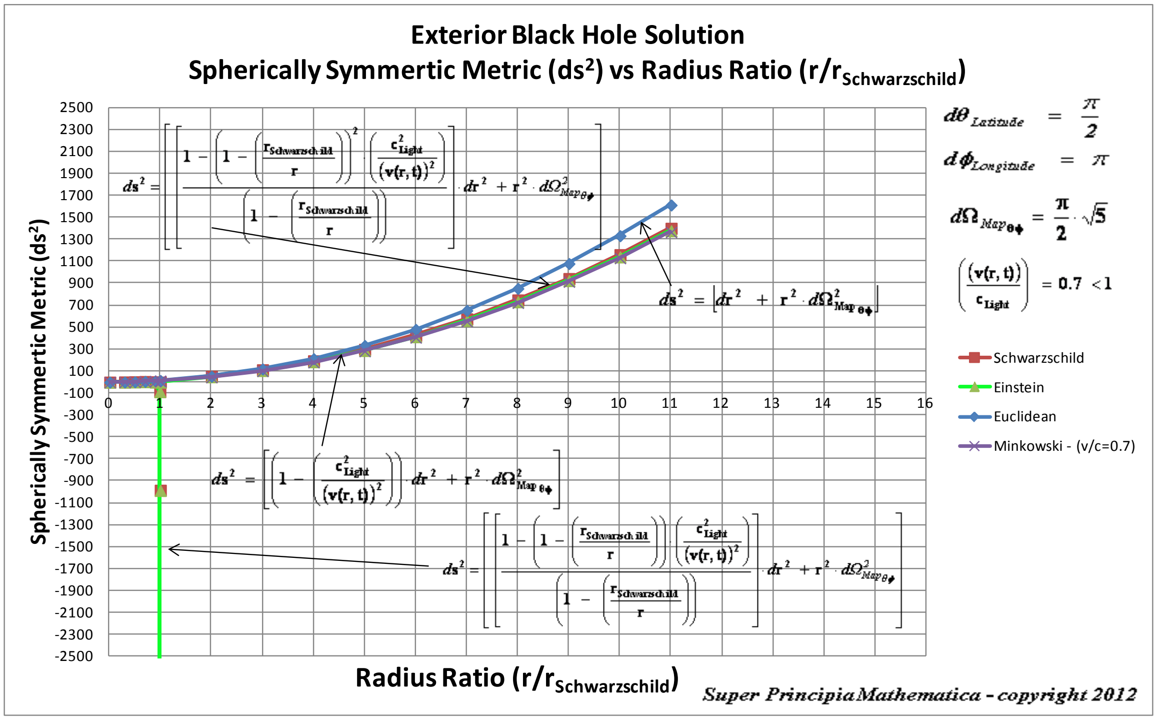


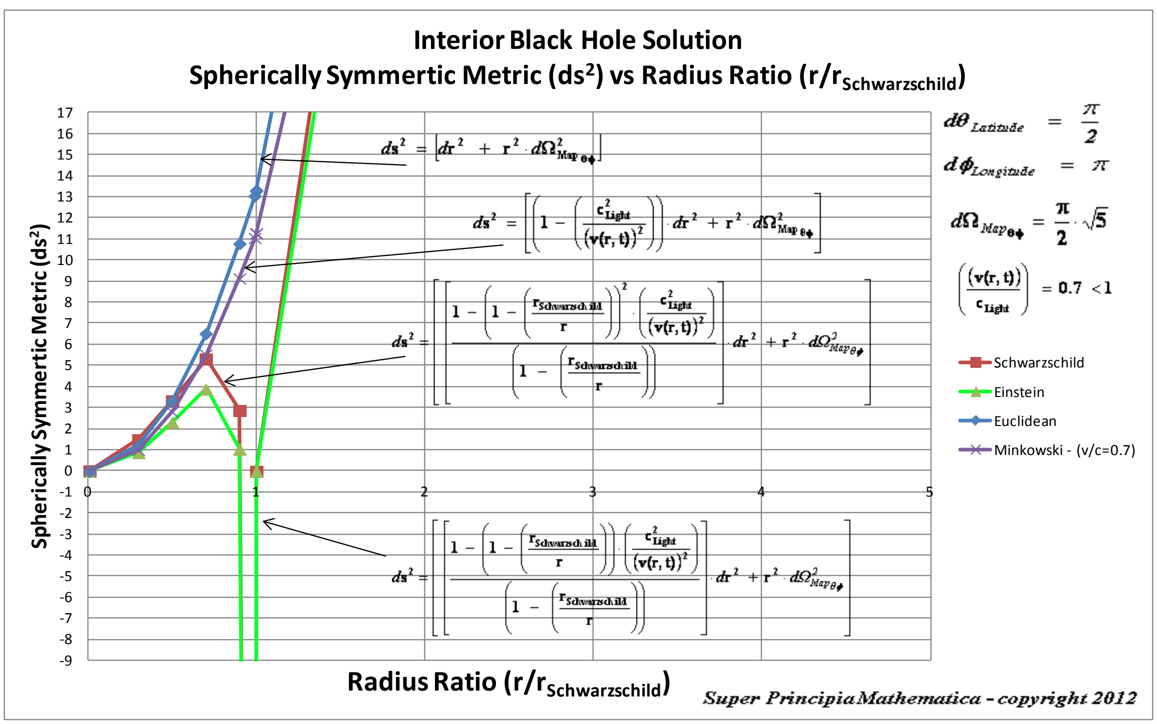
$$(r \to 0 \;\; ; \;\; ds^2 \to 0) \; ; \; (r = r_{Schwarzschild} \;\; ; \;\; ds^2 = \infty) \; ; \; \left(\left(\frac{c_{Light}^2}{(v(r,t))^2} \right) = \frac{1}{0.3} \right)$$



