A Different Neutron Star/Black Hole Model Based Upon A Rotational/Vorticity Gravitational Field

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Abstract- **Anomalies and enigmas are pathways to discovery. Irrotational gravitational models for Newton and Winterberg are not capable of producing gravitational waves. Jefimenko's model introduces vorticity crafting a rotational field to provide gravitational waves. Other model variants with stronger rationales produce a wave equation without creating Jefimenko's co-gravity as a prerequisite while allowing gravitational waves. Anomalous gravitational behavior and spin are evaluated and postulated based upon charge conservation that allows a rotational Newtonian field to produce gravitational waves if and only if temporal gravitational currents exist. This charge conservation model uses a gyrating electromagnetic neutron star model augmenting source density to enhance gravity which then collapses to a constant gravity value observed by results from Pioneer 10 and 11 spacecraft at considerable distances in contrast to the Newtonian approximations. The implications of this model imply that the neutron star topology depends upon the supernova exterior boundary and this neutron star model may be valid for rotating stars within a spiral galaxy. A black hole model also represents a neutron-like star enclosed within a Faraday cage which spins to intensify and accumulates gravity before ejected a single jet generated by the black hole where its interior acts as a monopole. Both of these models provide unusual insights where the spin is analogous to an accumulating electrical charge in a capacitor as a mechanism to increase gravitational intensity.**

Keywords—gravitation, vorticity, supernova, neutron stars, black holes.

I. Introduction

In a recent investigation, Maxwell equations were examined and concluded that most electrical and magnetic fields are most likely irrotational at face value. This will induce a temporal effect that does not allow any spatial constraints allowing a rotational field to exist as an aether, Dirac Sea, or Shipov's physical vacuum. This temporal effect allows wave behavior for the fields.

Does the same methodology apply for gravitation? It may be worthwhile to look at this from a philosophic perspective. Finding a meaningful gravitational model could be viewed as trivial. In reality, there is a level of frustration. For example, Newtonian gravitation satisfies our immediate needs in the near-term cosmos because it answers questions about satellite orbits and the motion of the planets. The anomalies occur with the far-term region where it appears that based upon the Pioneer 10 and 11 (Turyshev, Toth 2009, Nieto et al, Brownstein et al 2007, Anderson et al 2008, 1998), other orbiting craft past Saturn as well as the celestial visitor Oumuamua have found that gravity does not decay as expected but reaches some inconsequential value that is almost constant.

The Pioneer anomaly or Pioneer effect (Murad 2019) denotes the observed deviation from predicted Newtonian accelerations of the Pioneer 10 and Pioneer 11 spacecraft after they passed about 20 astronomical units (3×10^9 km; 2×10^9 mi) on their trajectories out of the Solar System. The apparent anomaly was a matter of interest for many years and explained as an anisotropic radiation pressure caused by the spacecraft's heat loss. However, when these extemporaneous values were removed, the subsequent acceleration due to the sun is found to be $a = 8.74 \pm 1.33 \times 10^{-8}$ cm s^{-2}. Moreover, Newtonian gravity does not deal well with rotation or permit the existence of gravitational waves. *Regarding Einstein with gravitational waves and Newton with no gravitational waves, someone must be lying.*

There is no such thing as a good or bad model that could be rejected but rather there are either useful or useless models. This point is validated by Newtonian gravitation. The question is how to build and refine a more perfect gravitational model that satisfies the conventional wisdom as well as addresses these unusual but real anomalies. Moreover, items will be addressed to look at relevant models and how some of these changes before developing a final model, it too may become obsolete and become warm from the trash heap of history. Finally, the impact of rotation will be considered as well.

Neutron stars provide signals. The following is paraphrased from (Douglas Kenyon 2005). 'Paul LaViolette deals with anomalies that include pulsars. The theory prevails in 1968 to explain pulsars based upon the Neutron Star Lighthouse Model. A rapidly burnt-out star under a supernova implosion transforms the atoms within the dying red giant star into a bunch of tightly packed neutrons supposedly stacked like a crystal. This matter is incredibly dense and much smaller than the initial star that may be three times larger than our sun finally reduced in size to less than 10 to 30 kilometers in diameter. The star rotates emitting a synchrotron beam, like the beacon from a lighthouse, where the signal might be detected from the Earth.'

LaViolette raises questions about this neutron star model. 'This signal for each neutron star is different from each other. These pulses are timed not precisely from pulse to pulse, but only when time-averaged pulses are dealt with during two thousand pulses. This time-averaged pulse is exceedingly accurate and regular. Furthermore, in some pulsars the pulse drifts at a constant rate, adding another layer of complexity to the waveform signal. Another factor involves amplitude modulation. Some pulses increase amplitude is varied but with regular patterns. Many of the pulses exhibit 'mode switching' wherein the pulse suddenly exhibits an entirely new set of characteristics that persist over time and then reverts to its original mode. This switch may be frequency-dependent and in some cases conforms to regular patterns.'

In terms of precision, some neutron stars demonstrate periodic, regular variations in terms of color and luminosity. Several binary X-ray stars pulse with periods accurate to six or seven significant digits. Pulsars, on the other hand, are from a million to one hundred billion times more precise than an X-ray star.'

These neutron stars operate differently. The so-called Millisecond Pulsar rotates the fastest out of a sample of 1,100 discovered neutron stars. This beats at 642 pulses per second and is more precise and accurate to seventeen significant digits that have more accuracy as an atomic clock.'

Can this be explained? There is another important inference. When a Red Giant star dies and collapses with a supernova, several things occur. If below a mass threshold, the result is a neutron star. If the weight of the initial star is larger, the resulting implosion will result in an entirely different celestial body, a black hole. What is the mechanism for these celestial bodies that can be so close and yet so far away from each other? What is the impact of spin? This is obviously worth discussing.

II. Discussion

A. Gravitational Models

Of the two models, Newton and Winterberg, these models imply gravity as an irrotational field. Moreover, neither of these partial differential equations is mathematically capable of supporting gravitational waves. Jefimenko (Jefimenko 1992, 1997, 2006) made his model mirror Maxwell's equations whereas gravity was analogous to the electric field and co-gravity was similar to the magnetic field. What is interesting is that Jefimenko's model and its Murad variants described below, counter this assumption that gravity is irrotational. If a gravity field is irrotational, then Newton and Winterberg's gravity law would be perfectly satisfied. This implies there would be *no* gravitational waves. *Einstein lied!*

How do you create a rotational gravitational field? Jefimenko carefully tailors his model to allow a rotational gravitational field allowing the use of a time derivative of co-gravity. These plus the Jefimenko model with extensions and variants (Murad 2010, 2017) is presented in the following table.

