The Lore of Robert Lazar

Complete Solution

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Abstract

*We validate Robert Lazar's implied 1989 Gravity-B Wave Frequency Claim of 7.46 (Hz) utilising **Q**uantised **F**ourier **H**armonics (QFH); such that it does not require the existence of Element-115 (Moscovium), Area-51, S-4, Extraterrestrial Intelligence or US Government Conspiracy. We demonstrate that Robert Lazar predicted a **Q**uantum **V**acuum (QV) property of the Earth at its surface, which is presently unknown to the **S**tandard **M**odel **o**f **P**article-**P**hysics (SMoP^2) & the **S**tandard **M**odel **o**f **C**osmology (SMoC). Robert Lazar has successfully predicted the existence of new **Q**uantum **P**hysics (QP), seventeen (17) years in advance of the 2006 method developed by Storti & Desiato, which facilitates the confirmation of Lazar's claim. The significance of this being that the only testable scientific claim made by Robert Lazar has been validated, inferring that the entire Lazar story is genuine. The consequences of this are that all non-scientific assertions presented by Lazar credibility assassins, may be discarded en masse. To conclude that the Lazar story is a hoax, based upon so-called 'missing documentation' or any other metric, has been summarily overturned by the existence of the scientific evidence we present.*

Keywords: Area-51, Bob Lazar, Electro-Gravi-Magnetics, EGM, Gravity-A, Gravity-B, Photons, Polarisable Vacuum, PV, Robert Lazar, S-4, Zero-Point-Field, ZPF

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1 Nomenclature

Symbol	Description
a	Acceleration (m/s^2)
BPT	Buckingham-Π-Theory
c	Speed of Light in a Vacuum = 299,792,458 (m/s)
C_{PV}	Quantised Polarisable Vacuum Amplitude Spectrum
CSA	Computational Solution Algorithm
C_Θ, $C_{M\Theta}$, $C_{g\Theta}$	Quantised Electro-Gravi-Magnetic Amplitude Spectra
DAT's	Dimensional Analysis Techniques
EGM	Electro-Gravi-Magnetics
EGMS	Electro-Gravi-Magnetic-Spectrum
EM	ElectroMagnetic
G	Newton's Gravitational Constant = $6.6743 \cdot 10^{-11}$ ($m^3/kg/s^2$)
GHO: g_Θ	Gravitational Harmonic Operator
GR	General Relativity
h	Planck's Constant = $6.62607015 \cdot 10^{-34}$ (J/Hz)
$K_0(\omega,r,E,B,X)$	Experimental Relationship Function (*dimensionless*)
K_{PV}	Refractive Index
M	Mass (kg)
MCE	MathCad Computational Environment
M_E	Mass of the Earth = $5.97217 \cdot 10^{24}$ (kg)
N	Odd Harmonic Mode Limit
n_0, n_{PV}	Quantised Harmonic Mode Fourier-Distribution
N_{Lazar}	Lazar Harmonic Limit (N = 415)
n_Ω	Harmonic Cut-Off Mode
PV	Polarisable Vacuum
PVS	Polarisable-Vacuum-Spectrum
QED	Quantum-Electro-Dynamics
QFT	Quantum Field Theory
QM	Quantum Mechanics
QV	Quantum Vacuum
QVE	Quantum-Vacuum-Energy
QVS	Quantum-Vacuum-Spectrum
r	Distance or Displacement (m)
R_E	Radius of the Earth = $6.3781 \cdot 10^3$ (km)
SED: ρ_0	Spectral-Energy-Density
SFD	Spectral Frequency Distribution
t	Time (s)
t_0	Fundamental Spectral Period (s)
UHO: $\Theta(t)$	Unit Harmonic Operator
U_m	Mass-Energy per Unit Volume of a material object
U_ω	Spectral Bandwidth Pressure (Pa)
VPP's	Virtual Particle Pairs
ZPF	Zero-Point-Field
ZPFS	Zero-Point-Field-Spectrum
$\Theta_{N\ PV}$	Average value of the UHO as a function of 'N'
MHO: M_Θ	Massive Harmonic Operator
ω	Spectral Frequency (Hz)
Ω	Harmonic Cut-Off Function
ω_0, $\omega_{PV}(1,r,M)$	Fundamental Spectral Frequency (Hz)
ω_{Actual}	Actual Gravity-B Wave Frequency = 7.46 (Hz)
ω_{Lazar}	Theoretical Gravity-B Wave Frequency = 7.43 (Hz)
ω_{PV}	Quantised Polarisable Vacuum Frequency Spectrum
ω_Θ	Quantised Electro-Gravi-Magnetic Frequency Spectrum
ω_Ω	Harmonic Cut-Off Frequency

Tab. (1): Nomenclature

2 Foreword

The central tenet in the **S**tandard **M**odel **o**f **C**osmology (SMoC) is **G**eneral **R**elativity (GR). Since its appearance, GR has replaced Newtonian gravitation as the cosmological instrument of choice. GR successfully predicted the existence of **B**lack-**H**oles (BHs), decades prior to their experimental confirmation; hence (*for this & other reasons*), GR is often touted as a 'well-tested' theory. However, this view should be balanced against the fact that GR failed to predict the existence of **A**ccelerated **C**osmological **E**xpansion (ACE). Considering that GR introduced the concept of Space–Time to Physics, failing to predict accelerated space–time expansion is no minor oversight. Moreover, arguments may be positioned such that, if GR successfully predicted the missing mass associated with BHs, it should also have predicted the existence of other forms of missing Mass–Energy such as **D**ark **M**atter &/or **D**ark **E**nergy. Since Baryonic Mass only occupies approximately 5–6% of **T**otal **C**osmological **M**ass (TCM), insisting that GR is 'well tested' appears to be somewhat of an obtuse perspective when 94–95% of TCM evaded prediction. In addition, the persistent fact that GR does not integrate seamlessly & convincingly into any widely accepted **Q**uantum **M**echanical **M**odel (QMM) reinforces the assertion that GR is incomplete. Evidence confirming this assertion has been published utilising the **P**olarizable **V**acuum (PV) Model of Gravity to capture & correct a flaw in the SMoC. Consequently, we assert that GR is incomplete at the Cosmological Scale & substantiate this position by explicitly demonstrating that the Hubble tension **does not exist** in a companion publication (https://youtu.be/79wutrnJUWQ). The preceding comments should not be perceived as slights against GR, rather they represent 'alerts' for relying too heavily upon a single theory, implying that caution should be exercised when navigating Cosmological History exclusively utilising GR as a Cosmological Compass – particularly so in the absence of QMM integration.

GR is widely accepted as being profoundly limiting, particularly with the development of **Q**uantum **M**echanics (QM) shortly after the publication of GR in 1915. By 1925, it became apparent that the true nature of existence was Quantised. This meant that the predictive power of GR rested predominantly in the mathematical methods supporting it, not in the theory itself; once the mathematical construct has been stripped from GR, what remains is not abundantly useful. In fact, for all but the most extreme Astrophysical & Cosmological applications, & perhaps 'some' terrestrial ones, not much more than **N**ewtonian **M**echanics (NM) is required. So, GR is certainly an improvement over NM, but it has been unjustly glorified in popular science. However, in the case of QM, the theory remains highly productive, even in the absence of the mathematics quantifying it, & great scientific effort is being invested into merging GR with QM. This means that the New Physics associated with the Robert Lazar story, cannot be addressed by any direct measure involving GR. In the most basic terms, this means that GR is simply incapable of describing New Physics in what is fundamentally, a Quantum Existence. Thus, to overcome this impasse, herein we utilise an isomorphic representation of GR, termed the PV Model of Gravity, & integrate it with QM via the **Q**uantum **V**acuum (QV). Therefore, it is essential for readers to understand & appreciate that GR has value, but QM has greater value in deriving Robert Lazar's 7.46 (Hz) Gravity-B Wave Frequency Claim.

Recommended Minimum Viewing:

- https://youtu.be/S2VXX8LPlCQ?si=7JMiic4tHYnVL6ZC
- https://youtu.be/fvziYeRskeA?si=3n1KnWSSjyGklgUs
- https://www.youtube.com/playlist?list=PLVVSj-2HuQooCERAt9B2hrPlU4sExnqSI
- https://youtu.be/kKj4CrFX6Lo?si=g1i81gRJqlslsxvq

Recommended Extended Viewing:

- https://www.youtube.com/playlist?list=PLVVSj-2HuQoqKUNAD_uccUM1py1GNEy73
- https://www.youtube.com/playlist?list=PLVVSj-2HuQoprx7CRyakvlUEIZXbZJutG
- https://www.youtube.com/playlist?list=PLVVSj-2HuQopSIJFju8iM8XltJS9-OhPa

3 Introduction

Our species loves a good story; this is precisely why we study history; not just for its sequence of events, but for the stories behind them. Every human being to have ever existed, presently exists, or will ever exist – has, does or will have a 'story'. Every human story is intensely interesting & immensely valuable; however, some stories capture public attention more than others. The story of *Robert Scott Lazar* (*Bob Lazar*) is a prime example. Lazar claims to have worked at a facility termed S-4 in the Nevada Desert, where he was involved with the Reverse Engineering of Extraterrestrial Spacecraft in 1988-1989. In 1989, Lazar came forward to a journalist (*George Knapp*), & has told a consistent story of his experiences at S-4 ever since. As one might expect, countless renditions & interpretations of Lazar's story have propagated uncontrollably across the media & the internet, virtually all of which have focused on 'the man' & not the science behind the story. *Maverick Leung* [1], attempted to assess Lazar's credibility through a legal lens, whilst *Emeritus Professor Paul Edwin Potter* [2], attempted a modest scientific appraisal. Internet personalities such as *Danny Jones* [3], driven by commercialisation & monetisation, has sought to capitalise on the

Lazar story by being a contrarian; in typical fashion, by 'playing the man' & not 'playing the ball'. In other words, it was an exercise in character assassination, not an attempt at investigative journalism; not by any reasonable measure of the concept of 'investigative journalism'.

In science, credibility is valueless. Credibility carries no weight & neither should it; only logic & verifiable, consistent & reproducible evidence has any value. Carl Sagan once famously claimed that "*being brilliant is no guarantee against being dead wrong*". This was a reference to many things, one of them being the fact that for 1,500 years, the greatest minds in the history of our species believed the Earth to be flat. Thus, we can immediately discard *Leung* [1] & *Jones* [3] because their efforts are, quite frankly, non-scientific & therefore valueless. Focusing on credibility & character assassination is not the path to knowledge. Consider where our technology would **not** be, if science reasoned similarly to *Leung* [1] & *Jones* [3]; no electricity, no smart devices, no internet, no refrigeration, no rapid mobility, no cancer treatments. We would literally be living as we once did, before the Renaissance. It is difficult to imagine that anyone nowadays, would be willing to subject their children to this kind of lifestyle, particularly without modern medicines (*e.g. antibiotics*); all of which were derived via the scientific method. However, one voice has stood apart in the wilderness; *Emeritus Professor Paul Edwin Potter* [2]. *Potter* attempted a modest scientific appraisal of the science underpinning the Lazar story. In this article, we substantially advance *Potter's* research, by applying the **E**lectro-**G**ravi-**M**agnetic (EGM) Construct.

To begin with, we need to recognise the fact that the Lazar story, seems to be the only story with accompanying testable technical information. Unlike the so-called whistle-blower stories sensationalised by the media, Lazar provides testable technical information; this is extremely rare & valuable in itself. Herein, we will address Lazar's Gravity-B-Wave 7.46 (Hz) Frequency Claim, exclusively. Lazar claims that the Extraterrestrial Spacecraft he Reverse Engineered, pulse released a Gravitational Wave at a frequency of 7.46 (Hz) (*refer to Appendix-A*). In other words, the Earth radiates a so-called Gravity-B Wave at 7.46 (Hz), which is counteracted by an **E**lectro**M**agnetic (EM) 'like' propulsion system of an Extraterrestrial Spacecraft in order to hover at the surface of the Earth, also at a frequency of 7.46 (Hz). However, there is some extremely important foundational logic which is critically important to appreciate. That is, the so-called Gravity-B Wave being radiated by the Earth, is a **Q**uantum **V**acuum (QV) property of the Earth, at its surface; hence, it is location specific. Thus, Lazar's 7.46 (Hz) Gravity-B Wave Frequency Value:

1) Does not require the existence of Extraterrestrial Spacecraft.
2) Does not require the existence of Extraterrestrial Intelligence.
3) Does not require the existence of Area-51 or S-4.
4) Does not require the existence of Element-115 (*Moscovium*).
5) Does not require Lazar to possess any credibility; *i.e.* it is independent of 'the man'.
6) Does not require the existence of any Conspiracy Theory.
7) Does not require the existence of any so-called 'US Government Cover-up'.
8) Does not require the Lazar story to even exist.

Lazar's so-called Gravity-B Wave Frequency Value of 7.46 (Hz) is a QV property of the Earth, at its surface; so how did he arrive at this value ? It is unknown to standard scientific doctrine, so how could he have asserted this value, upon what basis ? It is a very specific value, stated to two significant figures; so, where did it come from ? Is it correct?