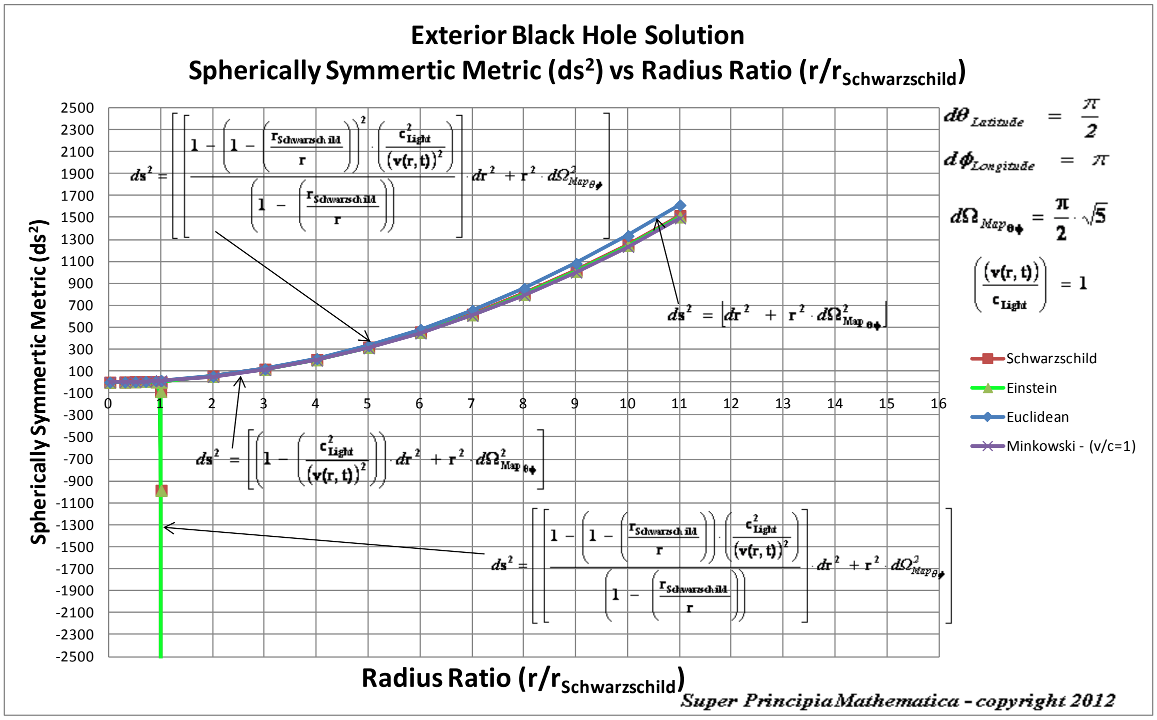


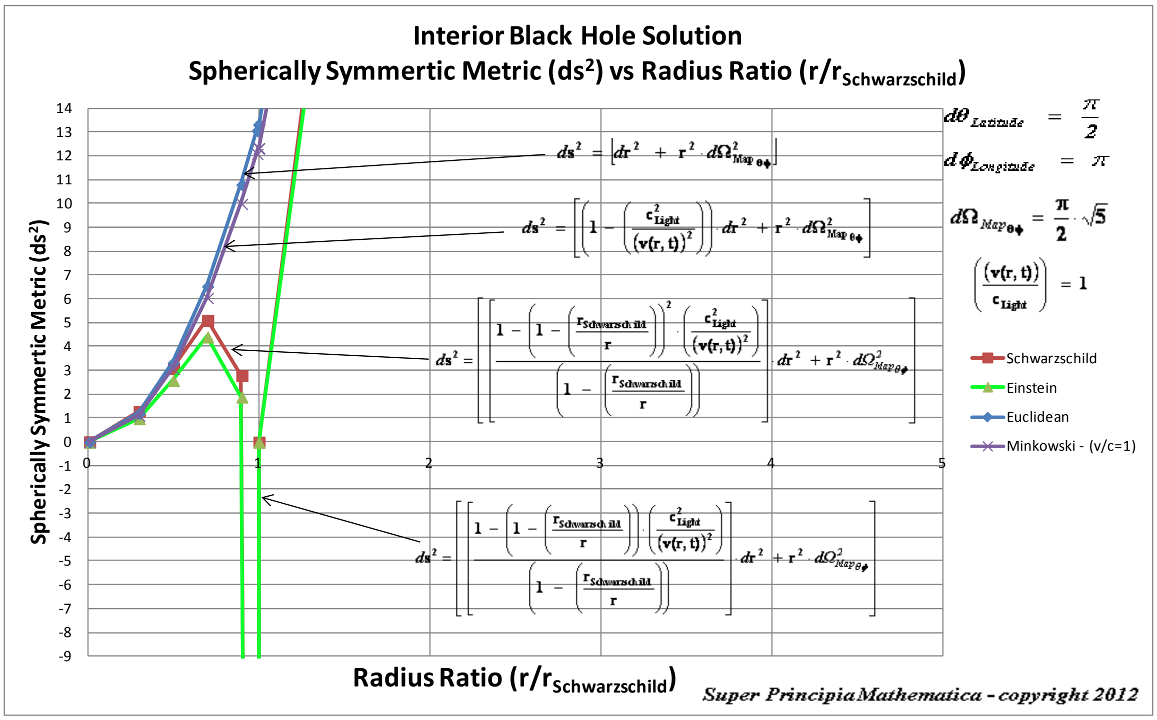
$$(r \to 0 \;;\; ds^2 \to 0)\;;\;(r = r_{Schwarzschild} \;;\; ds^2 = \infty)\;;\;\left(\left(\frac{c^2_{Light}}{(v(r,t))^2}\right) = \frac{1}{0.7}\right)$$