Table I. Different Gravitational Laws which cover a spectrum of conditions of interest.

Gravity Law	***Assumptions***	***Gravitational Rule***
Newtonian Gravitation	$\nabla \times \bar{g} = 0. and\ \nabla \cdot \bar{g} = -4\pi G\rho_s,$	$\vec{g} = -\nabla\phi(r)\ \ and\ \ \nabla^2\phi = 4\pi G\rho_s$ $where\ \ \vec{g} \approx {}^{1}/_{r^2}\,.$
Winterberg's Rule	$\nabla \cdot \vec{g} = -4\pi G\rho_s = 2\omega^2$ $where\ \rho_s = -\frac{\omega^2}{2\pi G}.$	$\vec{g} = -\nabla\phi(r)\ and\ \nabla^2\phi = -2\,\omega^2$ $where\ \ \vec{g} \approx {}^{1}/_{r^2}\,.$
Jefimenko's gravity and co-gravity.	$\nabla \times \bar{g} = -\frac{\partial \bar{K}}{\partial t};\ \nabla \cdot \bar{g} = -4\pi G\rho_s;\ \nabla \cdot \bar{K} =$ $and\ \nabla \times \bar{K} = -\frac{4\pi G}{c^2}\bar{J}_s + \frac{1}{c^2}\frac{\partial \bar{g}}{\partial t}.$	$\frac{1}{c^2}\frac{\partial^2 \bar{g}}{\partial t^2} - \nabla^2 \bar{g} = 4\pi G\left[\nabla \cdot \rho_s + \frac{1}{c^2}\frac{\partial \bar{J}_s}{\partial t} - \frac{\nabla \times \bar{J}_s}{c}\right],$ $\frac{1}{c^2}\frac{\partial^2 \bar{K}}{\partial t^2} - \nabla^2 \bar{K} = 4\pi G\left[\frac{\nabla \cdot \rho_s}{c^3}\right],$
Murad's modification of Jefimenko	$\nabla \times \bar{g} = -\frac{\partial \bar{K}}{\partial t} - \frac{4\pi G}{c}\bar{J}_c;\ \nabla \cdot \bar{g} = -4\pi$ $\nabla \cdot \bar{K} = -\frac{4\pi G}{c^2}\rho_c\ and\ \nabla \times \bar{K} = -\frac{4\pi G}{c^2}\bar{J}_s$	$\frac{1}{c^2}\frac{\partial^2 \bar{g}}{\partial t^2} - \nabla^2 \bar{g} = 4\pi G\left[\nabla \cdot \rho_s + \frac{1}{c^2}\frac{\partial \bar{J}_s}{\partial t} - \frac{\nabla \times \bar{J}_c}{c}\right],$ $\frac{1}{c^2}\frac{\partial^2 \bar{K}}{\partial t^2} - \nabla^2 \bar{K} = 4\pi G\left[\frac{\nabla \cdot \rho_c}{c} - \frac{1}{c^3}\frac{\partial \bar{J}_c}{\partial t} - \frac{\nabla \times \bar{J}_s}{c^2}\right],$
Murad's gravity law	$\nabla \times \bar{g} = -\frac{1}{c}\frac{\partial \bar{g}}{\partial t} + \frac{4\pi\gamma G}{c}\bar{J}_g.$ $and\ \nabla \cdot \bar{g} = -4\pi\gamma G\rho_{,}\ \text{where}\ \gamma = \frac{1}{\sqrt{1 - \frac{u}{c}}}$	$\frac{1}{c^2}\frac{\partial^2 \bar{g}}{\partial t^2} - \nabla^2 \bar{g} = 4\pi\gamma G\left[\nabla \cdot \rho_s + \frac{1}{c^2}\frac{\partial \bar{J}_g}{\partial t} - \frac{\nabla \times \bar{J}_g}{c}\right]$

The problem with Murad's variation is by introducing additional co-gravitic sources and current terms to achieve mathematical symmetry. The major problem is that gravitational sources are currently treated as matter masses but the understanding about gravitational currents is not so clear or if you could feel comfortable. Moreover, the confusion becomes more difficult with co-gravity counterparts. The issue matches electric and magnetic fields with symmetry implying existence of magnetic currents. This is *not* to say that electric and magnetic currents may or may not be the same or different due to symmetry. Since Jefimenko built his model on Maxwell's equations, this rationale was extended to include co-gravity counterparts for mathematical completion. This may easily add unnecessary complications.

Let us address some shortcomings in these models. Both Newtonian and Winterberg models are irrotational. Here, these two models are elliptical partial derivative equations. In the following discussion about representing a modified MOND model for using Winterberg's model, here too, there are no gravitational waves. The other models are empirical and not materialistic especially explaining where a curl term is introduced. They do appear as magic; however, they create a wave equation despite there is no physical evidence that provides insights with these terms. As mentioned, what physical evidence exists for co-gravity, its source, or its current? For simplification, the obvious response would be to assume the currents and sources for gravity and co-gravity are probably the same. The last model is an attempt to provide a gravitational wave equation without the awkward appendage of requiring co-gravity. Even here, a wave equation is provided but the extension of the curl term introducing a function of time is an implied assumption that gravity has a temporal character.

In terms of vorticity, curl items in the table with a yellow border allow the existence of partial differential equations to produce gravitational waves. Clearly, these values require experimental confirmation. The basic problem is that these models, correct or not, depend upon gravitational currents. Let us assume these currents may include the motion of mass. How do we deal with the use of energy which can, through DeBroglie, create mass into matter which thereby affects gravitation? This is a challenge to reconcile.

B. The MOND and Modified Winterburg Model

Explaining multipliers for values selected by Milgrom (Milgrom 1983, 1984, Almida 2004, Pawlowski et al 2012, Boran et al 2017, McGaugh 2014, Corbelli 2000, Murad 2019) may not be obvious to the casual investigator. The first impression would logically go to the conclusion that matter must exist and something is amiss. Let us assume that the distances are correct and that gravitational lensing, where the field of view is near a star, will be inconsequential to manipulate the accuracy with the distances and velocities selected.

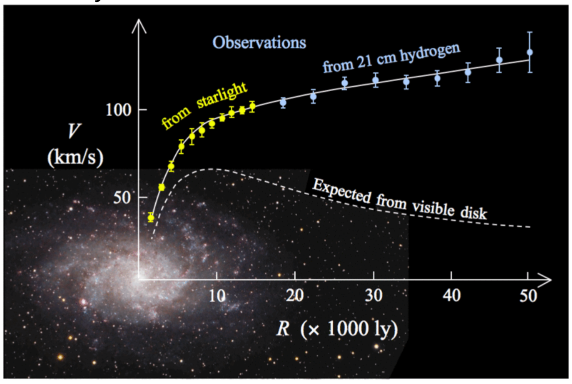

Figure 1. MOND results showing the disparity from using Newtonian gravitation and experimental results.