In this article, we derive a Gravity-B Wave Frequency Value of 7.43 (Hz); thereby, confirming Lazar's claim. As stated previously, the Gravity-B Wave Frequency is location specific, & has been asserted to two significant figures; hence, it is inconceivable that Lazar could have randomly guessed such a specific & precise value. Also as stated previously, Lazar's Gravity-B Wave Frequency Value of 7.46 (Hz) is unknown to standard scientific doctrine. Since Lazar's Gravity-B Wave Frequency Value is the only testable technical claim associated with his story, the only logical & rational conclusion is that the Lazar story is genuine. All character, testimonial & credibility based assertions by 3rd parties, claiming that the Lazar story is a hoax, have been conclusively undermined by our rigorous scientific derivation of a Gravity-B Wave Frequency Value of 7.43 (Hz). Moreover, we also demonstrate that alternative explanations for Lazar's Gravity-B Wave Frequency Value of 7.46 (Hz), such as the *Schumann Effect*, are absurd in the extreme:

1) We have mathematically derived Lazar's 7.46 (Hz) Gravity-B Wave Frequency Claim, to astonishing precision, utilising Quantised Fourier Harmonics: https://youtu.be/S2VXX8LPlCQ?si=7JMiic4tHYnVL6ZC
2) The *Schumann Effect* is not Gravitational, it is Atmospheric; no direct comparison to Lazar's Claim exists.
3) No known manner exists, to lift many metric tons of any Engineering Material into the air utilising the *Schumann Effect*. To assert that Lazar's Gravity-B Wave Frequency Claim is related to the *Schumann Effect* of 7.83 (Hz), requires the asserter to provide the mathematical construct proving that it is a valid Engineering Solution; of course, nobody can provide this because it doesn't exist.
4) The *Schumann Effect* is bound by the Ionosphere, which NASA states starts at 48 (km) above the surface of the Earth, & extends to 965 (km) above the surface of the Earth. So then, how does Extraterrestrial Intelligence travel to Earth through Space if the *Schumann Effect* requires an Atmosphere to do it ?
5) The *Schumann Effect* Fundamental Frequency of 7.83 (Hz), is known to two significant figures. This means that Lazar's 7.46 (Hz) Gravity-B Wave Frequency Claim, is completely 'out of bounds' with respect to the *Schumann Effect* Value, & any relationship between them can be dismissed upon this basis alone.

6) The *Schumann Effect* Value of 7.83 (Hz) deviates 4.7 (%) away from the Lazar Value of 7.46 (Hz). Typically in real Engineering terms, if an answer is more than 1 (%) away from the true value, then the derived result should be discarded.

Thus, we have identified six (6) reasons why the *Schumann Effect*, is in no way connected to Lazar's 7.46 (Hz) Gravity-B Wave Frequency Claim. Once again, the suggestion that Robert Lazar's Gravity-B Wave Frequency Claim is 'somehow' related to the *Schumann Effect*, is absurd in the extreme.

4 Quantising Gravitational Acceleration

4.1 Synopsis

We propose that the **Z**ero-**P**oint-**F**ield (ZPF) **S**pectral-**E**nergy-**D**ensity (SED) (ρ_0) distribution as presented by *Haisch et. al*. in accordance with Eq. (1) [4], is modified by the presence of matter; whereby (ω) is expressed in (Hz);

$$\rho_0(\omega)=\frac{2\cdot h\cdot \omega^3}{c^3} \qquad \text{Eq. (1)}$$

In 2006, *Storti & Desiato* [5] demonstrated that the minimum & maximum Spectral Limits of the ZPF may be computed by assuming that the constitution of Spectral Frequencies between these limits, obeys a Quantised Fourier-Distribution such that the Spectral Energy contained locally within the ZPF is equal to the Rest-Mass-Energy of the matter content present. The computed Spectral Limits were subsequently utilised to formulate many observationally verified solutions to key Particle-Physics & Cosmological problems ([6] & [7] respectively). Hence, outside the minimum & maximum Spectral Limits computed by the authors, the ZPF cannot be said to exist. One of the fundamental benefits of such a construct is that it evades the '*infinite energy in a vanishing volume problem*' of contemporary **Q**uantum-**E**lectro-**D**ynamics (QED); as no more Spectral Energy exists in the ZPF surrounding an object, than the Rest-Mass-Energy of the object itself (*i.e*. matter exists in equilibrium with the ZPF surrounding it).

4.2 General Relativity (GR)

Michelson & Morley disproved the existence of the mechanical luminiferous aether conceptualised in Maxwell's era, but it did little to arrest the emergence of a contemporary version. Einstein is, at least partially, responsible for destroying the mechanical aether of old & replacing it with a new aether. Einstein's development of Relativity & the notion of a new aether termed 'Curved Space-Time' evaporated the concept that Gravity was a force mediated by the ill-defined aether of Newton's time. Einstein's equations demonstrate that an object's motion in a gravitational field is determined by its geodesic path. Einstein introduced this concept to describe gravitational interactions between mass-objects, eliminating the necessity for 'action-at-a-distance'. Curved Space-Time is a geometric *contrivance*, but exactly what is being curved ? And if the vacuum of space is indeed a formless void, then how may 'nothing' have shape ? **G**eneral **R**elativity (GR) not only invokes, but requires the existence of a medium (*i.e.* a manifold) capable of conveying information indicating whether the Space-Time a mass-object transits is curved.

4.3 The Polarisable Vacuum (PV) Approach to GR

Bernard Haisch & Alfonso Rueda introduced a model describing matter as being immersed-in & wholly dependent upon the **Q**uantum **V**acuum (QV) for its existence. This fed an intuitively appealing interpretation of Space-Time Curvature termed the '**P**olarisable **V**acuum (PV) Approach to GR' [8]. The PV Model is an *optical* interpretation of Gravity because it applies optical principles to define the topological features of Space-Time, otherwise represented geometrically within GR. It attributes Space-Time with a variable **R**efractive **I**ndex (K_{PV}), not 'curvature'. The value of K_{PV} is proportional to the energy density associated with a gravitational field. As light passes a mass-object, it transits through regions of variable K_{PV} & refracts in accordance with the experimentally verified results within the GR construct. The PV Model ascribes a value of K_{PV} to the QV such that all matter generates a gradient in the energy density of the QV surrounding it. The gradient relates to a change in K_{PV} acting as a Space-Time lens causing light to bend. Hence, the PV Model demonstrates that substituting the metaphysical conceptualisation of Space-Time Curvature with a physically meaningful optical construct, yields a congruent interpretation of Gravity to that of GR.

The key difference between interpretations is that the PV Model describes the physical manner by which Space-Time is 'curved', GR does not. However, neither GR nor the PV Model specifically addresses the precise mechanism by which matter physically polarises Space-Time. Fortunately, the PV Model is not required to do so because QED explains this mechanism based upon the premise that within a volume of Space-Time devoid of matter, a chaotic & equally distributed mix of **V**irtual **P**article **P**airs (VPP's) are said to 'pop' into & out of existence. The PV Model asserts that matter *polarises* the QV (*i.e.* enforcing direction & order) into variable regions of energy density which, in turn,

generates regions of variable K_{PV}. A well-developed precedent for the existence of vacuum polarisation exists, based upon the generally accepted model of the Electron. The contemporary model of the Electron stems from QED, modelling it as a negatively charged point core surrounded by a cloud of VPP's, constantly emerging from & disappearing into the QV. According to QED & the relativistic **Q**uantum **F**ield **T**heory (QFT) of the interaction of charged particles & Photons, an Electron may emit virtual Photons which, in turn, may become virtual Electron-Positron pairs. The virtual Positrons are attracted to the 'bare' Electron whilst the virtual Electrons are repelled from it. The bare Electron is therefore screened due to polarisation. The presence of the negatively charged core attracts the virtual positive charges & repels the virtual negative charges present in the vacuum, biasing the QV, resulting in a vacuum gradient as it segregates clustered regions of virtual charges. In this state the vacuum is no longer uniform – it has been *polarised*. The effect of an Electron upon the QV is termed 'vacuum polarisation' & the property of *charge* emerges due to a change in the **Q**uantum-**V**acuum-**E**nergy (QVE) distribution of the surrounding Space-Time. Thus, if the QV is effervescent with VPP's, we must consider its effect on all elementary particles, not just the Electron. *From the perspective of the PV Model*; matter polarises the QV, forming gravitational fields because its atomic constituents are composed of large populations of elementary particles, all generating their own localised polarisations of the vacuum such that the cumulative effect results in a large-scale, synergistic polarisation. Conceptualising the Space-Time Manifold in terms of vacuum polarisation yields an isomorphic representation of GR.

4.4 Electro-Gravi-Magnetics (EGM)

4.4.1 Section Synopsis

The PV Model of Gravity asserts that the metaphysical concept of Space-Time Curvature, may be replaced by an optical representation of QV polarisation. Thus, it follows that the formation of gravitational fields are a result of QVE displacement due to the presence of matter. Recognising that QVE is **E**lectro**M**agnetic (EM) in composition, a fundamental relationship between matter, EM-Energy & Gravity is implied. This may be described utilising a mathematical method termed **E**lectro-**G**ravi-**M**agnetics (EGM) [9], developed from the application of Standard Engineering Principles, modelling the manner in which matter equilibrates with, & is constrained by, the local QV as a *system*. The initial premise in the development of the EGM Construct, is the assumption that Gravity & **E**lectro**M**agnetism may be unified via **Q**uantum **M**echanics (QM) in terms of the QV, utilising **B**uckingham-**Π**-**T**heory (BPT). BPT is a well established & widely utilised engineering principle developed by Edgar Buckingham in the early 1900's. BPT is applied to simplify complex systems & determine which parameters are necessary (or unnecessary) to adequately represent them. The Greek letter **Π** denotes the formulation of dimensionless groups describing the system. BPT is utilised to model the behaviour of a whole system without requiring precise interactional knowledge of all components simultaneously. BPT formulations are executed within the structural framework of **D**imensional **A**nalysis **T**echnique's (DAT's), indicating that similar systems may be described in like terms.

An important consideration involving DAT's & BPT is the rule of 'similitude'. In order to compare a mathematical model to a physical system, certain criteria must be satisfied. The model must have *Dynamic*, *Kinematic* or *Geometric* Similarity to the real-world system (any of, or all of these if applicable). 'Dynamic Similarity' relates forces, 'Kinematic Similarity' relates motion[2] & 'Geometric Similarity' relates shape[3]. Once the design principles of similitude are satisfied, the mathematical model is considered applicable to the real-world system. The EGM Construct commences by mathematically representing mass as an equivalent localised density of wavefunction energy, contained by the QV surrounding it. Properties of Quantised Fourier Harmonics are utilised to mathematically decompile the Mass-Energy into a spectrum of EM-Frequencies. This technique considers Gravity to be the *result* of an interaction between matter & the Space-Time Manifold surrounding it; leading to the following precepts:

1) An object at rest polarises, & exists in equilibrium with, the QV surrounding it.
2) The magnitude of QVE surrounding an object at rest is equivalent to $E = mc^2$.
3) The Frequency Distribution of the QVE surrounding an object at rest is cubic.

4.4.2 The Quantum Vacuum (QV) Spectrum

Historically, the QV has been considered to comprise of a potentially infinite spectrum of randomly orientated wavefunctions in the form of VPP's, each of specific frequency & amplitude, analogous to the static one observes on a dead television channel. However, the EGM Construct disagrees with this historical conception as it implies the existence of a potentially infinite quantity of energy in a vanishing volume; *i.e.* free space contains a *potentially infinite* amount of energy because (ω) in Eq. (1) may equal an infinite quantity. EGM asserts that the localised QV surrounding an object is more appropriately described as a finite spectrum whose VPP population is governed by the quantity of

[2] *i.e.* Synonymous with the Time-Domain.
[3] *e.g.* The topology of Space-Time Curvature within the context of GR.

Mass-Energy influencing or occupying a specific volume; *i.e.* a vanishingly small volume of free space contains a *near zero* amount of energy.

4.4.3 The Zero-Point-Field (ZPF) Spectrum

The **ZPF**-**S**pectrum (ZPFS) is defined by Eq. (1) & refers to the **QV**-**S**pectrum (QVS) associated with Minkowski-Space. The ZPFS is considered to be dispersed homogeneously throughout the Universe; consequently, the Spectral Energy of the VPP's within it, denotes the ground state of the QV. However, standard QM implies the existence of a potentially infinite quantity of energy in a vanishing volume, due to the potential for high frequency VPP Creation-Annihilation. Fortunately, EGM resolves this conflict such that a vanishingly small volume of flat Space-Time *does not* contain an infinite amount of energy because, although the potential for such VPP Creation-Annihilation processes exist within the EGM Construct, the probability of high frequency VPP creation approaches zero in the *absence* of Matter-Energy[4]. Hence, the probability of low or high frequency VPP Creation-Annihilation is biased by the presence of Matter-Energy within a defined region of Minkowski-Space[5]. Mathematically within the EGM Construct, this is achieved by merging the continuous cubic frequency characteristic of the ZPF with a discrete & finite Quantised Fourier-Distribution, such that the highest frequency mode within the ZPFS tends to 0 (Hz) in a vanishing **G**ravitational **A**cceleration **F**ield (GAF).

4.4.4 The EGM Spectrum

The Energy Spectrum associated with matter is termed the **EGM**-**S**pectrum (EGMS). This is a harmonic wavefunction representation of Mass-Energy obeying a Quantised Fourier-Distribution, in terms of conjugate wavefunction pairs, such that the number of Spectral Frequency Modes decreases as energy density increases; *i.e.* the number of modes is inversely proportional to the energy density of the Space-Time Manifold [5], implying that the energy density of free-space approaches zero, avoiding the '*infinite energy in a vanishing volume problem*'. The EGMS is based upon the **U**nit **H**armonic **O**perator [Θ(t)]; *i.e.* the number one (1) expressed as the summation of harmonic wavefunctions in the time domain, obeying a Quantised Fourier-Distribution for a fully rectified Square-Wave. Within the EGM Construct, Θ(t) utilises a Quantised Fourier-Distribution in Complex form to operate upon a scalar function in order to harmonically quantise it over the Real & Imaginary planes. It is important to recognise that for any harmonic decomposition of a constant function, Unity in our case, only odd harmonics are required to be summed, & the summation of Imaginary terms equals zero; Θ(t) may be written in Complex form as follows;

$$\Theta(t) = \left| -i \cdot \sum_{n_0} \frac{2}{\pi \cdot n_0} \cdot e^{\left(\pi \cdot n_0 \cdot \omega_0 \cdot t\right) \cdot i} \right| = 1 \qquad \text{Eq. (2)}$$

where;

1) The Quantised Harmonic Mode Fourier-Distribution is given by the odd sequence, as follows:
   - $[n_0 = -N, 2\text{-}N \ldots N]$ & $[N \rightarrow +\infty]$; *e.g.* -N … -21, -19, -17, -15 ... 15, 17, 19, 21 … +N
2) The maximum period is given by $[t_0 = 1 / \omega_0]$:
   - ω_0 denotes the fundamental (*i.e.* minimum) Spectral Frequency; this is an arbitrary value. However, if one applies the Hubble-Age (t_Φ) as a physical limit, then $\omega_0 = 1 / t_\Phi$

Summing the first eleven (11) Real terms (*for illustrational purposes only*) of Θ(t), yields a graphical representation converging to Unity in Fig. (1), as follows;

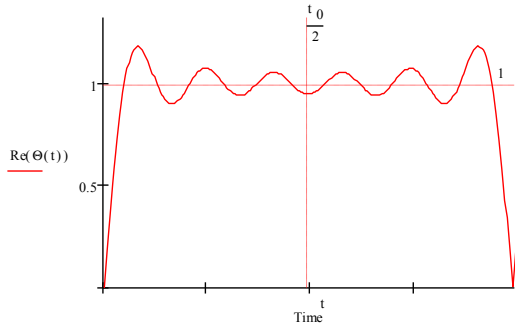

Fig. (1): **U**nit **H**armonic **O**perator (UHO)

[4] *i.e.* The probability of Low Frequency VPP Creation-Annihilation approaches Unity.
[5] *i.e.* The greater the quantity of Matter-Energy present, the greater the probability of High Frequency VPP Creation-Annihilation.