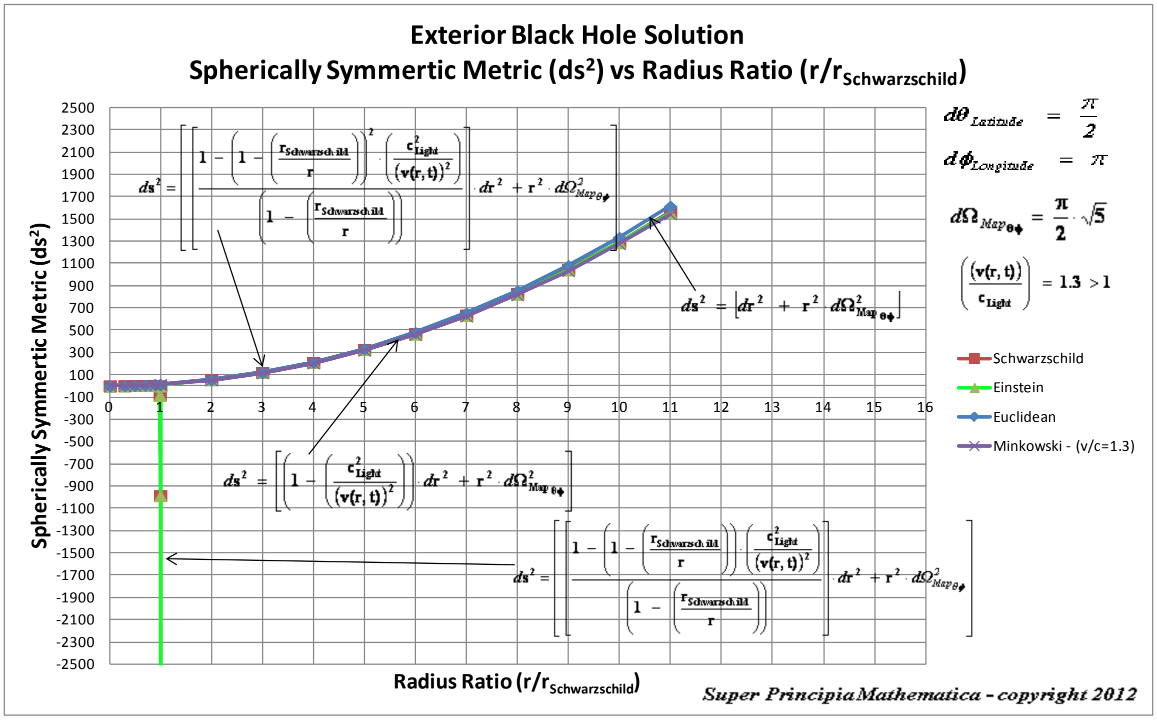


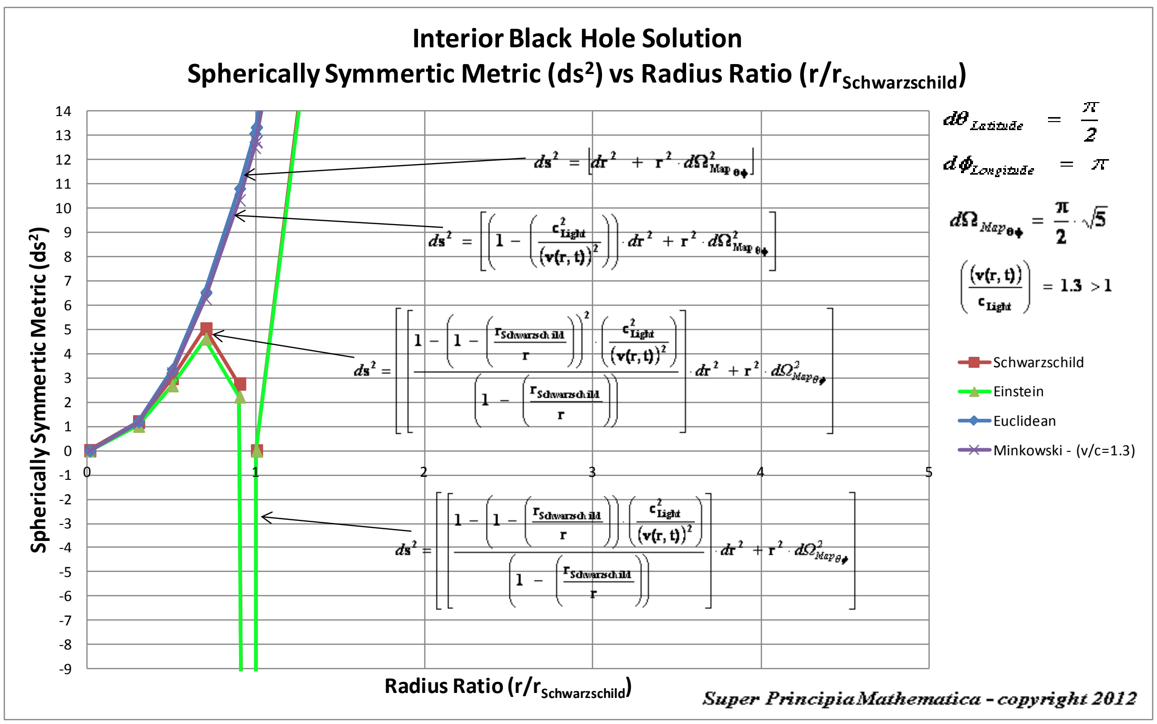
$$(r \to 0 \;;\; ds^2 \to 0) \;;\; (r = r_{Schwarzschild} \;;\; ds^2 = \infty) \;;\; \left(\left(\frac{c_{Light}^2}{(v(r,t))^2}\right) = 1\right)$$