The bottom curve represents the results of the velocity of stars in galaxy spirals using Newtonian gravitation. Upper curve values, based upon experimental results, is considerably higher implying the need for more gravitation. Note that these two curves, after considerable distances, appear to be close to $\sqrt{r}$ *and* $1/\sqrt{r}$ where the first value reflects the top curve and the second value imitates the expected Newtonian gravitational model. Let us assume based upon units, velocity is the square root of distance multiplied by gravity or simply $V \approx \sqrt{r\,g}$; if we use a constant per the new value, the curve would look like $\sqrt{r}$. By contrast, if we use the Newtonian model, $\approx 1/r^2$, the second value forms the curve.

What does this mean? The lower curve at long distances implies Newtonian gravity per MOND while the upper curve implies that at long distances, the assumption that Newtonian gravitation goes to zero is wrong. This is a far-reaching conclusion based upon findings of Pioneer 10 and 11. Moreover, a final value implies that gravity could satisfy these requirements when gravity is a value close to a constant rather than $1/r^2$.

Let us address neutron stars (Dunham 2008, Verbiest et al 2008, Williams 2001, Bell et al 1993, Taylor 1994, Murad 2009, 2016, Baker et al 2002, Novikov 1980, Merritt et al 2002) and assume that Winterberg's model may also apply to rotating stars as well. The Winterberg model has some shortcomings. The rotating energy field for spinning celestial bodies are intriguing. The issue is if indeed the modified MOND suggestion requires some interpretation considering the need for a near-constant value of gravity. How do we determine this factor other than dealing with dark matter? All of these situations provide evidence that Newtonian gravitation fails at very long distances. Can this be resolved?

Let us review the Winterberg model. The gravitational law is based upon the rotation rate. However, how long does this all last? If this is valid, the gravitational attraction effects of a spinning neutron star would go forever by distance. This does not make any sense as well as gravity increasing with distance from a gravitational source without any explanation for gravity currents. Thus, the rotation rate should be at the surface of the neutron star, a very small value. Several source terms are provided in Table

Table II- ***Gravity for a Spinning Body at Long Distances***

Source Term Exponent (n)	**Source Term Square Root**	**Gravity Potential**	**Gravity**
0	ω_o	$r\varphi = \frac{\omega_o^2}{6} r_s^3 \left[\left(\frac{r}{r_s}\right)^3 + 2 - 3\frac{r}{r_s}\right]$	$g = \omega_o^2 \frac{r_s^3}{3}\left[\frac{r^3 - r_s^3}{r^2 r_s^3}\right]$
0.5	$\omega_o \left({}^{r_s}/_{r}\right)^{.5}$	$r\varphi = \omega_o^2 r_s^2 \left[\frac{(r-r_s)^2}{2}\right]$	$g = \omega_o^2 \frac{r_s}{2}\left[1 - \left(\frac{r_s}{r}\right)^2\right]$
1	$\omega_o \left({}^{r_s}/_{r}\right)^{1}$	$r\varphi = \omega_o^2 r_s^2 r \left[ln\left[\frac{r}{r_s}\right] - \left(1 - \frac{r_s}{r}\right)\right]$	$g = \omega_o^2 \frac{r_s^2}{r}\left[1 - \frac{r_s}{r}\right]$
1.5	$\omega_o \left({}^{r_s}/_{r}\right)^{1.5}$	$r\varphi = \omega_o^2 r_s^3 \left[-\left(1 - \frac{r_s}{r}\right) - ln\left[\frac{r}{r_s}\right]\right]$	$g = \omega_o^2 \frac{r_s^3}{r^2}\left[ln\left[\frac{r}{r_s}\right]\right]$
2	$\omega_o \left({}^{r_s}/_{r}\right)^{2}$	$r\varphi = \omega_o^2 \frac{r_s^2}{2r^2}\left[1 - \frac{r_s}{r}\right]^2$	$g = \omega_o^2 \frac{r_s^4}{r^3}\left[1 - \frac{r_s}{r}\right]$

II that assumes that gravity is continuous where a constant rotation rate exists for the star.

This table uses a methodology based upon finding a solution for a spherical coordinate system with:

$$r\varphi = \int_{r_s}^{r} \xi\, f(\xi)(r-\xi)d\xi\,, \quad for\ \frac{\partial^2\varphi}{\partial r^2} + \frac{2}{r}\frac{\partial\varphi}{\partial r}\quad or\ \nabla^2\varphi = f(r). \tag{1}$$

Values in Table II are based upon finding the gravitational field Let us examine a source term with:

$$f(\xi) = \omega(\xi)^2\ where\ \omega(r) = \omega_o\left({}^{r_s}/_{r}\right)^n. \tag{2}$$

This may be incorrect with the use of this model, but we shall assume that the gravitational field is not limited only to the body interior of the neutron star. In other words, gravity depends upon the swirling environment and goes out to infinity. This is needed to deal with the problem of spinning stars interacting with each other in a galaxy. Let us modify the Winterberg gravity model as follows:

$$\nabla g = 2\,\omega_o^2\left({}^{r_s}/_{r}\right)^{2n}. \tag{3}$$

A value for ω_o is a constant for the source term, r is measured to the center of a neutron star and r_s is a small value to represent the radius from the center of the star to its surface.

Note that the first situation represents Winterberg's original model and uses gravity that increases with the distance where this is not in the desired direction growing with increasing distance. This is not realistic where gravity increases. The other values have an inverse function of distance for two situations whereas the next has an analogous solution typical of a Newtonian gravitational law. This suggests that the swirl or vorticity of the spinning celestial body would dissipate, and this approach can be used to define the type of decay. Surprisingly, this methodology could be used to understand the Podkletnov's spinning superconducting disk that demonstrated a weight loss above certain rotating thresholds.

It should also note that these issues may also hold with spinning black hole jets as well. Let us examine a source term with:

$$f(\xi) = \omega(\xi)^2\ where\ \omega(r) = \omega_o\left({}^{r_s}/_{r}\right)^n. \tag{4}$$

This modifies the Winterberg gravity model as follows:

$$\nabla g = 2\,\omega_o^2\left({}^{r_s}/_{r}\right)^{2n}. \tag{5}$$

Substituting the source term into the solution where n is an unknown:

$$\varphi = \frac{2}{(2-2n)(3-2n)}\,\omega_o^2\, r_s^{2n} r^{2-2n}. \tag{6}$$

Set the derivative equal to gravity and assume r is very large:

$$\frac{\partial\varphi}{\partial r} = g = \frac{2}{(3-2n)}\,\omega_o^2\, r_s^{2n} r^{1-2n}. \tag{7}$$

If $n = 1/2$ in this table above, then the derivative is near-constant. This is the second row in the table with a yellow border. Here, the model implies that gravity would approach a small constant value.