Verifying by integration yields the appropriate results as follows;

$$\omega_0 \cdot \int_0^{t_0} \mathrm{Re}(\Theta(t))\,dt = 1 \qquad \text{Eq. (3)}$$

$$\omega_0 \cdot \int_0^{t_0} \mathrm{Im}(\Theta(t))\,dt = 0 \qquad \text{Eq. (4)}$$

Therefore, utilising Θ(t), Mass-Energy may be harmonically quantised according to the **M**assive **H**armonic **O**perator (MHO) [$M_\Theta(M,t)$] as follows;

$$M_\Theta(M,t) = M \cdot \mathrm{Re}(\Theta(t)) \qquad \text{Eq. (5)}$$

Similarly, the **G**ravitational **H**armonic **O**perator (GHO) [$g_\Theta(r,M,t)$] may be written according to;

$$g_\Theta(r,M,t) = \frac{G}{r^2} \cdot M_\Theta(M,t) \qquad \text{Eq. (6)}$$

Hence, the Quantised EGM Mass-Energy *Amplitude* & *Frequency Spectra* for Θ(t), $M_\Theta(M,t)$ & $g_\Theta(r,M,t)$ may be described according to Tab. (2) as follows;

Operator	Quantised Amplitude Spectra	Quantised Frequency Spectrum
Unit: Θ(t)	$C_\Theta(n_0) = \frac{2}{\pi \cdot n_0}$ Eq. (7)	$\omega_\Theta(n_0) = n_0 \cdot \omega_0$ Eq. (10)
Massive: $M_\Theta(M,t)$	$C_{M\Theta}(n_0, M) = M \cdot C_\Theta(n_0)$ Eq. (8)	
Gravitational: $g_\Theta(r,M,t)$	$C_{g\Theta}(n_0, r, M) = \frac{G}{r^2} \cdot C_{M\Theta}(n_0, M)$ Eq. (9)	

Tab. (2): Harmonic Operators

4.4.5 The PV Spectrum

4.4.5.1 Derivation Thereof

The Energy Spectrum associated with Gravitational Acceleration 'g' is termed the **PV**-**S**pectrum (PVS). Consider the action of adding a stationary, non-rotating, neutrally charged point mass to an empty Universe. This action superimposes the EGMS of the point mass onto the ZPFS of the Universe; doing so forms the PVS[6] surrounding the point mass. This modifies the K_{PV} value of the Space-Time Manifold such that it changes at the same rate as 'g', radially outwards from the point mass. Merging the EGM & ZPF Spectra, results in a cross-fertilisation of characteristics[7]. The EGM Construct produces a PVS such that the '*infinite energy*' dilemma of ZPF Theory[8], is averted by assuming that the Mass-Energy Density of an object is equal to the SED of the gravitational field surrounding it. Therefore, when the EGM & ZPF spectra are merged, the continuous ZPFS is equated to the Quantised Fourier-Distribution of the EGMS such that the resulting PV Spectral Limits may be determined. This process mathematically transforms the continuous ZPFS to a discrete & finite Quantised Fourier-Distribution of equivalent energy.

The '*infinite energy in a vanishing volume problem*' is evaded within the EGM Construct by determining the *finite* limits of the PVS by application of the *Equivalence Principle*, which indicates that an accelerated reference frame is equivalent to a uniform gravitational field. *Storti & Desiato* [10] demonstrate that a generalised representation of acceleration '**a**' may be derived utilising DAT's & BPT, incorporating the ZPF **S**pectral **F**requency **D**istribution (SFD), according to;

$$a = K_0(\omega, r, E, B, X) \cdot \left(\frac{\omega^3 \cdot r^2}{c} \right) \qquad \text{Eq. (11)}$$

[6] *i.e.* A quantised representation of the **G**ravitational **A**cceleration **F**ield (GAF) in terms of 'g'.
[7] The complete mathematical derivation is contained in [5].
[8] Derived by contemporary QM methods.

where, $K_0(\omega,r,E,B,X)$ denotes a dimensionless constant related to K_{PV} as follows;

$$K_0(\omega,r,E,B,X)=\frac{1}{\sqrt{K_{PV}^{\,3}}} \qquad \text{Eq. (12)}$$

Assuming '**a**' represents Gravitational Acceleration & may be related to $g_\Theta(r,M,t)$ via the Equivalence Principle, it is immediately apparent that a problem exists because $g_\Theta(r,M,t)$ contains two spectra (*Amplitude & Frequency*), whilst '**a**' contains one spectrum (*Frequency*). This difference may be reconciled by synchronising the Frequency Spectrum of '**a**', with the Amplitude Spectrum of $g_\Theta(r,M,t)$ at the 1st harmonic (*i.e.* when $n_0 = 1$); by doing so, it is possible to derive an expression for the common fundamental Spectral Frequency of both equations as follows;

Step 1: substitute Eq. (12) into Eq. (11) to yield a generalised expression for acceleration in terms of the Refractive Index (*i.e.* K_{PV}) within the PV approach to GR:

$$a=\frac{1}{\sqrt{K_{PV}^{\,3}}}\cdot\left(\frac{\omega^3\cdot r^2}{c}\right) \qquad \text{Eq. (13)}$$

Step 2: substitute $[n_0 = 1]$ into Eq. (7,8,9) to determine the amplitude of the 1st harmonic of $g_\Theta(r,M,t)$:

$$C_{g\Theta}(1,r,M)=\frac{G}{r^2}\cdot C_{M\Theta}(1,M)=\frac{G\cdot M}{r^2}\cdot C_\Theta(1)=\frac{2\cdot G\cdot M}{\pi\cdot r^2} \qquad \text{Eq. (14)}$$

Step 3: equate the Right-Hand-Side (RHS) of Eq. (13) to the RHS of Eq. (14) & solve for 'ω'; this synchronises the Frequency Spectrum of '**a**' to the Frequency Spectrum of $g_\Theta(r,M,t)$ at the 1st Harmonic Amplitude of $g_\Theta(r,M,t)$. Hence, when $[\omega = \omega_0]$ the Minimum Spectral Frequency (ω_0) common to both representations of acceleration may be written as follows;

$$\omega_0=\frac{1}{r}\cdot\sqrt[3]{\frac{2\cdot c\cdot G\cdot M}{\pi\cdot r}}\cdot\sqrt{K_{PV}} \qquad \text{Eq. (15)}$$

Consequently, since the PV Amplitude & Frequency Spectra are theorised to obey a Quantised Harmonic Fourier-Distribution, the Quantised PV Frequency Spectrum (ω_{PV}) as a function of the odd harmonic sequence described by n_0 may be formulated according to;

$$\omega_{PV}(n_0)=\omega_\Theta(n_0)=n_0\cdot\omega_0 \qquad \text{Eq. (16)}$$

By inspection, Eq. (16) may be considered to exist as a subset of Eq. (10) because the Quantised PV Amplitude Spectrum (C_{PV}) associated with Eq. (16), diminishes to ZERO as $[r \rightarrow \infty]$. At this juncture, it is convenient to discriminate between spectra by the introduction of a PV subscript with respect to the odd harmonic distribution n_{PV}, such that $[n_{PV} = n_0]$. Hence, the Quantised PV Amplitude & Frequency Spectra, $C_{PV}(n_{PV},r,M)$ & $\omega_{PV}(n_{PV},r,M)$ respectively, are given by;

$$C_{PV}(n_{PV},r,M)=\frac{1}{n_{PV}}\cdot C_{g\Theta}(1,r,M)=\frac{1}{n_{PV}}\cdot\left(\frac{2\cdot G\cdot M}{\pi\cdot r^2}\right) \qquad \text{Eq. (17)}$$

$$\omega_{PV}(n_{PV},r,M)=n_{PV}\omega_0=\frac{n_{PV}}{r}\cdot\sqrt[3]{\frac{2\cdot c\cdot G\cdot M}{\pi\cdot r}}\cdot\sqrt{K_{PV}} \qquad \text{Eq. (18)}$$

4.4.5.2 Derivation of Limits

Eq. (18) may be applied to define the lower spectral limit of the ZPF encasing matter within the PV Model of Gravity (*i.e.* when $n_{PV} = 1$). The next requirement is to derive the Upper Spectral Limit, but the distribution utilised to derive the Lower Spectral Limit implies that the magnitude of the N^{th} harmonic approaches infinity (*i.e.* $n_{PV} \rightarrow \infty$). Consequently, the Upper Spectral Limit also approaches infinity [*i.e.* $\omega_{PV}(\infty,r,M) \rightarrow \infty$] & the '*infinite energy in a vanishing volume problem*' remains unresolved. Thus, if we are seeking to overcome this functional impasse, an alternative approach is required. Fortunately, the EGM Construct is capable of deriving the Upper Spectral Limit in accordance with the following solution algorithm;

Step 1:

Integrate Eq. (1) over the frequency domain:

$$\frac{2\cdot h}{c^3}\cdot\int \omega^3\,d\omega \rightarrow \frac{1}{2}\cdot\frac{h}{c^3}\cdot\omega^4 \qquad \text{Eq. (19)}$$

Step 2:

Transform the Continuous Frequency Spectrum of the ZPF represented in Eq. (19), into a Discrete Frequency Spectrum described by a Quantised Harmonic Fourier-Distribution. To execute this, substitute Eq. (18) into Eq. (19) over one change in odd harmonic mode number (*i.e.* over the odd harmonic range $|n_{PV}|$ to $|n_{PV}|+2$). This action concentrates the Spectral Energy contained within the ZPF implied by Eq. (19), into a narrow bandwidth described by a Quantised Harmonic Fourier-Distribution; the solution takes the form of being a scalar multiple of the PV Fundamental Spectral Frequency $\omega_{PV}(1,r,M)$. Hence, let $U_\omega(n_{PV},r,M)$ denote the Spectral Bandwidth Pressure (Pa) according to;

$$U_\omega\left(n_{PV},r,M\right)=\frac{h}{2\cdot c^3}\cdot\left(\omega_{PV}\left(\left|n_{PV}\right|+2,r,M\right)^4-\omega_{PV}\left(\left|n_{PV}\right|,r,M\right)^4\right)=\frac{h}{2\cdot c^3}\cdot\omega_{PV}(1,r,M)^4\cdot\left[\left(\left|n_{PV}\right|+2\right)^4-\left(\left|n_{PV}\right|\right)^4\right] \qquad \text{Eq. (20)}$$

Moreover, let:

$$U_\omega(r,M)=\frac{h}{2\cdot c^3}\cdot\omega_{PV}(1,r,M)^4=\frac{h\cdot\omega_0^4}{2\cdot c^3} \qquad \text{Eq. (21)}$$

such that,

$$U_\omega\left(n_{PV},r,M\right)=U_\omega(r,M)\cdot\left[\left(\left|n_{PV}\right|+2\right)^4-\left(\left|n_{PV}\right|\right)^4\right] \qquad \text{Eq. (22)}$$

Step 3:

Assume that the magnitude of Mass-Energy per Unit Volume of a material object (U_m) [*i.e.* as described by Eq. (23)] is equal to the magnitude of the ZPF Spectral Energy per Unit Volume surrounding it. Thus, equating Eq. (23) to Eq. (22) yields an expression with a single unknown (*i.e.* n_{PV}) described by Eq. (24) as follows;

$$U_m(r,M)=\frac{3\cdot M\cdot c^2}{4\cdot\pi\cdot r^3} \qquad \text{Eq. (23)}$$

$$\left|U_m(r,M)\right|=\left|U_\omega\left(n_{PV},r,M\right)\right| \qquad \text{Eq. (24)}$$

Step 4:

Derive the Harmonic Cut-Off Mode '$n_\Omega(r,M)$': let $n_\Omega(r,M)$ denote the Harmonic Mode associated with the Upper Spectral Limit of the ZPF in the presence of a material object, such that $[n_\Omega(r,M) = |n_{PV}|+2]$; the Solution Algorithm for the derivation of Eq. (25, 26) is contained in Appendix-B [see Eq. (B.6, B.7)];

$$n_\Omega(r,M)=\frac{\Omega(r,M)}{12}-\frac{4}{\Omega(r,M)}+1 \qquad \text{Eq. (25)}$$

where, the Harmonic Cut-Off Function '$\Omega(r,M)$' is given by;

$$\Omega(r,M)=\sqrt[3]{108\cdot\left|\frac{U_m(r,M)}{U_\omega(r,M)}\right|+12\cdot\sqrt{768+81\cdot\left(\frac{U_m(r,M)}{U_\omega(r,M)}\right)^2}} \qquad \text{Eq. (26)}$$

Step 5:

Derive the Harmonic Cut-Off Frequency '$\omega_\Omega(r,M)$': let $\omega_\Omega(r,M)$ denote the Harmonic Frequency associated with the Upper Spectral Limit of the ZPF in the presence of a material object; the Solution Algorithm for the derivation of Eq. (27) is contained in Appendix-B [see Eq. (B.8)];

$$\omega_\Omega(r,M)=n_\Omega(r,M)\cdot\omega_{PV}(1,r,M) \qquad \text{Eq. (27)}$$

- $\omega_{PV}(1,r,M) = \omega_0$

Thus, as radial displacement 'r' at a mathematical point from a mass-object increases:

1) **G**ravitational **F**ield **S**trength (GFS) decreases.