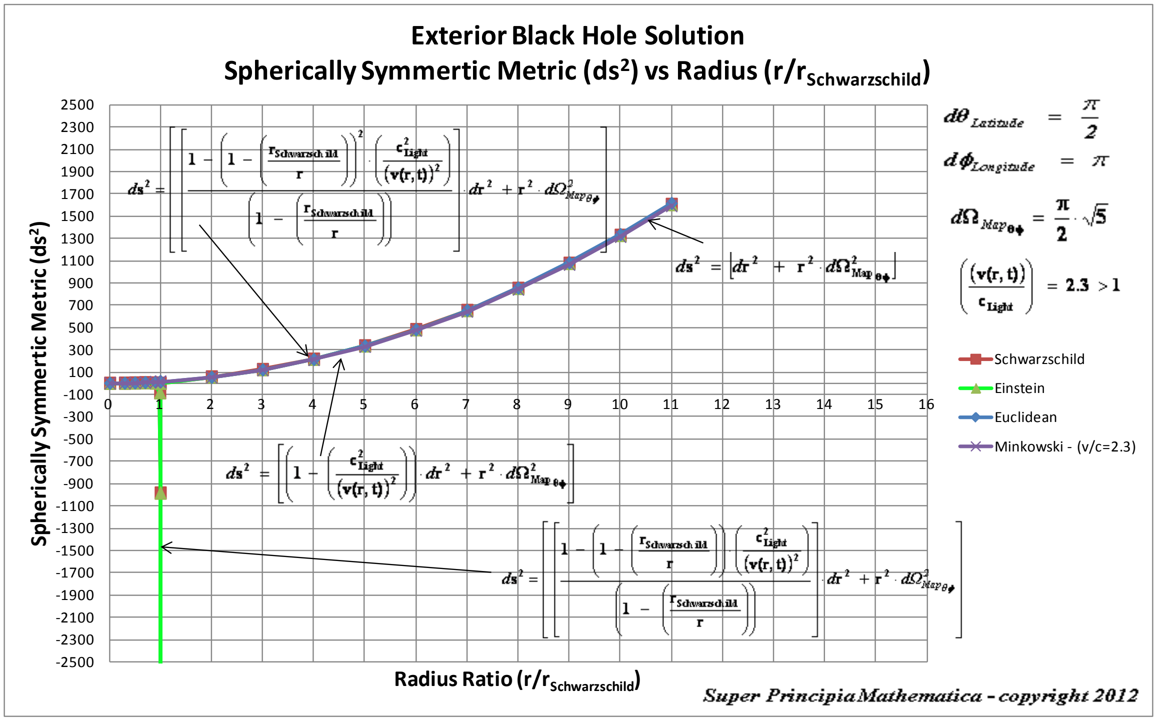


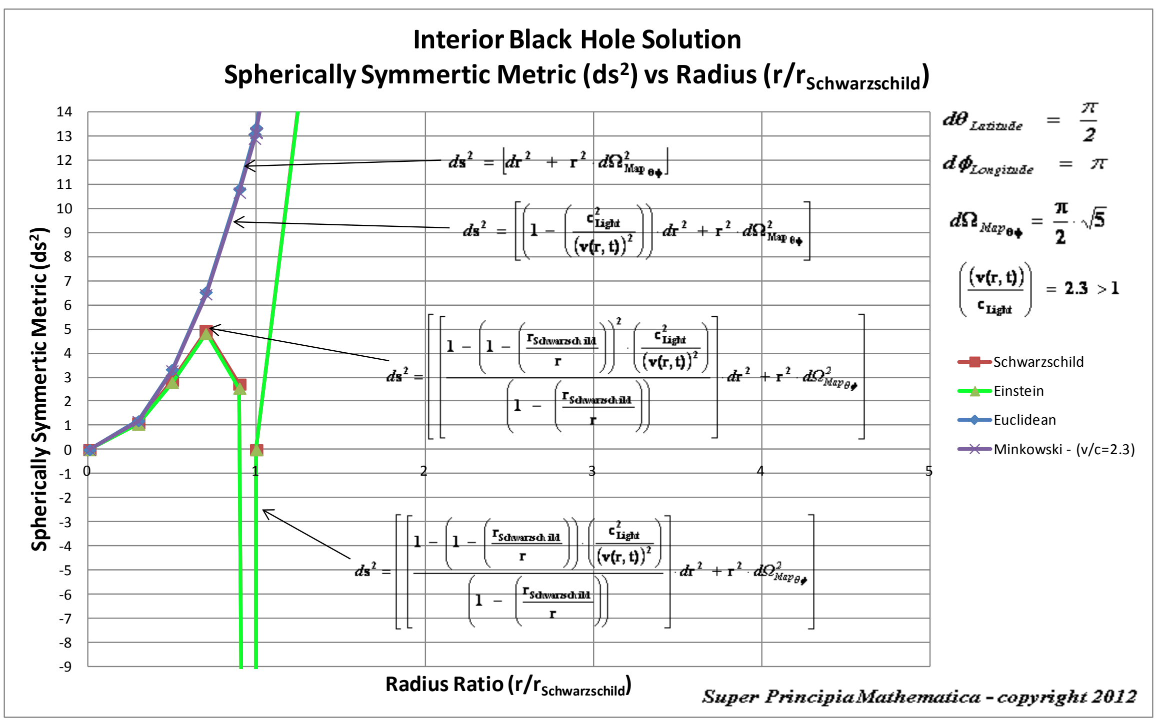
$$(r \rightarrow 0 \;\; ; \;\; ds^2 \rightarrow 0) \;\; ; \;\; (r = r_{\text{Schwarzschild}} \;\; ; \;\; ds^2 = \infty) \;\; ; \;\; \left(\left(\frac{c_{\text{Light}}^2}{(v(r,t))^2} \right) = \frac{1}{1.3} \right)$$