III. Analysis

There are many anomalies. The major issue is spin and how this can alter gravitation.

A. Gravity Conservation-An Alternative Newton Law with Gravitational waves

A major problem of these gravitational models is the lack of inclusion of mass or gravity conservation similar to the charge conservation required in say, fluid dynamics as well as previously used in Maxwell's equation. The objective is to gain some foundation for a more refined model involving mass conservation:

$$\frac{\partial\rho_s}{\partial t} + \nabla\cdot\bar{J}_s = 0. \tag{8}$$

Density here would signify mass density while the current implies mass motion. Obviously, this is simply conservation of mass, but this should be much broader and behave towards this as the scientific definition for a gravitational current is yet to be determined. The gravitation source term with integration becomes:

$$\rho_s = -\int_0^t \nabla\cdot\bar{J}_s\, dt + \tilde{\rho}_s(x,y,z) \tag{9}$$

The second term in the RHS does not have a function of time and only deals with a spatial coordinate system for the source term. If we assume a Newtonian approach to generally include relativity, we get:

$$\nabla\cdot\bar{g} = -4\pi G\gamma\rho_s = -4\pi G\gamma\left[-\int_0^t \nabla\cdot\bar{J}_s\, dt + \tilde{\rho}_s(x,y,z)\right]\ \text{where}\ \gamma = \frac{1}{\sqrt{1-\frac{u^2}{c^2}}} \tag{10}$$

This becomes:

$$\bar{g} = -4\pi G\gamma\left[-\int_0^t \bar{J}_s\, dt + \int_o^r \tilde{\rho}_s(x,y,z)\, d\bar{r}\right] + c_g + f_g(t). \tag{11}$$

Terms on the RHS are an integral involving the current with a time dependency, a term that is a spacial gravitational factor, a hidden variable as a constant and a function of time which is yet to be determined. One may infer that the two values in the RHS are limitless and represent an aether or Dirac Sea. This holds for a parallel methodology using Maxwell's equations. However, c_g may be a constant but an insignificantly small value accounting for gravity. Let us modify the integral term concerning the spatial term as follows:

$$\bar{g} = +4\pi G\gamma \int_0^t \bar{J}_s \ dt + \hat{g} + c_g + f_g(t). \quad (12)$$

If there is a curl term on this equation, the results are:

$$\nabla \times \bar{g} = +4\pi G\gamma \int_0^t \nabla \times \bar{J}_s \ dt + \nabla \times \hat{g} + 0 + 0. \quad (13)$$

Note that a rotational gravitational field occurs if and only if there is a circulating gravitational current plus some carry-over from a steady-state source term. On the Earth, there is a rotating molten core that is surrounded by moving plates. Viscosity and inertia of the plates move at differing rotation rates resulting in earthquakes. This moving core generates an electric field as well as a magnetic field and here, the implication is that by this definition, the gravitational field on the Earth is due to rotation. Thus, the Earth should generate gravitational waves. This is crucial. If no currents exist, then there is no hyperbolic partial differential equation and no gravitational waves. Let us use the curl of this term with:

$$\nabla \times \nabla \times \bar{g} = +4\pi G\gamma \int_0^t \nabla \times \nabla \times \bar{J}_s \ dt + \nabla \times \nabla \times \hat{g}. \quad (14)$$

This becomes:

$$-\nabla^2 \bar{g} + \nabla(\nabla \cdot \bar{g}) = -4\pi G\gamma \int_0^t [\nabla^2 \bar{J}_s - \nabla(\nabla \cdot \bar{J}_s)] \ dt + \nabla \times \nabla \times \hat{g}. \quad (15)$$

With substitutions:

$$-\nabla^2 \bar{g} - 4\pi G\gamma \nabla \rho_s = -4\pi G\gamma \int_0^t \left[\nabla^2 \bar{J}_s - \nabla\left(-\frac{\partial \rho_s}{\partial t}\right)\right] \ dt + \nabla \times \nabla \times \hat{g}. \quad (16)$$

With further manipulations, the density or source terms disappear:

$$-\nabla^2 \bar{g} = -4\pi G\gamma \int_0^t \nabla^2 \bar{J}_s \ dt + \nabla \times \nabla \times \hat{g}. \quad (17)$$

But:

$$\int_0^t \nabla^2 \bar{J}_s \ dt = -\int_0^t \nabla \frac{\partial \rho_s}{\partial t} \ dt = -\nabla \rho_s \quad (18)$$

This becomes:

$$-\nabla^2 \bar{g} = 4\pi G\gamma \nabla \rho_s + \nabla \times \nabla \times \hat{g}. \quad (19)$$

Alas, this is still not a wave equation. Note that we could have gotten almost the same equation except by taking the gradient of the earlier equation. Moreover, the curl of the curl term most likely will vanish as well but we will keep that term in the total final result. Let us take the time derivative over the definition for the gravitic field with:

$$\frac{1}{c^2}\frac{\partial^2 \bar{g}}{\partial t^2} = +\frac{4\pi G\gamma}{c^2}\frac{\partial \bar{J}_s}{\partial t} + \frac{1}{c^2}\frac{\partial^2 \hat{g}}{\partial t^2} + \frac{1}{c^2}\frac{\partial^2 f_g(t)}{\partial t^2} \quad (20)$$

Note that a derivative of stationary gravity is not a function of time, this becomes:

$$\frac{1}{c^2}\frac{\partial^2 \bar{g}}{\partial t^2} = +\frac{4\pi G\gamma}{c^2}\frac{\partial \bar{J}_s}{\partial t} + \frac{1}{c^2}\frac{\partial^2 f_g(t)}{\partial t^2} \quad (21)$$

Add these equations to form a wave equation results in:

$$+\frac{1}{c^2}\frac{\partial^2 \bar{g}}{\partial t^2} - \nabla^2 \bar{g} = 4\pi G\gamma \nabla \rho_s + \nabla \times \nabla \times \hat{g} + \frac{4\pi G\gamma}{c^2}\frac{\partial \bar{J}_s}{\partial t} + \frac{1}{c^2}\frac{\partial^2 f_g(t)}{\partial t^2} \quad (22)$$

One may argue that this is an artificial means to generate a wave equation. Can this be incorporated in an original definition of a curl term acting upon the gravitational field? Note that time is extremely important in this equation. Finally, there is no curl term acting on the current that exists with earlier gravitational laws. Regarding this finding: *One may conclude that neither Einstein nor Newton lied!*

B. Gravitational Source and Current Definitions

An enigmatic issue about neutron stars and black holes is that they possess unusual gravitational attraction beyond those of other celestial objects. Considering Newton's equation, gravity is a direct consequence of a *rest* mass. Let us assume that the *apparent* mass includes a contribution from the rest mass and a rest current as well as other effects to see if gravitation can be enhanced. This apparent mass characterizes the actual gravitation intensity. Likewise, a similar assumption is used for the current that shows interrelated components to include rest mass as well as possible other effects such as rotation. This model assumes both rest mass and current are spatial and not temporal functions. What this means is that mass could be a direct function of the current and possibly rotation. Admittedly, the evidence of this is not yet apparent and recognized to look purely as an artificial mathematic artifact that examines a conceivable postulate worthy of further consideration.