2) **S**pectral **E**nergy **D**ensity (SED) decreases.
3) The number of Harmonic Spectral Frequency Modes increases.
   - *Note*: this is analogous to the number of standing waves fitting into a cube. As the cube grows in size, so do the number of standing waves capable of occupying the dimensions of the cube. If it grows to the size of the Observable Universe, the number of standing waves capable of fitting within it tends to infinity. Conversely, if the cube diminishes in size, approaching the Planck Length, the number of standing waves capable of occupying it tends to unity.
4) Greater numbers of Spectral Frequency Modes are required to be summed for Mass-Energy Density Equivalence.

4.4.5.3 Spectral Comparison

The EGM interpretation of Gravity is similar to Newton's thoughts of an optical model such that the aether was presumed to be 'denser' farther away. The gradient in aether density causes light & objects to follow trajectories characteristic of GR. EGM demonstrates that the increasing density of Newton's aether is analogous to increases in Harmonic Frequency Mode population in the PV. Hence, the PV is an EM Frequency Spectrum obeying a Quantised Fourier-Distribution at displacement 'r' describing a mass 'M' induced gravitational field such that:

1) It denotes a polarised form of the ZPFS; *i.e*. mass pushes the ZPF surrounding it 'uphill', against the natural flux of Space-Time Manifold expansion.
2) The population of Spectral Frequency Modes decreases as Mass-Energy Density increases; *i.e*. the Spectral Frequency Mode Bandwidth compresses, tending to Unity for a case approaching the Planck Energy Density Limit.
3) Spectral Frequency Limits (Lower & Upper) increase as mass increases; converging to a Discrete Spectrum tending to the Planck Frequency, for a case approaching the Planck Energy Density Limit.

Thus, utilising Eq. (27) a spectral comparison diagram may be constructed demonstrating the key distinctions between the ZPF & its transformed form (*i.e*. the PV field) as follows;

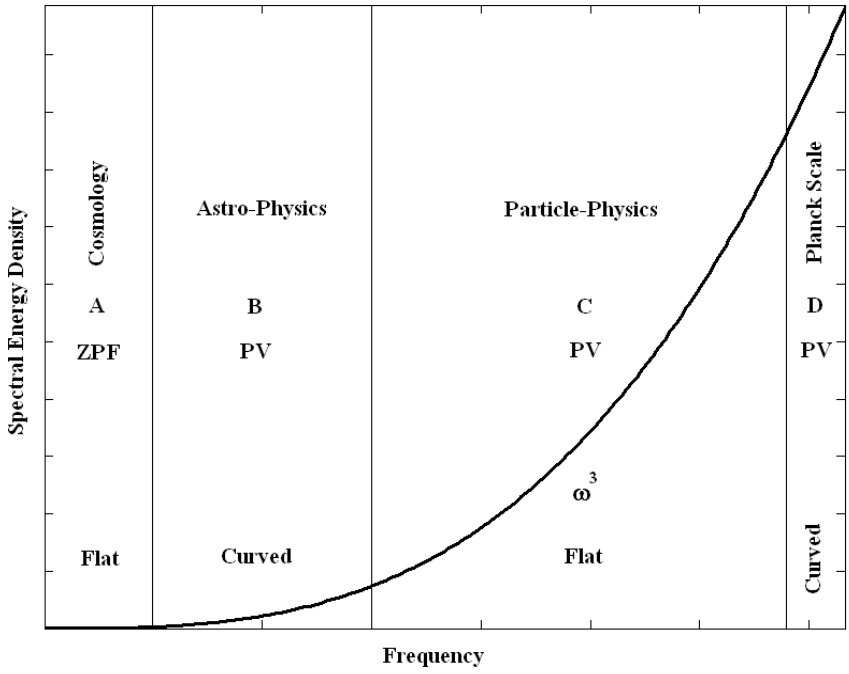

Fig. (2): (*illustrational only - not to scale*)
Increasing Mass-Energy density →→→→→→→→→→→→→→→→→→→→

where, the SED may be described by its Frequency Distribution appearing in Tab. (3), as follows;

Region / Zone	A	B	C	D
Applicable Category	Cosmology	Astro-Physics	Particle-Physics	Planck Scale
Gravitational Model	ZPF	PV	PV	PV
Space-Time Geometry	Flat	Curved	Flat	Curved

Tab. (3): SED Frequency Regions / Zones

On a Cosmological scale, the ZPF Upper Spectral Limit is influenced by the average energy density of the present Universe. The Spectral Density of the ZPF remains cubic; however, the present Upper Spectral Frequency Limit is lower than it was in the early Universe. Hence, the majority of **Z**ero-**P**oint-**E**nergy (ZPE) is presently in the form of low-frequency modes, each containing a relatively small amount of energy. The few high-frequency modes characterising the early Universe have bifurcated into a very large bandwidth of lower-frequency modes as the Universe expanded to its present form. The total energy of the Universe remains constant, but is spread out over a much greater volume as Cosmological Expansion continues. *Storti & Desiato* [11] demonstrate by derivation that the majority proportion of Gravitational Acceleration in a field, biases the maximum frequency limit such that lower frequencies may be usefully neglected for investigative purposes[9]; the assertion of high Spectral Frequency bias is supported by *Storti* [12]. By application of this proportional Spectral Frequency characteristic, *Storti* [13] demonstrates that a modal comparison diagram between the ZPF & its transformed form (*i.e.* the PV field) may be constructed as follows;

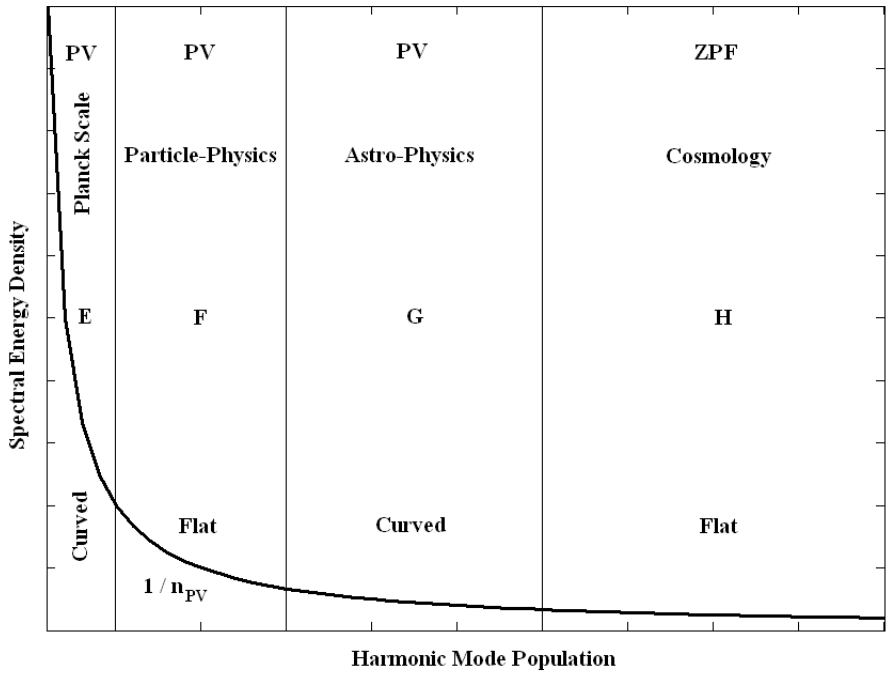

Fig. (3): (*illustrational only - not to scale*)
Decreasing Mass-Energy density →→→→→→→→→→→→→→→→→→→→→→→→

where, the SED may be described by its Harmonic Mode Population Distribution appearing in Tab. (4), as follows;

Region / Zone	E	F	G	H
Applicable Category	Planck Scale	Particle-Physics	Astro-Physics	Cosmology
Gravitational Model	PV	PV	PV	ZPF
Space-Time Geometry	Curved	Flat	Curved	Flat

Tab. (4): SED Harmonic Mode Population Regions / Zones

- *Note*: the [1 / n_{PV}] distribution depicted in Fig. (3) is analogous to the modal distribution of the Amplitude Spectrum described by Eq. (17) [*i.e.* $C_{PV}(n_{PV},r,M)$ for fixed values of 'r' & 'M'].

Further comparative characteristics between QV, ZPF, EGM & PV Spectra appear in Tab. (5), as follows;

Spectrum	**Characteristics**		**Bandwidth (Hz)**
QV	1)	Generalised reference to the QM nature of the vacuum	$-\infty < \omega_{QV} < +\infty$
	2)	Random & continuous	
	3)	Unspecified frequency distribution	
	4)	Within the EGM construct, in flat Space-Time geometries (*i.e.* Minkowski-Space), the QVS transforms to the ZPFS	
	5)	Within the EGM construct, in curved Space-Time geometries (*i.e.* gravitational fields), the QVS transforms to the PVS	
	6)	No significant governing equation/s	

[9] In the appropriate cases.

ZPF	7) 8) 9) 10) 11)	Relates to the vacuum Random & continuous Obeys a cubic frequency distribution Within the EGM construct, in Curved Space-Time geometries (*i.e.* gravitational fields), the ZPFS transforms to the PVS Primary equation: Eq. (1)	$-\infty < \omega_{ZPF} < +\infty$
EGM	12) 13) 14)	Relates to Mass-Energy Discrete & harmonically continuous Obeys a Quantised Fourier-Distribution; *i.e.* the Maximum Spectral Frequency is an integer multiple of the Minimum Spectral Frequency Primary equations: Eq. (2-10)	$-\infty < \omega_{\Theta} < +\infty$
PV	15) 16) 17) 18)	Relates to Gravitational Acceleration Formulated by relating the ZPF & EGM Spectra Discrete & finite Obeys a Quantised Fourier-Distribution; *i.e.* the Maximum Spectral Frequency is an integer multiple of the Minimum Spectral Frequency Primary equations: Eq. (17, 18, 25-27)	$-\omega_h \leq \omega_{PV} \leq +\omega_h$

Tab. (5): Comparative Spectral Characteristics

4.4.6 PV Transformations

The PV Model of Gravity exhibits isomorphism to GR. By comparison, the similarities between EGM & the PV Model demonstrate that EGM is also isomorphic to GR. However, differences exist between these two representations, primarily due to the introduction of a superposition of fields, facilitating the formulation of Engineering tools which may be utilised in practical applications. Within the EGM Construct, K_{PV} is a function of ρ_0 by wavefunction superposition at each point in a gravitational field. EGM supports the conjecture of the PV Model such that measurements by 'rulers & clocks' depend upon K_{PV} of the medium, by applying transformations to the ZPF. Hence, a PV Transformation Table for application to *Metric Engineering* effects was articulated by *Storti* [14] according to Tab. (6, 7), such that;

1) The subscript '∞' relates to values, as would be measured or defined by a non-local observer, in a globally flat Space-Time Manifold (*i.e.* at Infinity).
2) The non-subscripted parameters [*e.g.* 'c' as a function of Refractive Index $c(K_{PV})$] relate to measurements performed by a local observer.
3) The non-subscripted parameters of μ, ε & Z, do *not* refer to the classical representation of Relative Permeability, Permittivity & Impedance (*i.e.* they are generalised references to the constants *only*).
4) The section *Unit of Measure*, denotes PV Transformations at the physical scale (*i.e.* 'rulers & clocks').
5) The section *Planck Measure*, denotes PV Transformations at the Planck Scale.
6) The subscript 'h_∞', relates to Planck Scale values, as would be measured or defined by a non-local observer, in a globally flat Space-Time Manifold (*i.e.* at Infinity).
7) The section *Relative Measure*, demonstrates the consistency of relative measures of the PV Model (*i.e.* the relationship between the Physical & Planck Scales).