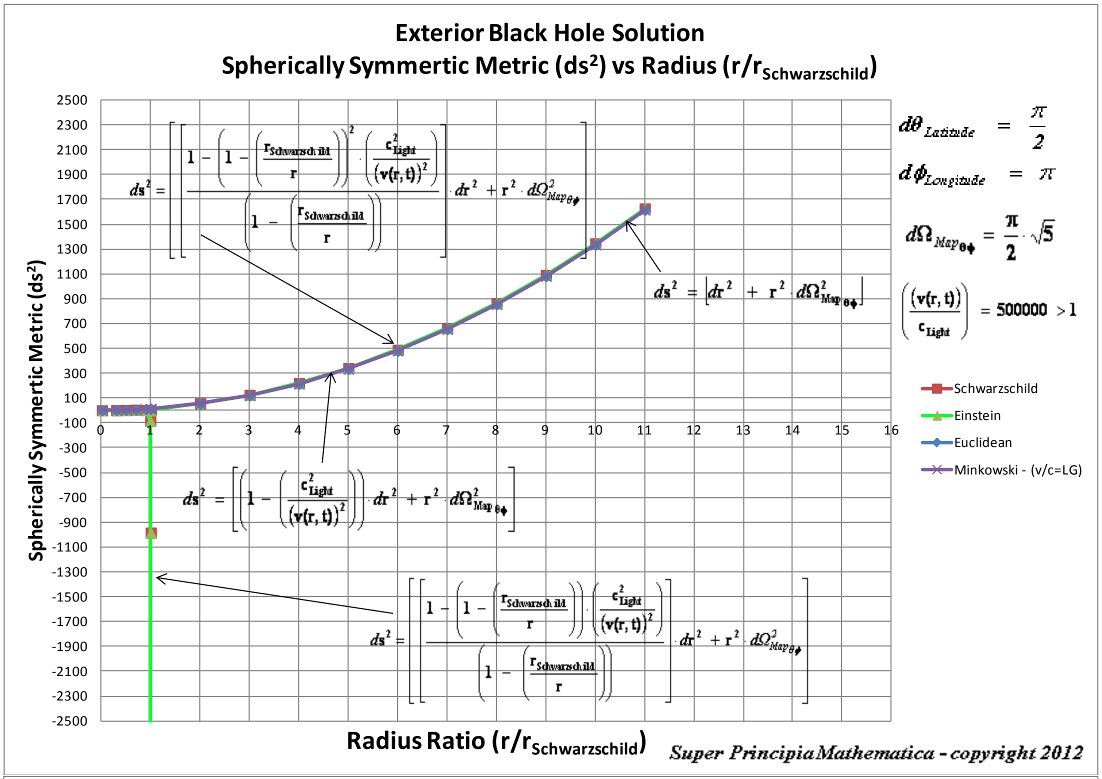


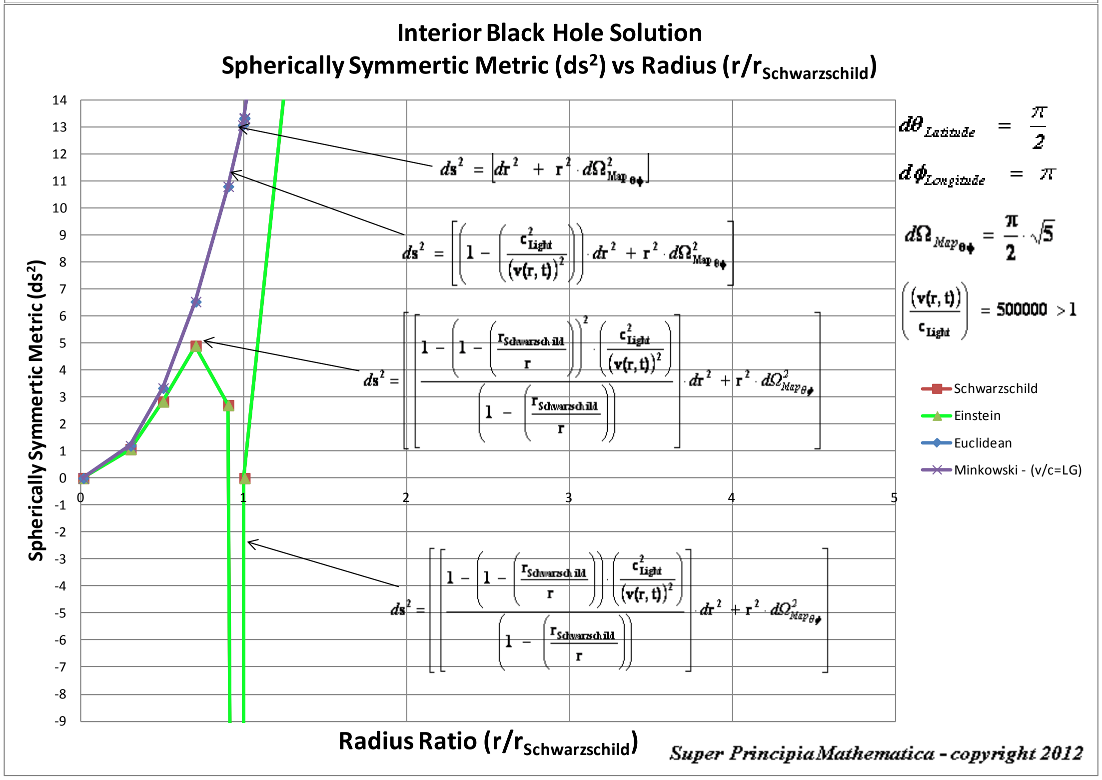
$$(r \to 0 \;;\; ds^2 \to 0) \;;\; (r = r_{Schwarzschild} \;;\; ds^2 = \infty) \;;\; \left(\left(\frac{c^2_{Light}}{(v(r,t))^2} \right) = \frac{1}{2.3} \right)$$