Let us assume a representation (Murad 1995a, Murad 1995b, Murad 2005a, Murad 2005b) such as:

$$\rho = e^{\alpha t}(\tilde{\rho} - \nabla \cdot \bar{J}') \ and \ \bar{J} = e^{\alpha t}(\gamma_o \nabla \tilde{\rho} + \alpha \bar{J}') \quad (23)$$

The time dependency only occurs with the exponential term for both the source and currents. The tilde and prime terms are rest states with steady-state or spatial expressions without time. No distinction is made if the time factor changes with the source and the currents. Here, we generalize the problem as being the same value and there is a correspondence between the temporal behavior of the source and currents.

The conservation of charge is:

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \bar{J} = \alpha\, e^{\alpha t}(\tilde{\rho} - \nabla \cdot \bar{J}') + e^{\alpha t}\nabla\,(\gamma_o\, \nabla\tilde{\rho} + \alpha\, \bar{J}') = 0. \qquad (24)$$

This steady-state spacial source term becomes a Helmholtz equation:

$$\nabla^2\tilde{\rho} + \frac{\alpha}{\gamma_o}\tilde{\rho} = 0 \qquad (25)$$

C. Seeking Irrotationality

This is very interesting and implies that despite the choice of the source and current terms, the gravitational field is irrotational. Normally the magnetic source and current are not included in the analysis. This would result in a rotational or solenoidal field. The obvious solution is to include additional terms that more directly account for rotation. Let us add more terms in the source and current accounting for rotation:

$$\rho = e^{\alpha t}(\tilde{\rho} - \nabla \cdot \bar{J}' + \beta\, \nabla \times \xi) \;\; and \;\; \bar{J} = e^{\alpha t}\left(\gamma_o\, \nabla\tilde{\rho} + \alpha\, \bar{J}' + \delta\, \nabla \times \varsigma\right). \qquad (26)$$

The conservation of mass becomes:

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \bar{J} = e^{\alpha t}[\alpha\,(\tilde{\rho} - \nabla \cdot \bar{J}' + \beta\, \nabla \times \xi) + \nabla\,(\gamma_o\, \nabla\tilde{\rho} + \alpha\, \bar{J}' + \delta\, \nabla \times \varsigma)] = 0. \quad (27)$$

If and only if:

$$\nabla^2\tilde{\rho} + \frac{\alpha}{\gamma_o}\tilde{\rho} = -\frac{\alpha\beta}{\gamma_o}\, \nabla \times \xi. \qquad (28)$$

Interestingly, this implies that the source term is amplified by rotation. This is not due to rotation in the current itself but directly by the source. As spin occurs, the charge density accumulates over time.

D. Thoughts of Modelling about Gravitational Anomalous Behavior

A previous postulated model was prescribed that looked like the following. With this inclusion with *a* and rotation effects, a gravity model would look like:

$$\bar{g} = \tilde{g} + \nabla \cdot \left[-\frac{1}{r} + \frac{\alpha}{3} r\right]\hat{r} \;\; \text{and}$$

$$\frac{1}{c^2}\frac{\partial^2 \tilde{g}}{\partial t^2} - \nabla^2\tilde{g} = 4\pi G\gamma\left[\nabla \cdot \rho_s + \frac{1}{c^2}\frac{\partial \bar{J}_g}{\partial t} - \frac{\nabla \times \bar{J}_g}{c}\right]. \qquad (29)$$

This does not include the original model where a curl of the curl of gravity is used. If the curl exists, this implies that the current is swirling in all rotation directions about a neutron star to generate this radial effect. One would assume that the first derivative will also vanish.

We can modify this earlier model. The gravitational field still depends primarily upon the current and a perturbation function expression. Let:

$$\hat{g} = \nabla \cdot \left[-\frac{1}{r} + \frac{\alpha}{3} r\right]\hat{r}. \qquad (30)$$

This marries Newtonian gravitation as well as account for the near-constant gravitational level observed with the Pioneer spacecraft and the Oumuamua celestial visitor. Also, since this is a radial function, the curl term disappears from the wave equation and this term is more like a perturbation function. The remaining terms are functions of time.

Let us spend more time about this more recent model:

$$+\frac{1}{c^2}\frac{\partial^2 \bar{g}}{\partial t^2} - \nabla^2\bar{g} = 4\pi G\gamma\nabla\rho_s + \nabla \times \nabla \times \hat{g} + \frac{4\pi G\gamma}{c^2}\frac{\partial \bar{J}_s}{\partial t} + \frac{1}{c^2}\frac{\partial^2 f_g(t)}{\partial t^2}. \qquad (31)$$

The last function is only temporal while the current is temporal and spatial. Again, this has no limits and most likely, represents an aether or Dirac sea, physical vacuum, or the zero-point field. The curl term disappears if gravity only acts radially. As mentioned previously, current changes are the key to creating gravitational waves. This is simply a consequence of celestial bodies, as large currents, colliding with each other. This would include neutron stars and black holes.

IV. Results/Observations

A. Pulsars

Neutron stars generate considerable gravitational attraction and have established significant rotation followed by the implosion of a giant red star and the transport of angular momentum. Here, the rotation acts as a consequence to increase the star's mass, hence gravitation. For example, the Winterberg gravitational model [Murad 2020] for neutron stars account for gravity as a function of the star's rotation rate regardless of the star going clockwise or counterclockwise.

One cannot assume that the neutron star is a perfect sphere. The implosion may be even or uneven. For example, even results occur if the exterior boundaries of the supernova debris are spherical. One could deduce the resultant neutron star itself is also spherical. However, many supernova topologies of the debris boundary are not spherical but rather ovaloid or even discontinuous.