Physical Constant	**PV Representation of GR**
Velocity of light	$c(K_{PV}) = K_{PV}^{-1} \cdot c_{\infty}$
Planck	$h(K_{PV}) = h_{\infty} = h$
Dirac (*i.e.* $\hbar \equiv h / 2\pi$)	$\hbar(K_{PV}) = \hbar_{\infty} = \hbar$
Gravitation	$G(K_{PV}) = G_{\infty} = G$
Permeability	$\mu(K_{PV}) = K_{PV} \cdot \mu_{\infty}$
Permittivity	$\varepsilon(K_{PV}) = K_{PV} \cdot \varepsilon_{\infty}$
Impedance	$Z(K_{PV}) = Z_{\infty} = (\mu_{\infty}/\varepsilon_{\infty})^{½}$
Unit of Measure	
Mass (m)	$m(K_{PV}) = K_{PV}^{3/2} \cdot m_{\infty}$
Length (r)	$r(K_{PV}) = K_{PV}^{-½} \cdot r_{\infty}$
Time (t)	$t(K_{PV}) = K_{PV}^{½} \cdot t_{\infty}$
Energy (E)	$E(K_{PV}) = K_{PV}^{-½} \cdot E_{\infty}$
Planck Measure	
Mass (m_h)	$m_h(K_{PV}) = K_{PV}^{-½} \cdot m_{h\ \infty}$
Length (λ_h)	$\lambda_h(K_{PV}) = K_{PV}^{3/2} \cdot \lambda_{h\ \infty}$
Time (t_h)	$t_h(K_{PV}) = K_{PV}^{5/2} \cdot t_{h\ \infty}$

Energy (E_h)	$E_h(K_{PV}) = K_{PV}^{-5/2} \cdot E_{h\,\infty}$
Relative Measure	
Mass	$m(K_{PV})/m_h(K_{PV}) = K_{PV}^{2} \cdot (m_\infty/m_{h\,\infty})$
Length	$r(K_{PV})/\lambda_h(K_{PV}) = K_{PV}^{-2} \cdot (r_\infty/\lambda_{h\,\infty})$
Time	$t(K_{PV})/t_h(K_{PV}) = K_{PV}^{-2} \cdot (t_0/t_{h\,\infty})$
Energy	$E(K_{PV})/E_h(K_{PV}) = K_{PV}^{2} \cdot (E_\infty/E_{h\,\infty})$

Tab. (6): PV Transformation Matrix

where,

Eq. (28)	Eq. (29)	Eq. (30)	Eq. (31)	Eq. (32)
$K_{PV}(r,M) = \frac{r \cdot c_\infty^{\,2}}{r \cdot c_\infty^{\,2} - 2 \cdot G \cdot M}$	$E_h = m_h \cdot c_\infty^{\,2}$	$t_h = \sqrt{\frac{G \cdot h}{c_\infty^{\,5}}}$	$m_h = \sqrt{\frac{h \cdot c_\infty}{G}}$	$\lambda_h = \sqrt{\frac{G \cdot h}{c_\infty^{\,3}}}$

Tab. (7): PV Transformation Matrix Supporting Equations

Hence, the preceding tables permit Engineers (*in principle*) to design & develop new technologies within the EGM Construct, to affect the PV medium controlling relative polarisability (*i.e.* via manipulation of K_{PV}), at any point in a gravitational field by the superposition of applied EM wavefunctions. This concept of *Metric Engineering* by superposition (*Storti & Desiato* [10]), lead to important experimentally verified predictions in Particle-Physics & Cosmology. We advise all readers to view the following video presentation relating QM to GR:

- Quantum Integrated GR: https://youtu.be/mRG8Jge9EpM?si=opYwP8gksQ_TqHUu

5 Validation of The EGM Construct

With a *fully* Quantised representation of Gravitational Acceleration[10] having been derived via the EGM Construct in the preceding section, we shall now validate the formalism. We may achieve this utilising six (6) key scientific outcomes, as follows:

1. Particle-Physics[11] [6,15]:
   - [2007] Storti derives the **R**oot-**M**ean-**S**quare (RMS) Charge Radius of the Proton.
   - [2007] Storti derives the **M**ean-**S**quare (MS) Charge Radius of the Neutron.
   - https://youtu.be/LWm1WzA1zXw?si=3Y0ilJypJ6q0w_oC
2. Astrophysics:
   - [2023] Storti constrains **P**article **D**ata **G**roup (PDG) Astrophysical Constants & Parameters to the **C**osmic **M**icrowave **B**ackground **R**adiation (CMBR) Temperature (T_0):
     - A Present-Epoch comparison between the EGM Construct & the **S**tandard **M**odel **o**f **C**osmology (SMoC), exhibits significant synergy; with the exception of Cosmological Age as explained by *Storti* [16]. The EGM Construct [17] offers corrections to greater than 23% of the data published by the PDG [18]. *Most importantly*, the corrections generated by the EGM Construct are constrained by T_0; unlike PDG data. Consequently, the constraint of a substantial portion of PDG data to T_0 is an extraordinary development for the SMoC, as appears in Tab. (8);

Electro-**G**ravi-**M**agnetics (EGM) vs. **S**tandard **M**odel **o**f **C**osmology (SMoC)

	EGM	**PDG-2022**
1	$H_\Phi = 67.1181447977434$ (km/s/Mpc)	$H_0 = 67.4$ (km/s/Mpc)
2	$t_\Phi = 14.5685359530647$ (Gyr)	$t_0 = 13.797$ (Gyr)
3	$\Omega_\Phi = 0.677345709533812$	$\Omega_\Lambda = 0.685$
4	$\Omega_m = 0.322654290466188$	$\Omega_m = 0.315$
5	$\Omega_c = 0.262875350332401$	$\Omega_c = 0.265$
6	$\Omega_b = 0.059778940133786$	$\Omega_b = 0.0493$
7	$\Omega_K = 0.000654290466188$	$\Omega_K = 0.0007$
8	$\rho_\Phi = 8.46163851959276 \cdot 10^{-27}$ (kg/m^3)	$\rho_{crit} = 8.53286 \cdot 10^{-27}$ (kg/m^3)
9	$\rho_\Lambda = 5.73145454687219 \cdot 10^{-30}$ (gm/cm^3)	$\rho_\Lambda = 5.83 \cdot 10^{-30}$ (gm/cm^3)
10	$n_\gamma = 410.726847902135$ (cm^{-3})	$n_\gamma = 410.73$ (cm^{-3})
11	$\rho_\gamma = 0.260570578238883$ (eV/cm^3)	$\rho_\gamma = 0.260$ (eV/cm^3)

[10] In accordance with a Quantised Fourier-Distribution.

[11] The mathematical forms derived & experimentally verified, are identical; the significance of this cannot be overstated.

12	$\eta = 7.35787809937048 \bullet 10^{-10}$	$\eta = 6.14 \bullet 10^{-10}$
13	$n_b = 3.02207807900259 \bullet 10^{-7}$ (cm^{-3})	$n_b = 2.515 \bullet 10^{-7}$ (cm^{-3})
14	$\Omega_\gamma = 5.48958983118303 \bullet 10^{-5}$	$\Omega_\gamma = 5.38 \bullet 10^{-5}$
15	$R_\Phi = 14.5685359530647$ (GLyr)	$c/H_0 = 14.502$ (GLyr)
16	$\Lambda_S = 6.33200653109817 \bullet 10^{51}$ (m^2)	$\Lambda_S = 6.28 \bullet 10^{51}$ (m^2)
17	$\Lambda_\Phi = 0.789639109726698 \bullet 10^{-56}$ (cm^{-2})	$\Lambda = 1.088 \bullet 10^{-56}$ (cm^{-2})

Nomenclature: [H_Φ, H_0] Λ_{CDM} Hubble Constant, [t_Φ, t_0] Cosmological Age, [Ω_Φ, Ω_Λ] Dark Energy Density Parameter, [Ω_m] Pressureless Matter Parameter, [Ω_c] Cold Dark Matter Density Parameter, [Ω_b] Baryon Density Parameter, [Ω_K] Curvature, [ρ_Φ, ρ_{crit}] Critical Density, [ρ_Λ] Energy Density of Dark Energy, [n_γ] CMBR Photon Number Density, [ρ_γ] CMBR Photon Density, [η] Baryon-to-Photon Ratio, [n_b] Baryon Number Density, [Ω_γ] CMBR Density of the Universe, [R_Φ] Hubble Radius (*Length*) (*Schwarzschild Radius*), [Λ_S] Scaling for Cosmological Constant, [Λ_Φ, Λ] Cosmological Constant

Tab. (8)

3. Astrophysics
   - [2023] Storti resolves the Hubble Tension Problem [19].
   - https://youtu.be/ovLbvj3HuNM?si=4L6hDPXumh3GxRGv
4. Cosmology:
   - [2020] Storti resolves the Cosmological Flatness Problem [20].
5. Cosmology:
   - [2020] Storti resolves the Early Universe Galactic Formation Problem identified by the **J**ames **W**ebb **S**pace **T**elescope (JWST), by demonstrating that the true age of the Universe is the Hubble Age [16].
6. Cosmology:
   - Storti predicted the value of Power Spectrum Hubble Constant (H_0), five (5) years in advance of experimental confirmation in 2008 [7], by the Planck Satellite in 2013 [21]. It is important to appreciate the sequence of historical events:
     - [2008] Storti: $H_0 = 67.0843$ (km/s/Mpc) [7].
     - [2008] PDG: $H_0 = 73$ (km/s/Mpc) [22].
     - [2013] PDG: $H_0 = 67.3$ (km/s/Mpc) [21].
     - [2019] PDG: $H_0 = 67.4$ (km/s/Mpc) [18].
     - [2020] Storti: $H_0 = 67.1181$ (km/s/Mpc) [16].

     Thus, Storti's 2008 prediction which debunked scientific dogma in 2013, is ample evidence of experimentally verified prediction & scientific validation of the EGM Construct, as appears in Tab. (9);

PDG (2008) [22] *Measurement*	**Storti (2008)** [7] **Storti (2009)** [23] *Prediction*	**PDG (2019)** [18] *Measurement*
$H_0 = 73$ (km/s/Mpc)	$H_0 = 67.0843$ (km/s/Mpc)	$H_0 = 67.4$ (km/s/Mpc)
$R_0 = 8.0$ (kpc)	$R_0 = 8.1072$ (kpc)	$R_0 = 8.178$ (kpc)
$T_0 = 2.725$ (K)	$T_0 = 2.7248$ (K)	$T_0 = 2.7255$ (K)

Tab. (9): Advanced Prediction of The Power Spectrum Hubble Constant

6 Gravity-B Wave

6.1 The Lazar Frequency: 7.46 (Hz)

With the EGM Construct scientifically validated, we are now in a position to evaluate & assess the Gravity-B Wave Frequency Claim asserted by Robert Lazar. Firstly, we recommend readers to review the following video presentation [https://youtu.be/S2VXX8LPlCQ?si=7JMiic4tHYnVL6ZC], prior to continuing. Secondly, for readers with particular interest in the complete **C**omputational **S**olution **A**lgorithm (CSA) associated specifically with key technical claims asserted by Robert Lazar, we recommend reviewing the following artefacts: [24], [25], [26] & [27], which have been built within a **M**athCad **C**omputational **E**nvironment (MCE). However, for readers with considerably less free time, we shall walk through the derivation of the Lazar Gravity-B Wave Frequency Claim; succinctly. Our journey begins with Eq. (18), which integrates the Polarised form of the QV (*i.e.* the PVS), with GR. Careful consideration of Eq. (18) reveals that $K_{PV} = 1$, for all but the most extreme celestial bodies in the Universe (*e.g.* Black-Holes); hence, Eq. (18) simplifies to Eq. (33) as follows;

$$\omega_{PV}\left(n_{PV}, r, M\right) = \frac{n_{PV}}{r} \cdot \sqrt[3]{\frac{2 \cdot c \cdot G \cdot M}{\pi \cdot r}} \qquad \text{Eq. (33)}$$

The next parameter we need to consider is n_{PV}. Eq. (25) demonstrates that the maximum value of n_{PV} at the surface of the Earth for 100 (%) Gravitational Similarity, is given by $n_{\Omega}(R_E,M_E) \approx 1.45 \cdot 10^{28}$. Similarly, Eq. (27) demonstrates that the maximum value of ω_{PV} at the surface of the Earth for 100 (%) Gravitational Similarity, is given by $\omega_{\Omega}(R_E,M_E) \approx 520 \cdot 10^{24}$ (Hz); *see* Tab. (B.1). However, it is abundantly clear that these values substantially exceed any form of technological manipulation; terrestrial, extraterrestrial or otherwise. Hence, the obvious question arises: is there a workaround to this apparent impasse ? **Yes**, utilising the UHO associated with Fig. (1); *i.e.* by determining Θ_{N_PV} in accordance with a Quantised Fourier-Distribution: pg. 25, [24] as follows;

$$\Theta_{N\_PV} = \sum_{n_{PV}} \left(\frac{2}{\pi \cdot n_{PV}} \right)^2 \qquad \text{Eq. (34)}$$

where;

- The Quantised Harmonic Mode Fourier-Distribution is given by the odd sequence, as follows:
  $[n_{PV} = -N, 2\text{-}N \ldots N]$ & $[N \rightarrow +n_{\Omega}(R_E,M_E)]$; *e.g.* -N … -21, -19, -17, -15 ... 15, 17, 19, 21 … +N

such that,

N	$\boldsymbol{\Theta_{N\ PV}}$
15	97.47 (%)
215	99.81 (%)
415	99.9 (%)
615	99.93 (%)
815	99.95 (%)
1,015	99.96 (%)

Tab. (10): Gravitational Similarity

Thus, Tab. (10) demonstrates that at least 99.9 (%) of Gravitational Acceleration at every point in a **Q**uantised **G**ravitational **F**ield (QGF), is contained within the first 415 Harmonic Modes of the PVS. We term this limit N_{Lazar}; hence, substituting N_{Lazar} into Eq. (33) yields Eq. (35) as follows;

$$\omega_{PV}(415, r, M) = \frac{415}{r} \cdot \sqrt[3]{\frac{2 \cdot c \cdot G \cdot M}{\pi \cdot r}} \qquad \text{Eq. (35)}$$

Eq. (35) denotes the PV Frequency associated with a specific harmonic; *i.e.* N = 415. The resultant frequency associated with the summation of all odd harmonic modes from N = ±1 to N = ±415, yields ω_{Lazar} given by Eq. (36, 37) as follows;

$$\omega_{Lazar}(r, M) = \frac{1}{2} \cdot \frac{415}{r} \cdot \sqrt[3]{\frac{2 \cdot c \cdot G \cdot M}{\pi \cdot r}} \qquad \text{Eq. (36)}$$

$$\omega_{Lazar} = \frac{1}{2} \cdot \frac{415}{R_E} \cdot \sqrt[3]{\frac{2 \cdot c \cdot G \cdot M_E}{\pi \cdot R_E}} = 7.43 \text{ (Hz)} \qquad \text{Eq. (37)}$$

Therefore, the similarity between the Theoretical Gravity-B Wave Frequency (ω_{Lazar}) & the Actual Gravity B-Wave Frequency of 7.46 (Hz) asserted by Robert Lazar (ω_{Actual}), is given by Eq. (38) as follows;

$$\frac{1}{2} \cdot \frac{415}{R_E} \cdot \sqrt[3]{\frac{2 \cdot c \cdot G \cdot M_E}{\pi \cdot R_E}} \cdot \frac{1}{7.46 \cdot (\text{Hz})} = 99.64 \text{ (\%)} \qquad \text{Eq. (38)}$$

As we have mathematically proven, the similarity between ω_{Lazar} & ω_{Actual}, is astonishing. This alone, validates the entire Lazar story because ω_{Lazar}, until recently, was unknown to Physics; Robert Lazar predicted a scientifically validated principle of QM, many years in advance of Eq. (36, 37), utilising the mathematical precision of Joseph Fourier [28]. In this article, we have established the physical meaningfulness of a key Lazar claim; *i.e.* a QV property of the Earth at its surface (*i.e.* it is location specific), which:

1) Does not require the existence of Extraterrestrial Spacecraft.
2) Does not require the existence of Extraterrestrial Intelligence.
3) Does not require the existence of Area-51 or S-4.
4) Does not require the existence of Element-115 (*Moscovium*).