$$(r \to 0 \;\; ; \;\; ds^2 \to 0) \; ; \; (r = r_{\text{Schwarzschild}} \;\; ; \;\; ds^2 = \infty) \; ; \; \left(\left(\frac{c_{\text{Light}}^2}{(v(r,t))^2} \right) = \frac{1}{500{,}000} \right)$$





2. Conclusion

This work was written to physicists that are interested in understanding from a conceptual view, “Flat Geometry” Euclidean Space, and “Curved Geometry” Non-Euclidean Space; as a description for causality of gravity, or general motion in a gravitational field.

The **Euclidean** and the **Minkowski “Euclidean” Metrics** (ds^2) describes the causality and geometry of the “flat” space, space-time, and the gravitational field; and is *independent* of the condensed mass, matter, or energy absent or present, in a localized region, of a space or space-time, or gradient gravitational field under consideration.

The **Schwarzschild** and the **Einstein “Non-Euclidean” Metrics** (ds^2) describes the causality and geometry of the “curvature” of space, space-time, and the gravitational field, and is used in conjunction, with a fluid mechanical model, ***Perfect Fluid “Static or Dynamic” Vacuum Energy Solution*** for the causality gravitation; and is *dependent* of the condensed mass, matter, or energy absent or present, in a localized region, of a space or space-time, or gradient gravitational field under consideration.

It was demonstrated that the ***“Coordinate Singularity”*** ($ds^2 = \infty$) located at the Black Hole Event Horizon, Schwarzschild Radius ($r = r_{Schwarzschild}$), is not a natural artifact for any Non-Euclidean metric; and is a problem to be solved.

If this ***“Coordinate Singularity”*** problem is resolved, the Schwarzschild and Einstein metrics are considered a valid description for the physical description of the curvature of space, space-time, or gradient gravitation field, surrounding, and in the presence of a condensed mass, matter, or energy of an isolated system mass body.

The ***“Physical Singularity”*** ($ds^2 \to 0$) located at zero radius ($r = 0$), is a value that approaches zero, as the radius approaches zero. The ***“Physical Singularity”*** ($ds^2 = \infty$) is a natural artifact for any Non-Euclidean metric; and cannot be eliminated.

This paper described a new algorithm, for “generalized mathematical formalism” of a “Spherically Symmetric Metric” (ds^2), that describes the ***Euclidean Metric, Minkowski Metric, Einstein Metric, or the Schwarzschild Metric***; using an algorithm which is composed of, ***Three (3) Metric Components***

& Three (3) Metric Coefficients; and likewise an algorithm using ***Two (2) Metric Components & Two (2) Metric Coefficients***.

In future works, a new algorithm, that describes the ***Euclidean Metric, Minkowski Metric, Einstein Metric, or the Schwarzschild Metric*** using a general equation which is composed of:

- ***Four (4) Metric Components & Four (4) Metric Coefficients***

The ***Four (4) Metric Components & Four (4) Metric Coefficients*** algorithm is the current model used by the mainstream literature, and physics community; today.

Below are the topics that were discussed in this paper:

- ***1.1 Algorithm for Describing Spherically Symmetric Metrics of a Gravitational Field Using – Three (3) Metric Components & Three Metric Coefficients***

- ***1.2 Euclidean "Flat Space" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm***

- ***1.3 Minkowski "Flat Space-Time" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm***

- ***1.4 Schwarzschild "Curved Space-Time" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm***

- ***1.5 Einstein "Curved Space-Time" Spherically Symmetric Metric – Three (3) Metric Components & Three (3) Metric Coefficients – Algorithm***

- ***1.6 "New" Algorithm for Describing Spherically Symmetric Metrics of a Gravitational Field Using – Two (2) Metric Components & Two (2) Metric Coefficients***

References

[1] **Physical Acceptability of Isolated, Static, Spherically Symmetric, Perfect Fluid Solutions of Einstein's Equations**, M.S.R. Delgaty and Kayll Lake1, Department of Physics, Queen's University, Kingston Ontario, Canada K7L 3N6 (Dated: Septem 1998): http://arxiv.org/pdf/gr-qc/9809013v1.pdf

[2] **Generating perfect fluid spheres in general relativity**, Petarpa Boonserm, ∗ Matt Visser, and Silke Weinfurtner, School of Mathematics, Statistics, and Computer Science, Victoria University of Wellington,PO Box 600, Wellington, New Zealand (Dated: March 2005 - February 6, 2008): http://arxiv.org/pdf/gr-qc/0503007v1.pdf - (Pages: 13 - 16)