This implies the neutron star surface would be irregular and jagged. Moreover, this will impact the type of signal previously mentioned by LaViolette. It can be assumed that the cover of a neutron star is enclosed with an electron gas. As these celestial bodies rotate, the gas continuum is not uniform if the solid structure consisted of jagged surfaces. Subsequent electron gas vortices will impact the signal previously mentioned with LaViolette.

There is another problem. Stars do not generally have a single magnetic pole but consist of numerous poles. Would the supernova collapse the star into a single pole, or would multiple poles still remain which we, unfortunately, could not see because the Earth is only a single point of reference using the neutron star lighthouse model when in reality, there is a multi-lighthouse model. Likewise, magnetic filaments may rise and fall back to the star because of the strength of the star's gravitational attraction.

Figure 2. Samples of the results of supernovae.

A binary pulsar could cover the same footprint within weeks where the Earth would travel around the same footprint for the sun within a year. Neutron stars generate considerable gravitational attraction and have established significant rotation followed by the implosion of the original giant red star. Here, rotation tends to act in a fashion that increases the star's mass, hence gravitation.

If the gravitational source and current could be represented as:

$$\rho = e^{\alpha t}(\tilde{\rho} - \nabla \cdot \bar{J}' + \beta\,\omega^2)\ \ and$$

$$\bar{J} = e^{\alpha t}\left(\gamma_o\,\nabla\tilde{\rho} + \alpha\,\bar{J}'\right) \qquad (32)$$

At this point, one may ask that the rotation ends when the distance falls outside of the neutron star's solid boundary. What is suggested is this is continuous and results in a rotational effect of the stars within each galaxy. This modifies the Helmholtz equation comparable to Winterberg's model definition by increasing the neutron star's mass:

$$\nabla^2\tilde{\rho} + \frac{\alpha}{\gamma_o}\tilde{\rho} = -\frac{\alpha\beta}{\gamma_o}\,\omega^2 \qquad (33)$$

For damped exponents as expected for the source and gravitational current, α would-be negative. The implication is that an analogous gravitational source would have a dependency upon rotation as well based upon gravitational currents. What this equation implies is that electric, magnetic and now *gravitational charges can be increased by rotation*. The same probably occurs using a mass source in a celestial body where the rotation generates an increase in the pseudo-mass gravitational attraction. Regrading neutron stars, there may be a threshold where a neutron star cannot exceed in terms of size. Moreover, the neutron star can somehow convert rotation to create the energy that continuously emits as a beam.

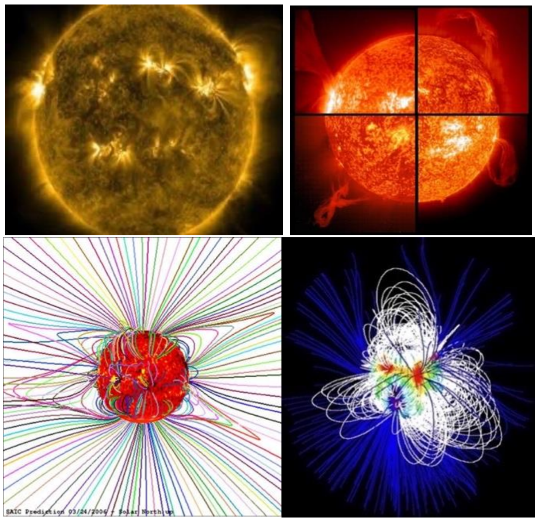

Figure 3. This shows the multipolar magnetic fields on the surface of the sun. A Corona Sun Magnetic Field Visualization of the Sun's magnetic field, with its north pole on top as well as the poles for a neutron star model are also shown as a multi-beam lighthouse model.

The question is that ω may be due to individual stars but, more importantly, this could be a very low value based upon the rotation due inherent to a spinning galaxy. The existence of these gravitational currents of individual stars would provide the meager gravitational attraction found on Oumuamua, the Pioneer, and other far-distance spacecraft without the need for Dark Matter.

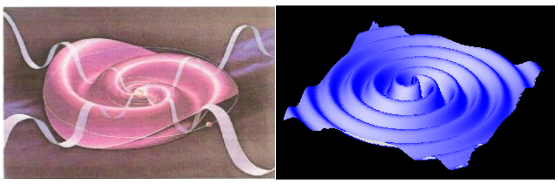

Figure 4. The Sun's magnetic field as mapped by the Pioneer Spacecraft that may affect the Pioneer Anomalies as well as a neutron star model showing the magnetic field ferrules.

B. Black Holes

Since the black hole has a larger mass than a neutron star, it should rotate in terms of angular momentum somewhat slower than with a neutron star. This is still a major consideration. By Novikov, nothing leaves the black hole which implies that electric and magnetic fields or light do not leave the black hole. Moreover, Hawkin radiation which does not transport by thermal radiation, tends to imply that mass and energy are somehow ejected from the black hole.

Since debris in the accretion disk are balanced with rotating to produce centrifugal motion thereby offsets the black hole's gravitation, this debris is not a candidate for a jet that would leave a black hole. Some conventional wisdom implies that the accretion debris is the only candidate for a black hole jet. The jet itself must leave the black hole at a considerable velocity greater than the speed of light, and if this is the justification, then Einstein's argument that you cannot move faster than the speed of light is violated. The gravitational attractions from a black hole are extremely large acting as a gravitational singularity compared to other celestial bodies to include neutron stars.

Where does this jet come from? Let us postulate the black hole may be enclosed by a Faraday cage which surrounds a rotating core that includes trapped electric and magnetic fields. The Faraday cage short-circuits and keeps these fields within the black hole interior accumulate as a function of time analogous to increasing the source term in the previously mentioned Helmholtz equation. For neutron stars, energy is emitted continuously by the beams. This does not occur in a black hole. This is like an accumulator or a capacitor continually charged over time with electrons and voltage. When overcharged, the multi-layered capacitor containing a substantial charge of electrostatic energy releases a current. This is similar to the notion of a jet relieving a black hole. Finally, observations do *not* show that the jet goes outside in both directions along the axis of revolution but only in one direction as shown above [Wagget et al 1977]. Why only in one direction? This is probably because the black hole also operates as an electromagnetic object like a monopole allowing only one jet. Overall, with this neutron star encrusted Faraday cage model, the black hole may not really be a singularity but rather an overcharged neutron star. More work is needed to assess rotation of these jets and how this impacts the jet's trajectory.