5) Does not require Lazar to possess any credibility; *i.e.* it is independent of 'the man'.
6) Does not require the existence of any Conspiracy Theory.
7) Does not require the existence of any so-called 'US Government Cover-up'.
8) Does not require the Lazar story to even exist.

Two obvious questions now appear:

1) Why should $N_{Lazar} = 415$; *i.e.* why stop there ?
2) Why not target a higher value of 'N', & potentially eliminate more Gravity[12] ?

We shall address these questions in the proceeding section.

6.2 The Lazar Harmonic: $N_{Lazar} = 415$

$N_{Lazar} = 415$ denotes the optimal solution for Engineering a Gravitational Effect allegedly enabling an Extraterrestrial Spacecraft to hover at the surface of the Earth; Lazar terms this vehicle as being the 'Sports Model'. We may demonstrate this by considering the **S**pectral **P**ower **F**low (SPF) through the surface area of a sphere (P_ω), in accordance with Eq. (39) as follows;

$$P_\omega(N,r,M) = 4\cdot\pi\cdot r^2\cdot\frac{h}{2\cdot c^2}\cdot\omega_{PV}(N,r,M)^4 \qquad \text{Eq. (39)}$$

Moreover, the ratio of the SPF at location 'r' for a celestial body of mass 'M', to the SPF associated with a Proton at radial displacement 'r_π', is termed the **S**pectral **P**ower **A**mplification **F**actor (SPAF) denoted by (P_{AF}), in accordance with Eq. (40) as follows;

$$P_{AF}(N,r,M) = \frac{P_\omega(N,r,M)}{P_\omega\left(1,r_\pi,m_p\right)} \qquad \text{Eq. (40)}$$

where,

- $r = R_E$, $M = M_E$
- $r_\pi = 830.592231241803$ (am) = **R**oot-**M**ean-**S**quare (RMS) Charge Radius of a Proton [6].
- $m_p = 1.67262191146007 \bullet 10^{-27}$ (kg) = Mass of a Proton [29].

such that the P_{AF} associated with Harmonic Mode Limits[13], is given by Tab. (11) as follows;

N	$\Theta_{N\ PV}$	P_{AF}	RP_{AF}
15	97.47 (%)	3.09	$1.71 \bullet 10^{-6}$
215	99.81 (%)	$1.31 \bullet 10^{5}$	0.07
415	99.9 (%)	$1.81 \bullet 10^{6}$	1
615	99.93 (%)	$8.74 \bullet 10^{6}$	4.82
815	99.95 (%)	$2.7 \bullet 10^{7}$	14.87
1,015	99.96 (%)	$6.48 \bullet 10^{7}$	35.78

Tab. (11): Power Amplification Factors; pg. (25,32), [24]

Lazar asserts that a stable isotope of the Element-115 Atom (*Moscovium*) exists & radiates an EM-like signal which is subsequently amplified & utilised for interstellar propulsion; he defines this as the Gravity-A Wave. Moreover, Lazar also asserts that the Gravity-A Wave exists in the **M**icrowave **F**requency **R**ange (MFR), & extends substantially beyond the radius of the Element-115 Nucleus[14]. However, given that a stable isotope of the Element-115 Atom is presently unknown to terrestrial science, we have substituted this requirement with the Proton; as appears in Eq. (40):

1) If a so-called 'Anti-Gravitational Atom' actually exists, it must be 'Anti-Gravitational' relative to the most abundant 'gravitationally generating' element in the Universe; *i.e.* the Proton. Hence, the reputed characteristics of a stable isotope of the Element-115 Atom, may be considered to be an inverted image of the Proton (*in a manner of speaking*), but not an Anti-Proton.
2) *Storti* conjectures that the reputed properties of a stable isotope of the Element-115 Atom, arises from a QV Phase-Difference between ElectroStatic & Gravitational Spectra. [30,31,32]
3) Due to the similarity of Mass & Size between the Proton & Neutron, Eq. (40) can be formulated with Neutron properties, without modifying the results displayed in Tab. (11).

Thus, P_{AF} represents the magnitude of **S**pectral **P**ower **A**mplification (SPA) required to be artificially achieved, from a single stable nucleus of Element-115, at its **F**undamental **S**pectral **F**requency (FSF)[15] as defined by Eq. (18). Therefore, by targeting N = 1,015 instead of N = 415, almost 36 times more **R**elative-**SPA** (RP_{AF}) is required to generate a 0.06

[12] Via the so-called Gravity Amplifiers aboard the claimed Extraterrestrial Spacecraft.
[13] In accordance with a Quantised Fourier-Distribution.
[14] Such that it may be acquired & amplified in accordance with standard MFR Engineering Principles.
[15] N = 1; such that, $\omega_0 = \omega_{PV}(1,r,M)$.

(%) **G**ravitational **S**imilarity **A**dvantage (GSA); *i.e.* '**A**nti-**G**ravitational **A**dvantage' (AGA). Consequently, Tab. (11) provides clear evidence of the principle of diminishing returns, & that $N_{Lazar} = 415$ = Optimal Solution. Moreover, with the validity of N_{Lazar} established, we may calculate the Theoretical Gravity-B Wave Frequency (ω_{Lazar}) for various locations in accordance with Tab. (12, 13) as follows;

Location	ω_{Lazar}	P_{AF}	RP_{AF}	% RP_{AF}
Surface of the Moon	9.71 (Hz)	$3.92 \bullet 10^{5}$	0.22	22
Surface of the Earth	7.43 (Hz)	$1.81 \bullet 10^{6}$	1	100
Cloud Surface of Jupiter	2.02 (Hz)	$1.25 \bullet 10^{6}$	0.69	69
Surface of the Sun	0.99 (Hz)	$6.74 \bullet 10^{6}$	3.72	372
Schwarzschild Black-Hole[16]	1.25 (MHz)	$3.1 \bullet 10^{38}$	$1.71 \bullet 10^{32}$	$1.71 \bullet 10^{34}$

Tab. (12): (*Celestial*) Theoretical Gravity-B Wave Frequencies; pg. 32, [24]

Location		ω_{Lazar}	P_{AF}	RP_{AF}	% RP_{AF}
High-Earth-Orbit (HEO)	R_E + 35,780 (km)	0.6 (Hz)	$3.34 \bullet 10^{3}$	0.0018	0.18
Mid-Earth-Orbit (MEO)	R_E + 2,000 (km)	5.17 (Hz)	$7.3 \bullet 10^{5}$	0.4	40
Low-Earth-Orbit (LEO)	R_E + 180 (km)	7.16 (Hz)	$1.65 \bullet 10^{6}$	0.91	91
Surface of the Earth	R_E	7.43 (Hz)	$1.81 \bullet 10^{6}$	1	100

Tab. (13): (*Terrestrial*) Theoretical Gravity-B Wave Frequencies; pg. 32, [24]

- *Note*: Throughout this article, we apply the PDG-2019 Value of R_E, which denotes the **N**ominal **E**quatorial **R**adius (NER). However, if the **I**nternational **U**nion of **G**eodesy and **G**eophysics [IUGG] Global Average Radius is utilised instead; R_E = 6,371 (km) ±10 (km), such that R_E = 6,361 (km); then an exact match for the Lazar value may be calculated: $\omega_{Lazar} = \omega_{Actual}$ = 7.46 (Hz); pg. 32, [24]

7 Discussion

7.1 Establishing Basic Principles

The persistent fact that GR does not integrate seamlessly & convincingly into any widely accepted **Q**uantum **M**echanical **M**odel (QMM), reinforces the assertion that GR is incomplete. Moreover, GR is widely accepted as being profoundly limiting, particularly with the development of QM. By 1925, it became apparent that the true nature of existence is quantised. The predictive power of GR rests predominantly in the mathematical methods supporting it, not in the theory itself. However, in the case of QM, the theory remains highly productive, even in the absence of the mathematics quantifying it. This meant that the New Physics associated with the Robert Lazar story, could not be addressed by any direct measure involving GR. Thus, to overcome this impasse, we have utilised an isomorphic representation of GR, termed the PV Model of Gravity, & integrated it with QM via the QV; hence, deriving & validating Robert Lazar's 7.46 (Hz) Gravity-B Wave Frequency Claim.

Robert Scott Lazar (*Bob Lazar*) claims to have worked at a facility termed S-4 in the Nevada Desert, where he was involved with the Reverse Engineering of Extraterrestrial Spacecraft in 1988-1989. *Maverick Leung* [1], attempted to assess Lazar's credibility through a legal lens, whilst *Emeritus Professor Paul Edwin Potter* [2], attempted a modest scientific appraisal. Internet personalities such as *Danny Jones* [3], driven by commercialisation & monetisation, has sought to capitalise on the Lazar story by being a contrarian. However in science, credibility is valueless & carries no weight; only logic & verifiable, consistent & reproducible evidence has any value. Thus, we can immediately discard *Leung* [1] & *Jones* [3] because their efforts are non-scientific. Focusing on credibility & character assassination is not the path to knowledge. In this article, we substantially advanced *Potter's* research, by applying the EGM Construct.

Lazar indirectly implies that the Earth radiates a so-called Gravity-B Wave at 7.46 (Hz). This value denotes a QV property of the Earth, at its surface; hence, it is location specific such that:

1) It does not require the existence of Element-115 (*Moscovium*).
2) It does not require Lazar to possess any credibility; *i.e.* it is independent of 'the man'.
3) It does not require the Lazar story to even exist.

From the above points, obvious questions arise. This QV property of the Earth at its surface, is unknown to standard scientific doctrine; *i.e.* it is unknown to Standard Physics:

1) Is it correct?
2) How did Lazar arrive at this value ?
3) It is a very specific value, stated to two significant figures; so, where did it come from ?

[16] 0.25 (mm) prior to the Event Horizon.

It is inconceivable that Lazar could have randomly guessed such a specific & precise value. Moreover, since Lazar's Gravity-B Wave Frequency Value is the only testable technical claim associated with his story, the only logical & rational conclusion is that the Lazar story is genuine. Moreover, we have demonstrated that alternative explanations for Lazar's Gravity-B Wave Frequency Value of 7.46 (Hz), such as the *Schumann Effect*, are absurd in the extreme. In fact, we identified six (6) reasons why the *Schumann Effect* value of 7.83 (Hz), is in no way connected to Lazar's 7.46 (Hz) Gravity-B Wave Frequency Claim.

Herein, we have proposed that the ZPF-SED distribution as presented by *Haisch et. al*. in accordance with Eq. (1) [4], is modified by the presence of matter. In 2006, *Storti & Desiato* [5] demonstrated that the minimum & maximum Spectral Limits of the ZPF may be computed by assuming that the constitution of Spectral Frequencies between these limits, obeys a Quantised Fourier-Distribution such that the Spectral Energy contained locally within the ZPF is equal to the Rest-Mass-Energy of the matter content present. The computed Spectral Limits were subsequently utilised to formulate many observationally verified solutions to key Particle-Physics & Cosmological problems ([6] & [7] respectively). Hence, outside the minimum & maximum Spectral Limits computed by the authors, the ZPF cannot be said to exist. One of the fundamental benefits of such a construct is that it evades the '*infinite energy in a vanishing volume problem*' of contemporary QED; as no more Spectral Energy exists in the ZPF surrounding an object, than the Rest-Mass-Energy of the object itself (*i.e*. matter exists in equilibrium with the ZPF surrounding it).

Einstein's development of Relativity & the notion of an aether termed 'Curved Space-Time', is a geometric *contrivance*; GR requires the existence of a medium (*i.e.* a manifold) capable of conveying information indicating whether the Space-Time a mass-object transits is curved. Nowadays, we term this aether 'the QV'. Bernard Haisch & Alfonso Rueda introduced a model describing matter as being immersed-in & wholly dependent upon the QV for its existence. This fed an intuitively appealing interpretation of Space-Time Curvature termed the PV Approach to GR [8]. The PV Model is an *optical* interpretation of Gravity because it applies optical principles to define the topological features of Space-Time, otherwise represented geometrically within GR. It attributes Space-Time with a variable K_{PV}, not 'curvature'. The value of K_{PV} is proportional to the energy density associated with a gravitational field. As light passes a mass-object, it transits through regions of variable K_{PV} & refracts in accordance with the experimentally verified results within the GR construct. The PV Model ascribes a value of K_{PV} to the QV such that all matter generates a gradient in the energy density of the QV surrounding it. The gradient relates to a change in K_{PV} acting as a Space-Time lens causing light to bend. Hence, the PV Model demonstrates that substituting the metaphysical conceptualisation of Space-Time Curvature with a physically meaningful optical construct yields a congruent interpretation of Gravity to that of GR.