[3] Karl Friedrich Gauss, **General Investigations of Curved Surfaces of 1827 and 1825**, The Project Gutenberg EBook of General Investigations of Curved Surfaces of 1827 and 1825, by Karl Friedrich Gauss: http://www.gutenberg.org/files/36856/36856-pdf.pdf

[4] Gauss Law - Theorema Egregium: http://en.wikipedia.org/wiki/Theorema_Egregium

[5] List of Differential Geometry Topics (Wikipedia): http://en.wikipedia.org/wiki/List_of_differential_geometry_topics

[6] D.F. Lawden. **Introduction to Tensor Calculus, Relativity and Cosmology**; Dover Publications; 3 edition (January 27, 2003), ISBN 978-0486425405 pp. 6-10

[7] Minkowski, Hermann (1907/8), "Die Grundgleichungen für die elektromagnetischen Vorgänge in bewegten Körpern", Nachrichten von der Gesellschaft der Wissenschaften zu Göttingen, Mathematisch-Physikalische Klasse: 53–111 *** Wikisource translation: **The Fundamental Equations for Electromagnetic Processes in Moving Bodies.** http://en.wikipedia.org/wiki/Differential_geometry_of_surfaces

[8] List Of Differential Geometry Topics: http://en.wikipedia.org/wiki/List_of_differential_geometry_topics

[9] Einstein's Paper: "Explanation of the Perihelion Motion of Mercury from General Relativity Theory"; Anatoli Andrei Vankov; IPPE, Obninsk, Russia; Bethany College, KS, USA: http://www.gsjournal.net/old/eeuro/vankov.pdf

[10] Schwarzschild, K. (1916). "Über das Gravitationsfeld eines Massenpunktes nach der Einstein'schen Theorie". Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften 1: 189–196: text of the original paper, in Wikisource: http://de.wikisource.org/wiki/%C3%9Cber_das_Gravitationsfeld_eines_Massenpunktes_nach_der_Einsteinschen_Theorie

[11] Schwarzschild Geodesics: http://en.wikipedia.org/wiki/Schwarzschild_geodesics

[12] Robert Louis Kemp. "Super Principia Mathematica – The Rage To Master Conceptual & Mathematical Physics – The General Theory of Relativity." ISBN 978-0-9841518-2-0, Flying Car Publishing Company, July 2010, pp. 20-21.

[13] Robert Louis Kemp. "Super Principia Mathematica – The Rage To Master Conceptual & Mathematical Physics – http://superprincipia.wordpress.com/2011/12/23/inertial-mass-vortex-gravitation-theory-continued-part-3/

[14] Robert Louis Kemp. "Super Principia Mathematica – The Rage To Master Conceptual & Mathematical Physics – http://superprincipia.wordpress.com/2012/01/28/total-mechanical-energy-conservation-escape-velocity-binding-energy-einstein-field-equation/

[15] Robert Louis Kemp. "Super Principia Mathematica – The Rage To Master Conceptual & Mathematical Physics – http://superprincipia.wordpress.com/2012/01/16/a-theory-of-gravity-for-the-21st-century-the-gravitational-force-and-potential-energy-in-consideration-with-special-relativity-general-relativity/

[16] Robert Louis Kemp. “Super Principia Mathematica – The Rage To Master Conceptual & Mathematical Physics – http://superprincipia.wordpress.com/2012/05/29/newtonian-self-gravitational-force-video-lecture/

[17] Robert Louis Kemp. “Super Principia Mathematica – The Rage To Master Conceptual & Mathematical Physics – http://superprincipia.wordpress.com/2012/11/08/conditions-for-the-absence-and-presence-of-matter-in-general-relativity-gr-einstein-field-equations-efes/

[18] Robert Louis Kemp. “Super Principia Mathematica – The Rage To Master Conceptual & Mathematical Physics – http://superprincipia.wordpress.com/2013/01/20/what-are-the-mathematical-and-physical-concepts-of-flat-euclidean-and-curved-non-euclidean-gravitational-fields/

[19] Robert Louis Kemp. “Super Principia Mathematica – The Rage To Master Conceptual & Mathematical Physics – http://superprincipia.wordpress.com/2013/01/20/what-are-the-mathematical-and-physical-concepts-of-flat-euclidean-and-curved-non-euclidean-gravitational-fields/

[20] Robert Louis Kemp. “Super Principia Mathematica – The Rage To Master Conceptual & Mathematical Physics – http://superprincipia.wordpress.com/2013/01/20/the-perfect-fluid-vacuum-unified-gravitation-vortex-model-and-non-euclidean-spherically-symmetric-metrics/