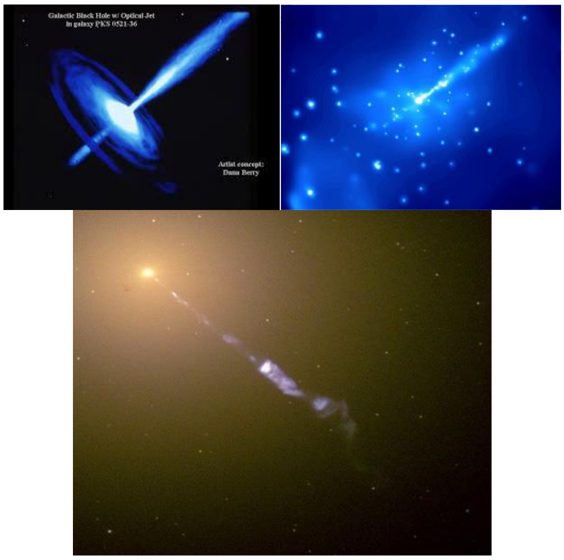

Figure 5: A model showing a black hole jet and an actual jet for a black hole.

We can postulate where a neutron star can only be below a maximum threshold size. During the temperature and pressure of the supernova, these electrons and protons are pushed together, with neutrinos, to produce neutrons thereby forming the neutron crystal core. Since a larger red giant star exceeds a certain mass, this additional matter is also pushed together undergoing nuclear reactions. Here, hydrogen and helium form more and more heavier elements and so on and so on. As this occurs, Iron which is the lowest energy potential, is also formed. However, this iron surrounds the neutron core, and would act like a ferrite-like Faraday cage. If true, the core acts as previously mentioned, like a capacitor continually building up charges either electrical, magnetically or gravitic that generates the black hole's behavior. So, nothing but gravity would reach beyond the Faraday cage. Under this model, the notion that a black hole is a singularity might be nonsense. The reason is the singularity would have infinite gravitation. If so, the accretion disk debris would have to rotate at an infinite rate thereby easily exceeding the speed of light. Thus, the gravitational level might be limited and a reasonable value.

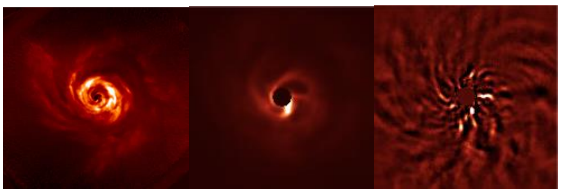

Figure 6. Images of the AB Aur system are presented with three different methods
representing the creation of a planet.

There is a final point in closing. The impact of rotation or spin is hard to calibrate because we think only in terms of linear momentum. The use of rotation to influence gravitation, implies transporting from angular motion into linear motion in some unknown sense. The problem is unusual. Here (Boccalenti et al 2020) in fig. 6, the swirling gases of a plasma are a precursor for the creation of a planet. Rotation appears to be the start of this process and eventually leads toward core gravitation. Does spin create gravity or does gravity create spin? The effects may be characterized as previously shown by the modified Winterberg's model. Moreover, this effect is probably prevalent throughout the cosmos to sense a small constant value of gravitation at faraway distances demonstrated by the Pioneer spacecraft, Oumuamua celestial visitor, or MOND for a star within a spiral arm of another galaxy. This offers a new and exciting venue for astrophysics.

V. Conclusions

Thoughts here imply a gravitational current curl or vorticity is required to identify a rotational field that would result in gravitational waves. Vorticity introduces a temporal behavior to create a hyperbolic partial differential equation supporting gravitational waves as a disparity to Newtonian gravitation. Efforts provide insights commonplace to analogous actions using Maxwell's equations regarding electric and magnetic fields. Thus, it is assumed there is a correspondence between electric and magnetic fields with gravity.

The source term is driven by a Helmholtz equation where rotation amplifies the source's density. In this fashion, neutron stars demonstrate a larger gravitational attraction driven by rotation. The Winterberg gravitational model is modified where the effects of rotation tend to decay as a function of distance. At long ranges, it is assumed that Newtonian gravity fails but gravity approaches some small insignificant value. Resulting analysis establishes the decay as being an inverse square-root function of distance. These values and the constant gravitational value imply results for a neutron star as well as the MOND analysis concerning stars in rotating galaxies.

Neutron stars are by far more complex than the simple lighthouse model. The possibility of the star being perfectly spherical may not hold and this topology should be defined by the supernova's debris cloud exterior boundary. Thus, the neutron star is also an electromagnetically driven celestial body-obsessed by rotation. Moreover, this is converted to energy which is continuously emitted with several beams with a multi-lighthouse model. Furthermore, there may exist a threshold limiting the neutron star's diameter.

Black holes are created by heavier red giant stars that also result in supernovas. Here, the model is treated differently. The black hole interior is still considered as being an electromagnetic machine somewhat akin of a neutron star with the exception that it is enclosed by a Faraday cage. The cage may be a ferritic material created by the initial star's mass greater than the threshold required to create a neutron star. Here too, rotation plays an important role but unlike the neutron star continually emitting energy, the rotation effects remain inside of this interior. Accumulation over time amplifies gravity where there must be some pressure valve to eject mass and/or energy in the form of Hawkin radiation. This may result in a single jet that ejects only one side of the black hole because the interior black hole acts like a monopole.

Finally, the use of charge conservation implies that both Newtonian and the Winterberg models are capable of producing gravitational waves if and only if gravity currents exist. This is a profound thought. The question is how can we characterize gravitational currents?

These are rather unique models for creating gravity and the evolution of either a neutron star or a black hole. Interestingly, these models warrant further evidence and confirmation especially the postulation of where a Faraday cage surrounds over a neutron star to produce a black hole…

References

[1] Almeida, J., B. (2004) "An Hypersphere Model of the Universe – The Dismissal of Dark Matter", submitted to: J. Phys. A: Math. Gen. arXiv: physics/0402075v3 [physics.gen-ph] 24 Feb 2004.

[2] Anderson, J. D., Campbell, J. K., Ekelund, J. E., Ellis, J. and Jordan, J. F. 2008. "Anomalous Orbital-Energy Changes Observed during Spacecraft Flybys of Earth," *Phys. Rev. Lett.*, 100, (2008), p. 091102.

[3] Anderson, J. D., Laing, P. A., Lau, A. L., Liu, A. S., Nieto, M. M., and Turyshev, S. G. 1998. "Indication, from Pioneer 10/11, Galileo, and Ulysses Data, of an Apparent Anomalous, Weak, Long-Range Acceleration," Phys. Rev. Lett., 81, p. 2858.

[4] Baker, J., Campanelli, M., Lousto, C. O., and Takahashi, R (2002) "Modeling gravitational radiation from coalescing binary black holes," *arXiv:astro-ph/0202469 v1, February 25, 2002.*

[5] Bell, J. F., Bailes, M., Bessell, M. S. (1993) "Optical detection of the companion of the millisecond Pulsar J0437 – 471", *Nature* (ISSN 0028-0836), vol. 364, no. 6438, p. 603-605, 08/1993.