The key difference between interpretations is that the PV Model describes the physical manner by which Space-Time is 'curved', GR does not. However, neither GR nor the PV Model specifically addresses the precise mechanism by which matter physically polarises Space-Time. Fortunately, the PV Model is not required to do so because QED explains this mechanism based upon the premise that within a volume of Space-Time devoid of matter, a chaotic & equally distributed mix of VPP's are said to 'pop' into & out of existence. The PV Model asserts that matter *polarises* the QV (*i.e.* enforcing direction & order) into variable regions of energy density which, in turn, generates regions of variable K_{PV}. A well-developed precedent for the existence of vacuum polarisation exists, based upon the generally accepted model of the Electron. The contemporary model of the Electron stems from QED, modelling it as a negatively charged point core surrounded by a cloud of VPP's, constantly emerging from & disappearing into the QV. According to QED & the relativistic QFT of the interaction of charged particles & Photons, an Electron may emit virtual Photons which, in turn, may become virtual Electron-Positron pairs. The virtual Positrons are attracted to the 'bare' Electron whilst the virtual Electrons are repelled from it. The bare Electron is therefore screened due to polarisation. The presence of the negatively charged core attracts the virtual positive charges & repels the virtual negative charges present in the vacuum, biasing the QV, resulting in a vacuum gradient as it segregates clustered regions of virtual charges. In this state the vacuum is no longer uniform – it has been *polarised*. The effect of an Electron upon the QV is termed 'vacuum polarisation' & the property of *charge* emerges due to a change in the QVE distribution of the surrounding Space-Time. Thus, if the QV is effervescent with VPP's, we must consider its effect on all elementary particles, not just the Electron. *From the perspective of the PV Model*; matter polarises the QV, forming gravitational fields because its atomic constituents are composed of large populations of elementary particles, all generating their own localised polarisations of the vacuum such that the cumulative effect results in a large-scale, synergistic polarisation. Conceptualising the Space-Time Manifold in terms of vacuum polarisation yields an isomorphic representation of GR.

The PV Model of Gravity asserts that the metaphysical concept of Space-Time Curvature, may be replaced by an optical representation of QV polarisation. Thus, it follows that the formation of gravitational fields are a result of QVE displacement due to the presence of matter. Recognising that QVE is EM in composition, a fundamental relationship between matter, EM-Energy & Gravity is implied. This may be described utilising a mathematical method termed EGM [9], developed from the application of Standard Engineering Principles, modelling the manner in which matter equilibrates with, & is constrained by, the local QV as a *system*. The initial premise in the development of the EGM Construct, is the assumption that Gravity & **E**lectro**M**agnetism may be unified via QM in terms of the QV, utilising a framework of BPT & DAT's, indicating that similar systems may be described in like terms. An important consideration involving DAT's & BPT is the rule of 'similitude'. In order to compare a mathematical model to a

physical system, certain criteria must be satisfied. The model must have *Dynamic*, *Kinematic* or *Geometric* Similarity to the real-world system (any of, or all of these if applicable). 'Dynamic Similarity' relates forces, 'Kinematic Similarity' relates motion & 'Geometric Similarity' relates shape. The EGM Construct commences by mathematically representing mass as an equivalent localised density of wavefunction energy, contained by the QV surrounding it. Properties of Quantised Fourier Harmonics are utilised to mathematically decompile the Mass-Energy into a spectrum of EM-Frequencies. This technique considers Gravity to be the *result* of an interaction between matter & the Space-Time Manifold surrounding it; leading to the following precepts:

1) An object at rest polarises, & exists in equilibrium with, the QV surrounding it.
2) The magnitude of QVE surrounding an object at rest is equivalent to $E = mc^2$.
3) The Frequency Distribution of the QVE surrounding an object at rest is cubic.

Historically, the QV has been considered to comprise of a potentially infinite spectrum of randomly orientated wavefunctions in the form of VPP's, each of specific frequency & amplitude, analogous to the static one observes on a dead television channel. However, the EGM Construct disagrees with this historical conception as it implies the existence of a potentially infinite quantity of energy in a vanishing volume; *i.e.* free space contains a *potentially infinite* amount of energy because (ω) in Eq. (1) may equal an infinite quantity. EGM asserts that the localised QV surrounding an object is more appropriately described as a finite spectrum whose VPP population is governed by the quantity of Mass-Energy influencing or occupying a specific volume; *i.e.* a vanishingly small volume of free space contains a *near zero* amount of energy.

The ZPFS is defined by Eq. (1) & refers to the QVS associated with Minkowski-Space. The ZPFS is considered to be dispersed homogeneously throughout the Universe; consequently, the Spectral Energy of the VPP's within it, denotes the ground state of the QV. However, standard QM implies the existence of a potentially infinite quantity of energy in a vanishing volume, due to the potential for high frequency VPP Creation-Annihilation. Fortunately, EGM resolves this conflict such that a vanishingly small volume of flat Space-Time *does not* contain an infinite amount of energy because, although the potential for such VPP Creation-Annihilation processes exist within the EGM Construct, the probability of high frequency VPP creation approaches zero in the *absence* of Matter-Energy. Hence, the probability of low or high frequency VPP Creation-Annihilation is biased by the presence of Matter-Energy within a defined region of Minkowski-Space. Mathematically within the EGM Construct, this is achieved by merging the continuous cubic frequency characteristic of the ZPF with a discrete & finite Quantised Fourier-Distribution, such that the highest frequency mode within the ZPFS tends to 0 (Hz) in a vanishing **G**ravitational **A**cceleration **F**ield (GAF).

The Energy Spectrum associated with matter is termed the EGMS. This is a harmonic wavefunction representation of Mass-Energy obeying a Quantised Fourier-Distribution, in terms of conjugate wavefunction pairs, such that the number of Spectral Frequency Modes decreases as energy density increases; *i.e.* the number of modes is inversely proportional to the energy density of the Space-Time Manifold [5], implying that the energy density of free-space approaches zero, avoiding the '*infinite energy in a vanishing volume problem*'. The EGMS is based upon the UHO [Θ(t)]; *i.e.* the number one (1) expressed as the summation of harmonic wavefunctions in the time domain, obeying a Quantised Fourier-Distribution. Within the EGM Construct, Θ(t) utilises a Quantised Fourier-Distribution in Complex form to operate upon a scalar function in order to harmonically quantise it over the Real & Imaginary planes. It is important to recognise that for any harmonic decomposition of a constant function, Unity in our case, only odd harmonics are required to be summed, & the summation of Imaginary terms equals zero. Hence, the Quantised EGM Mass-Energy *Amplitude* & *Frequency Spectra* for $\Theta(t)$, $M_\Theta(M,t)$ & $g_\Theta(r,M,t)$ are described in Tab. (2).

The Energy Spectrum associated with Gravitational Acceleration 'g' is termed the PVS. Consider the action of adding a stationary, non-rotating, neutrally charged point mass to an empty Universe. This action superimposes the EGMS of the point mass onto the ZPFS of the Universe; doing so forms the PVS surrounding the point mass. This modifies the K_{PV} value of the Space-Time Manifold such that it changes at the same rate as 'g', radially outwards from the point mass. Merging the EGM & ZPF Spectra, results in a cross-fertilisation of characteristics. The EGM Construct produces a PVS such that the '*infinite energy*' dilemma of ZPF Theory, is averted by assuming that the Mass-Energy Density of an object is equal to the SED of the gravitational field surrounding it. Therefore, when the EGM & ZPF spectra are merged, the continuous ZPFS is equated to the Quantised Fourier-Distribution of the EGMS such that the resulting PV Spectral Limits may be determined. This process mathematically transforms the continuous ZPFS to a discrete & finite Quantised Fourier-Distribution of equivalent energy. The '*infinite energy in a vanishing volume problem*' is evaded within the EGM Construct by determining the *finite* limits of the PVS by application of the *Equivalence Principle*, which indicates that an accelerated reference frame is equivalent to a uniform gravitational field. *Storti & Desiato* [10] demonstrate that a generalised representation of acceleration '**a**' may be derived utilising DAT's & BPT, incorporating the ZPF-SFD.

The EGM interpretation of Gravity is similar to Newton's thoughts of an optical model such that the aether was presumed to be 'denser' farther away. The gradient in aether density causes light & objects to follow trajectories characteristic of GR. EGM demonstrates that the increasing density of Newton's aether is analogous to increases in Harmonic Frequency Mode population in the PV. Hence, the PV is an EM Frequency Spectrum obeying a Quantised Fourier-Distribution at displacement 'r' describing a mass 'M' induced gravitational field such that:

1) It denotes a polarised form of the ZPFS; *i.e.* mass pushes the ZPF surrounding it 'uphill', against the natural flux of Space-Time Manifold expansion.
2) The population of Spectral Frequency Modes decreases as Mass-Energy Density increases; *i.e.* the Spectral Frequency Mode Bandwidth compresses, tending to Unity for a case approaching the Planck Energy Density Limit.
3) Spectral Frequency Limits (Lower & Upper) increase as mass increases; converging to a Discrete Spectrum tending to the Planck Frequency, for a case approaching the Planck Energy Density Limit.

On a Cosmological scale, the ZPF Upper Spectral Limit is influenced by the average energy density of the present Universe. The Spectral Density of the ZPF remains cubic; however, the present Upper Spectral Frequency Limit is lower than it was in the early Universe. Hence, the majority of ZPE is presently in the form of low-frequency modes, each containing a relatively small amount of energy. The few high-frequency modes characterising the early Universe have bifurcated into a very large bandwidth of lower-frequency modes as the Universe expanded to its present form. The total energy of the Universe remains constant, but is spread out over a much greater volume as Cosmological Expansion continues. *Storti & Desiato* [11] demonstrate by derivation that the majority proportion of Gravitational Acceleration in a field, biases the maximum frequency limit such that lower frequencies may be usefully neglected for investigative purposes (*in the appropriate cases*); the assertion of high Spectral Frequency bias is supported by *Storti* [12]. By application of this proportional Spectral Frequency characteristic, *Storti* [13] demonstrates that a modal comparison diagram between the ZPF & its transformed form (*i.e.* the PV field) may be constructed in accordance with Fig. (2, 3).

The PV Model of Gravity exhibits isomorphism to GR. By comparison, the similarities between EGM & the PV Model demonstrate that EGM is also isomorphic to GR. However, differences exist between these two representations, primarily due to the introduction of a superposition of fields, facilitating the formulation of engineering tools which may be utilised in practical applications. Within the EGM Construct, K_{PV} is a function of ρ_0 by wavefunction superposition at each point in a gravitational field. EGM supports the conjecture of the PV Model such that measurements by 'rulers & clocks' depend upon K_{PV} of the medium, by applying transformations to the ZPF. Hence, a PV Transformation Table for application to *Metric Engineering* effects was articulated by *Storti* [14] according to Tab. (6, 7). This permits Engineers (*in principle*) to design & develop new technologies within the EGM Construct, to affect the PV medium controlling relative polarisability (*i.e.* via manipulation of K_{PV}), at any point in a gravitational field by the superposition of applied EM wavefunctions. This concept of *Metric Engineering* by superposition (*Storti & Desiato* [10]), lead to important experimentally verified predictions in Particle-Physics & Cosmology.

7.2 Validating The Lazar Claim

With a *fully* Quantised representation of Gravitational Acceleration having been derived via the EGM Construct, we subsequently validated the formalism. We achieved this utilising numerous experimentally verified key scientific outcomes, involving Particle-Physics, Astrophysics & Cosmology. The most significant of which was the prediction of H_0 in 2008, five (5) years in advance of experimental confirmation by the Planck Satellite in 2013; see Tab. (9). Consequently, with the EGM Construct scientifically validated, we evaluated & assessed the Gravity-B Wave Frequency Claim asserted by Robert Lazar. Our journey began with Eq. (18), which integrated the Polarised form of the QV (*i.e.* the PVS), with GR. Careful consideration of Eq. (18) revealed that $K_{PV} = 1$, for all but the most extreme celestial bodies in the Universe (*e.g.* Black-Holes); hence, Eq. (18) simplified to Eq. (33). The next parameter we considered was n_{PV}. Eq. (25), which demonstrated that the maximum value of n_{PV} at the surface of the Earth for 100 (%) Gravitational Similarity, is given by $n_\Omega(R_E,M_E) \approx 1.45 \cdot 10^{28}$. Similarly, Eq. (27) demonstrated that the maximum value of ω_{PV} at the surface of the Earth for 100 (%) Gravitational Similarity, is given by $\omega_\Omega(R_E,M_E) \approx 520 \cdot 10^{24}$ (Hz); *see* Tab. (B.1). However, it became abundantly clear that these values substantially exceeded any form of technological manipulation; terrestrial, extraterrestrial or otherwise. Hence, the obvious question arose: was there a workaround to this apparent impasse ?

Yes was the answer, by utilising the UHO associated with Fig. (1); *i.e.* by determining Θ_{N_PV} in accordance with a Quantised Fourier-Distribution: pg. 25, [24]. Consequently, we generated Tab. (10) which demonstrated that at least 99.9 (%) of Gravitational Acceleration at every point in a **Q**uantised **G**ravitational **F**ield (QGF), is contained within the first 415 Harmonic Modes of the PVS; we termed this limit N_{Lazar}. Hence, substituting N_{Lazar} into Eq. (34) yielded Eq. (35), which denotes the PV Frequency associated with a specific harmonic; *i.e.* N = 415. The resultant frequency associated with the summation of all odd harmonic modes from N = ±1 to N = ±415, yielded ω_{Lazar} according to Eq. (36, 37); producing a Gravity-B Wave Frequency Value of 7.43 (Hz). Moreover, the similarity between the Theoretical Gravity-B Wave Frequency (ω_{Lazar}) & the Actual Gravity B-Wave Frequency of 7.46 (Hz) asserted by Robert Lazar (ω_{Actual}), is given by Eq. (38) & evaluated to be 99.64 (%). Thus, as we have mathematically proven, the similarity between ω_{Lazar} & ω_{Actual}, is astonishing. Therefore, this alone validates the entire Lazar story because ω_{Lazar}, until recently, was unknown to Physics. Robert Lazar predicted a scientifically validated principle of QM, many years

in advance of its derivation utilising the mathematical precision of Joseph Fourier [28]. Consequently, we have established the physical meaningfulness of a key Lazar claim; *i.e.* a QV property of the Earth at its surface.
However, this precipitated two obvious questions:

1) Why should $N_{Lazar} = 415$; *i.e.* why stop there ?
2) Why not target a higher value of 'N', & potentially eliminate more Gravity ?

We resolved these questions by considering the **S**pectral **P**ower **F**low (SPF) through the surface area of a sphere (P_{ω}) in accordance with Eq. (39), & the **S**pectral **P**ower **A**mplification **F**actor (SPAF) denoted by (P_{AF}) in accordance with Eq. (40). Thus, we demonstrated that P_{AF} represents the magnitude of **S**pectral **P**ower **A**mplification (SPA) required to be artificially achieved, from a single stable nucleus of Element-115, at its **F**undamental **S**pectral **F**requency (FSF) as defined by Eq. (18). Therefore, by targeting N = 1,015 instead of N = 415, almost 36 times more **R**elative-**SPA** (RP_{AF}) is required to generate a 0.06 (%) **G**ravitational **S**imilarity **A**dvantage (GSA); *i.e.* '**A**nti-**G**ravitational **A**dvantage' (AGA). Consequently, Tab. (11) provided clear evidence of the principle of diminishing returns, & that $N_{Lazar} = 415 =$ Optimal Solution. Moreover, with the validity of N_{Lazar} established, we calculated the Theoretical Gravity-B Wave Frequency (ω_{Lazar}) for various locations in accordance with Tab. (12, 13).

8 Conclusion

In this article, we have validated Robert Lazar's implied 1989 Gravity-B Wave Frequency Claim of 7.46 (Hz) utilising **Q**uantised **F**ourier **H**armonics (QFH); such that it does not require the existence of Element-115 (*Moscovium*), Area-51, S-4, Extraterrestrial Intelligence or US Government Conspiracy. We have demonstrated that Robert Lazar predicted a **Q**uantum **V**acuum (QV) property of the Earth at its surface, which is presently unknown to the **S**tandard **M**odel **o**f **P**article-**P**hysics ($SMoP^2$) & the **S**tandard **M**odel **o**f **C**osmology (SMoC). Robert Lazar has successfully predicted the existence of new **Q**uantum **P**hysics (QP), seventeen (17) years in advance of the 2006 method developed by *Storti & Desiato* [5], which facilitates the confirmation of Lazar's claim. The significance of this being that the only testable scientific claim made by Robert Lazar has been validated, inferring that the entire Lazar story is genuine. The consequences of this are that all non-scientific assertions presented by Lazar credibility assassins, may be discarded en masse. To conclude that the Lazar story is a hoax, based upon so-called 'missing documentation' or any other metric, has been summarily overturned by the existence of the scientific evidence we have presented.

9 Acknowledgement

The primary artefact utilised in the formulation of this research article: [33].

10 Data Availability

Supporting artefacts are available for download: [24], [25], [26], [27], [34].

11 Funding

No funding is associated with the generation of this research article.

12 Appendix-A

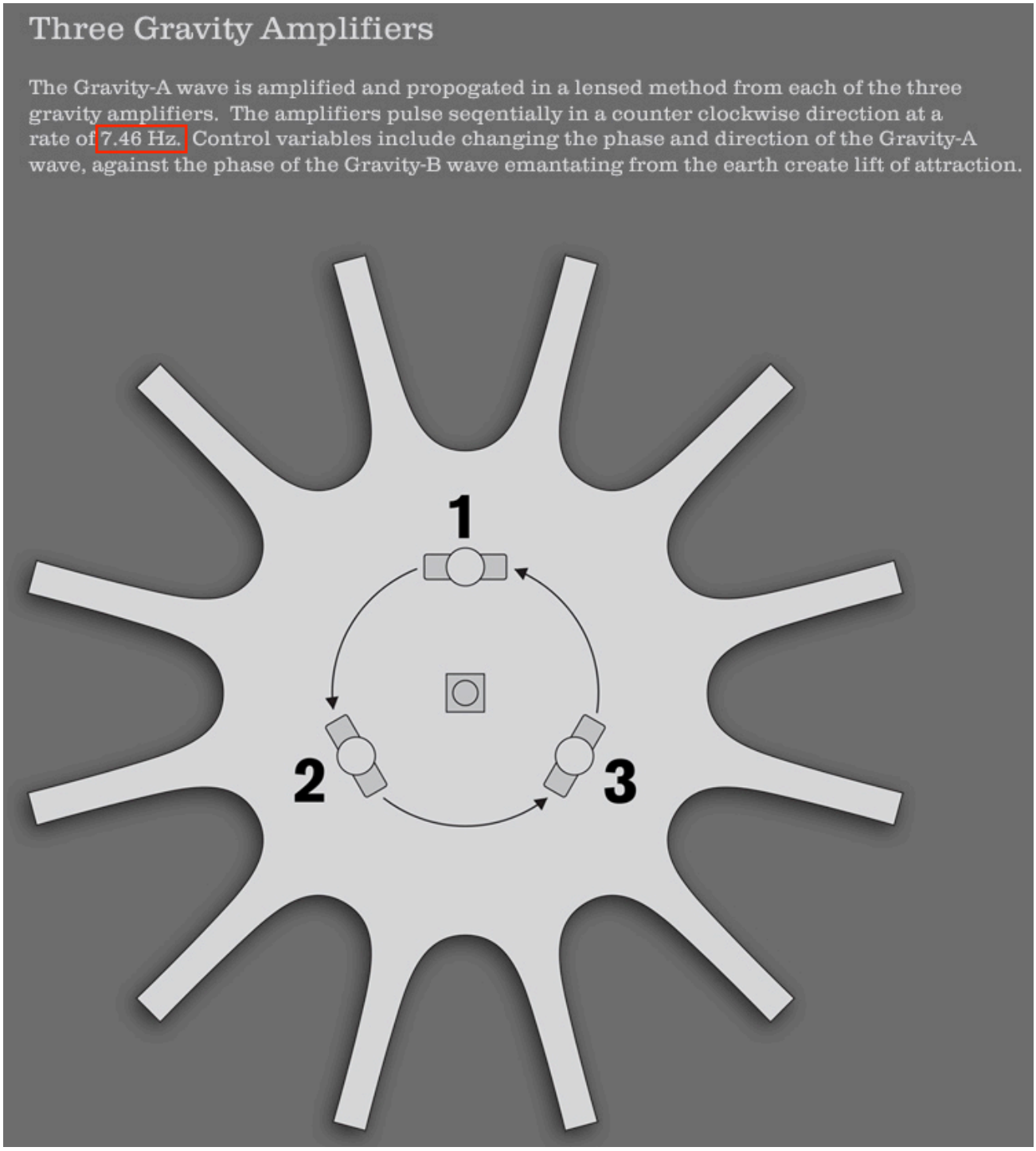

Fig. (A.1): https://boblazar.com/

13 Appendix-B

- Derivation of the Maximum (*i.e.* Upper) ZPF Spectral Frequency Limit

Let:

$$D=\frac{\left|U_m(r,M)\right|}{\left|U_\omega(r,M)\right|} \tag{B.1}$$

Hence referring to Eq. (22-24), Eq. (B.1) is equal to Eq. (B.2),

$$D=\left[\left(\left|n_{PV}\right|+2\right)^4-n_{PV}^4\right] \tag{B.2}$$

To proceed with the derivation utilising the MathCad-8-Professional symbolic computation environment, we are required to discard the magnitude notation associated with n_{PV}; henceforth, $|n_{PV}| = n_{PV}$. Solving for n_{PV} yields;

$$D=\left[\left(n_{PV}+2\right)^4-n_{PV}^4\right]\ \text{solve},n_{PV},\text{factor}\rightarrow\begin{bmatrix}\frac{1}{12}\cdot\frac{\left[\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{2}{3}\right)}-48-12\cdot\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{1}{3}\right)}\right]}{\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{1}{3}\right)}}\\ \frac{1}{24}\cdot\frac{-\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{2}{3}\right)}+48-24\cdot\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{1}{3}\right)}+i\cdot\sqrt{3}\cdot\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{2}{3}\right)}+48\cdot i\cdot\sqrt{3}}{\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{1}{3}\right)}}\\ \frac{-1}{24}\cdot\frac{\left[\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{2}{3}\right)}-48+24\cdot\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{1}{3}\right)}+i\cdot\sqrt{3}\cdot\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{2}{3}\right)}+48\cdot i\cdot\sqrt{3}\right]}{\left[108\cdot D+12\cdot\left(768+81\cdot D^2\right)^{\left(\frac{1}{2}\right)}\right]^{\left(\frac{1}{3}\right)}}\end{bmatrix}$$

(Eq. B.3)

- The solution execution sequence obeyed the following hierarchy:
  - Command: *solve* Eq. (B.2) for n_{PV}.
  - Command: *factor* the result of the preceding step with respect to 'D'.

The preceding result may be simplified by assigning temporary definitions of 'F' & 'L' to the appropriate elements within each row of the computed matrix. By inspection of Eq. (B.3); let: $F = 108\cdot D+12\sqrt{(768+81\cdot D^2)}$ & $F = L^3$. Hence, an expression for n_{PV} as a function of 'L' may be defined by;

$$D=\left[\left(n_{PV}+2\right)^4-n_{PV}^4\right]\left|\begin{array}{l}\text{solve},n_{PV},\text{factor}\\ \text{substitute},108\cdot D+12\cdot\sqrt{768+81\cdot D^2}=F\\ \text{substitute},\sqrt[3]{F}=L,\frac{1}{\sqrt[3]{F}}=\frac{1}{L},F^{\frac{2}{3}}=L^2\\ \text{collect},L\end{array}\right.\rightarrow\begin{bmatrix}\frac{1}{12}\cdot L-1-\frac{4}{L}\\ \left(\frac{1}{24}\cdot i\cdot\sqrt{3}-\frac{1}{24}\right)\cdot L-1+\frac{\left(2\cdot i\cdot\sqrt{3}+2\right)}{L}\\ \left(\frac{-1}{24}\cdot i\cdot\sqrt{3}-\frac{1}{24}\right)\cdot L-1+\frac{\left(-2\cdot i\cdot\sqrt{3}+2\right)}{L}\end{bmatrix}$$

(Eq. B.4)

- The solution execution sequence obeyed the following hierarchy:
  - Command: *substitute* $108\cdot D+12\sqrt{(768+81\cdot D^2)} = F$ into Eq. (B.3).
  - Command: *substitute* $F^{1/3} = L$, $F^{-1/3} = L^{-1}$ & $F^{2/3} = L^2$ into the result returned by the preceding substitution.
  - Command: *collect* 'L' terms.

Next, we shall discard the *Imaginary* results returned in Eq. (B.4); only the *Real* result shall be utilised going forward. Eq. (B.4) is a simplifying intermediary step facilitating an onward solution. However, to apply the *Real* result of this equation to the objective of the manuscript, we are required to express it as a function of 'r' & 'M'. Hence, let $\Omega(r,M)$ denote a solution characteristic termed the Harmonic Cut-Off Function such that $L = \Omega(r,M)$. Similarly, let $n_\Omega(r,M)$ denote a solution characteristic termed the Harmonic Cut-Off Mode such that $n_\Omega(r,M) = n_{PV} + 2$; where, $n_\Omega(r,M)$

represents the Maximum Frequency Mode of the ZPF, once the ZPF Frequency Spectrum has been transformed to the PV Model of Gravity by the enforcement of a Quantised Fourier-Distribution.

Substituting $L = \Omega(r,M)$ & $n_\Omega(r,M) = n_{PV} + 2$ into the *Real* result of Eq. (B.4) yields;

$$n_\Omega(r,M) = n_{PV} + 2 = \left(\frac{\Omega(r,M)}{12} - \frac{4}{\Omega(r,M)} - 1 \right) + 2 \tag{B.5}$$

Simplifying Eq. (B.5) produces;

$$n_\Omega(r,M) = \frac{\Omega(r,M)}{12} - \frac{4}{\Omega(r,M)} + 1 \tag{B.6}$$

An expression for $\Omega(r,M)$ to be utilised in Eq. (B.6), may be formulated simply by substituting Eq. (B.1) into $\Omega(r,M)^3 = L^3 = 108 \cdot D + 12\sqrt{(768 + 81 \cdot D^2)}$ as follows;

$$\Omega(r,M) = \sqrt[3]{108 \cdot \left| \frac{U_m(r,M)}{U_\omega(r,M)} \right| + 12 \cdot \sqrt{768 + 81 \cdot \left(\frac{U_m(r,M)}{U_\omega(r,M)} \right)^2}} \tag{B.7}$$

Therefore, the Maximum Spectral Frequency of the Transformed ZPF is termed the Harmonic Cut-Off Frequency, denoted by $\omega_\Omega(r,M)$, may be written as follows;

$$\omega_\Omega(r,M) = n_\Omega(r,M) \cdot \omega_{PV}(1,r,M) \tag{B.8}$$

- $\omega_{PV}(1,r,M) = \omega_0$

Sample Calculations:

$\omega_{PV}(1,r,M)$ Hz	$\omega_\Omega(r,M)$ Hz	$n_\Omega(r,M)$
$\omega_{PV}(1,R_M,M_M) \approx 0.05$	$\omega_\Omega(R_M,M_M) \approx 403 \cdot 10^{24}$	$n_\Omega(R_M,M_M) \approx 8.6 \cdot 10^{27}$
$\omega_{PV}(1,R_E,M_E) \approx 0.04$	$\omega_\Omega(R_E,M_E) \approx 520 \cdot 10^{24}$	$n_\Omega(R_E,M_E) \approx 1.45 \cdot 10^{28}$
$\omega_{PV}(1,R_J,M_J) \approx 9.8 \cdot 10^{-3}$	$\omega_\Omega(R_J,M_J) \approx 488 \cdot 10^{24}$	$n_\Omega(R_J,M_J) \approx 5.0 \cdot 10^{28}$
$\omega_{PV}(1,R_S,M_S) \approx 4.8 \cdot 10^{-3}$	$\omega_\Omega(R_S,M_S) \approx 646 \cdot 10^{24}$	$n_\Omega(R_S,M_S) \approx 1.4 \cdot 10^{29}$
Legend: $\omega_{PV}(1,r,M)$: Minimum (*i.e.* Lower) Spectral Frequency of the Transformed ZPF $\omega_\Omega(r,M)$: Maximum (*i.e.* Upper) Spectral Frequency of the Transformed ZPF $n_\Omega(r,M)$: Maximum Harmonic Mode of the Transformed ZPF R_M,R_E,R_J,R_S: Radius of the Moon, the Earth, Jupiter & the Sun respectively M_M,M_E,M_J,M_S: Mass of the Moon, the Earth, Jupiter & the Sun respectively		

Tab. (B.1)

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