[6] Boccaletti, A., Di Folco, E., Pantin, E., Dutrey, A., Guilloteau, S., Tang, Y. W., Piétu, V., Habart, E., Milli, J., Beck, T. L., and Maire, A. L. (2020) Possible evidence of ongoing planet formation in

AB Aurigae A showcase of the SPHERE/ALMA synergy, *Astronomy Astrophysics letter to the editor,* A&A 637, L5.

[7] Boran, Sibel; Desai, Shantanu; Kahya, Emre; Woodard, Richard (2017-10-17) *"GW170817 Falsifies Dark Matter Emulators".* arXiv:1710.06168.

[8] Brownstein, J. R., and Moffat, J. W. 2007. arXiv:gr-qc/0511026, 16 Jan 2007.

[9] Corbelli, E., Salucci, P. (2000) "The extended rotation curve and the dark matter halo of M33". *Monthly Notices of the Royal Astronomical Society*. **311** (2): 441–447. arXiv:astro-ph/9909252.

[10] Douglas Kenyon, J. (2005) *Forbidden History-Prehistoric Technologies, Extraterrestrial Intervention, and the Suppressed Origins of Civilizations*, Bear & Company.

[11] Dunham, W. 2008. Astronomers Baffled by Weird, Fast-Spinning Pulsar, Reuters, Washington, May 15, 2008.

[12] Jefimenko, O. D. 1992. *Causality Electromagnetic Induction and Gravitation*, Electret Scientific Company, Star City.

[13] Jefimenko, O. D. 1997. *Electromagnetic Retardation and Theory of Relativity*, Electret Scientific Company, Star City.

[14] Jefimenko, O. D. 2006. *Gravitation and Cogravitation*, Electret Scientific Company Star City, ISBN 0-917406-15-X.

[15] McGaugh, S. (2014) "A Tale of Two Paradigms: the Mutual Incommensurability of LCDM and MOND". *Canadian Journal of Physics. **93** (2): 250–259.* arXiv:1404.7525.

[16] Merritt, C. ,Ekers, R. D. (2002) "Tracing Black Hole Mergers Through Radio Lobe Morphology", *Science*, Vol. 297, No. 5585, 23 August 2002, pp. 1310-1313.

[17] Milgrom, M. 1983. "A modification of the Newtonian dynamics as a possible alternative to the hidden mass hypothesis," *Astrophysical Journal*, 270, p. 365.

[18] Milgrom, M. 1994. "Dynamics with a non-standard inertia-acceleration relation: an alternative to dark matter," *Ann. Phys.*, **229**, p. 384.

[19] Murad, P. A. (1995a) "An Electromagnetic Rocket Stellar Drive.... Myth or Reality? Part I-Electromagnetic and Relativistic Phenomenon", presented at the *31st AIAA/ASME/SAE/ ASEE Joint Propulsion Conference in San Diego*, AIAA Paper No. 95-2602.

[20] Murad, P. A. (1995b) "An Electromagnetic Rocket Stellar Drive.... Myth or Reality? Part II- Fluid Dynamic Interactions and an Engine Concept", presented at the *31st AIAA/ ASME/SAE/ASEE Joint Propulsion Conference in San Diego*, AIAA Paper No. 95-2894.

[21] Murad. P. A. (2005a) "Warp-Drives: The Dreams and Realities, Part I: A Problem Statement and Insights", *STAIF-2005, Albuquerque, New Mexico*.

[22] Murad, P. A. (2005b) "Warp-Drives: The Dreams and Realities, Part II: Potential Solutions", *STAIF-2005, Albuquerque, New Mexico*.

[23] Murad, P. A. (2009) "An Alternative Explanation of the Binary Pulsar PSR 1913+16", presented in AIAA Conference, Huntsville, Ala.

[24] Murad, P. A. (2010) "An Anzatz about Gravity, Cosmology, and the Pioneer Anomaly", presented at the February 2010 *SPESIF* Meeting at John Hopkins University.

[25] Murad, P. A. (2016) *Pulsars- An Adventure to Explore the Wonders of the Stars…,* Amazon.com.

[26] Murad, P. A. (2017) "To Find Different Gravity Laws… Proof Gravity Wave Equations are Real and Generate Gravitational Waves", *proceedings at Estes Conference, Colorado.*

[27] Murad, P. A. (2019) "Gravity, Anti-gravity, Libration Points, Relativity and Exposing Light on Dark Matter", *2019 ExtraOrdinary Technology Conference, COFE 11, Albuquerque, New Mexico*.

[28] Murad, P. A. (2020) "A New Cosmology and Understanding about Gravity", *APS*.

[29] Nieto, M. M., Turyshev, S. G., Anderson, J. D., gr-qc/0411077 and Gravitational solution to the Pioneer 10/11 anomaly.

[30] Novikov I. (1990) *Black Holes and the Universe*, Cambridge University Press.

[31] Pawlowski, M.; Milgrom, M. (2012) "The failures of the standard model of cosmology require a new paradigm". *International Journal of Modern Physics D. **21*** (14): 1230003. arXiv:1301.3907.

[32] Taylor, J.H., (1994) "Binary Pulsars and Relativistic Gravity," *Rev. Modern Physics* **66**, 711-719.

[33] Turyshev, S. G., Toth, V. T. 2009. "The Pioneer Anomaly in the Light of New Data," arXiv: 0906.0399 v1 [gr-qc] 2 June 2009.

[34] Verbiest, J. P. W., Bailes, M., van Straten, W., Hobbs, G. B., Edwards, R. T., Manchester, R. N., Bhat, N. D. R., Sarkissian, J. M., Jacoby, B. A., Kulkarni, S. R. 2008. "Precision Timing of PSR J0437-4715: An Accurate Pulsar Distance, a High Pulsar Mass, and a Limit on the Variation of Newton's Gravitational Constant", *The Astrophysical Journal, Volume* **679,** Issue 1, pp. 675-680.

[35] Waggett, P. C., Warner, P. J. and Baldwin, J. E. (1977) NGC 6251, a very large radio galaxy with an exceptional jet, *Mon. Not. R. astr. Soc.* **181**, 465-474.

[36] Williams, P.E. (2001) "Using the Hubble Telescope to Determine the Split of a Cosmological Object's Redshift in its Gravitational and Distance Parts," *Apeiron*, Vol. 8, No. 2 http://redshift.vif.com/JournalFiles/V08NO2PDF/V08N2WIL.pdf.

Acknowledgement

The author acknowledges that all figures in the paper were obtained either by Wikipedia or in the Internet. The author appreciates this information from T. Valone in Figure 6.