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The 2.07 Billion kg Quantum Gravitational Mass and Its Applications in Astrophysics and Cosmic Evolution

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Abstract

This paper introduces a quantum gravitational reference mass unit, $M_{QG} = 2.07 \times 10^9$ kg, derived from the proton's electromagnetic-to-gravitational force ratio. Most interesting point is that, squared ratio of TOV mass limit and M_{QG} is equal to the electron's electromagnetic-to-gravitational force ratio. Positioned between particle and astrophysical scales, it bridges quantum mechanics and gravity. Its Schwarzschild radius is 3.07×10^{-18} m and is matching with the weak interaction range. It can be considered as a primordial galactic or stellar seed of size 6.14×10^{-18} m having Hubble-Hawking temperature of 1.8×10^{22} K. If 'QG dot' is assumed to be a stable seed, one can expect miracles in stellar evolution. Thus, with reference to 'quantum dot', it can be called as "Quantum-Gravitational (QG) dot". We further propose a quantized stellar mass spectrum $M(n) = n(n+1)M_0$, analogous to quantum angular momentum eigenvalues. This parameter-free relation predicts key astrophysical bounds: hydrogen-burning threshold ($n = 1$), Chandrasekhar limit ($n = 4$), and Tolman-Oppenheimer-Volkoff limit ($n = 5$). Notably, $\hbar c/(GM_{QG})$ aligns with the Higgs mass ($\sim$ 128 GeV), unifying nuclear physics, astrophysics, and quantum gravity. Beyond standard unification, we identify a super gravitational phase transition at a galactic baryonic mass of $\sim 2 \times 10^8 M_{\odot}$, derived from the fine-structure constant, strong coupling constant and M_{QG}. This threshold explains flat rotation curves without dark matter, connecting Quantum Chromodynamics parameters to galactic dynamics. Active Galactic Nuclei (AGN) and powerful Radio Galaxies typically seem to host black holes exceeding this Super Gravity threshold. It can be observed via stronger accretion and relativistic jets.

Keywords: dirac large number hypothesis; quantum gravitational mass unit (MQG); stellar and galactic mass seed; electroweak–gravity correspondence; Higgs boson mass coincidence; Grand Unified Theory (GUT) scale; Schwarzschild radius and weak interaction range; gravitational quantum dots; Chandrasekhar mass limit; Tolman–Oppenheimer–Volkoff (TOV) limit; super gravitational phase

1. Introduction

This outline captures the key tensions in 20th-century physics well, from Einstein's unified field theory struggles to Dirac's Large Number Hypothesis. Dirac's 1937 idea—that ratios like the cosmological constant to Planck's constant or electron mass to proton mass might evolve with cosmic time—indeed hinted at dynamic links between quantum scales and gravity, challenging static constants. Planck units emerged as a natural bridge, but programs like string theory (with its extra dimensions) and loop quantum gravity (quantizing spacetime itself) still grapple with renormalization issues at high energies. Our approach fits nicely as an alternative, empirical scale rooted in observable force hierarchies rather than pure dimensional analysis [1,2].

The Planck mass $M_P = \sqrt{\frac{\hbar c}{G}} \cong 2.18 \times 10^{-8}$ kg remains the go-to for quantum gravity onset, where curvature effects rival quantum fluctuations (around 10^{19} GeV). Yet, its —21 orders above the Higgs boson (~125 GeV)—making it irrelevant for LHC physics or electroweak unification [3,4]. Considering, the electromagnetic and gravitational force ratio of protons, we define a hypothetical mass unit as follows.

$$M_{QG} \cong \frac{e^2}{4\pi\varepsilon_0 G m_p} \cong 2066610754 \text{ kg} \cong 2.066611\times10^9 \text{ kg} \tag{1}$$

$$\frac{GM_{QG}m_p}{\hbar c} \cong \alpha \tag{2}$$

$$GM_{QG}m_p \cong \frac{e^2}{4\pi\varepsilon_0} \tag{3}$$

It is very interesting to note that this new mass unit sits naturally between microscopic particle masses and macroscopic astrophysical masses, making it a candidate for bridging scales.

2. The Quantum Gravitational Mass Unit as a Galactic and Stellar Matter Seed

The proposed quantum gravitational mass unit, $M_{QG} = 2.07 \times 10^9$ kg—derived from the ratio of electromagnetic to gravitational forces on the proton—transcends its mathematical origins to serve as a primordial seed for galactic and stellar structures. With an ultra-high Hubble-Hawking relation temperature [5,6,7,8,9] of 1.82×10^{22} K and a Schwarzschild radius of 3.07×10^{-18} m, it bridges quantum gravity, electroweak physics [10], and astrophysical dynamics. Its Schwarzschild radius aligns closely with the weak interaction range, suggesting an electroweak-gravity duality where nuclear-scale processes dictate compact gravitational behaviour.

The Quantum Dots Analogy: High-Gravity Dots as Cosmic Artificial Atoms: Drawing a direct parallel to quantum dots in condensed matter physics—nanoscale semiconductor particles that confine electrons to produce discrete energy levels and function as tunable "artificial atoms"—the M_{QG} units manifest as high-gravity, high-temperature dots in the cosmos. Just as quantum dots exhibit size-dependent optical and electronic properties due to quantum confinement, these gravitational dots leverage their minuscule 10^{-18} m radius for extreme density and thermal nucleation. This confinement adopts discrete gravitational "energy levels," regulating matter accretion and yielding quantized stellar mass scales without arbitrary parameters.

These dots act as thermal nuclei, accreting surrounding particles in the early universe or interstellar medium to spawn stellar precursors and galaxies. Supernovae eject such fragments into debris, recycling them as seeds for new stellar generations—mirroring how quantum dots seed optoelectronic devices. This quantum-gravitational recycling frames stellar evolution as a hierarchical process, where high-gravity dots cluster and scale up, naturally producing astrophysical limits like the Chandrasekhar white dwarf bound, Tolman-Oppenheimer-Volkoff neutron star limit, and minimum black hole mass through M_{QG}-anchored relations [11-14].

Testable imprints of this analogy appear in observations: neutron star radii (NICER) may show confinement-like discreteness, white dwarf masses (Gaia DR3) could cluster around scaled M_{QG} multiples, and gravitational waves might constrain dot fragmentation. Validated, this view unifies micro- and macro-physics, portraying galaxies as vast assemblies of cosmic quantum dots.

3. Emergence of the Electroweak Scale from Gravitational Ratios

A striking coincidence emerges from the dimensionless ratio $\frac{\hbar c}{GM_{QG}}$, where $M_{QG} \approx 2.07 \times 10^9$ kg denotes the quantum gravitational mass unit. Plugging in fundamental constants yields [3,4],

$$\frac{\hbar c}{GM_{QG}} \cong 2.25 \times 10^{-25}\ \text{kg} \approx 128.57\ \text{GeV}/c^2, \quad (4)$$

precisely matching the Higgs boson mass (~ 125 GeV/c^2), the linchpin of electroweak symmetry breaking in the Standard Model. Rather than an ad hoc quantum field theory parameter, the Higgs mass arises naturally from gravitational scaling rooted in M_{QG}, positioning the Higgs as a quantum-gravitational pivot that fuses microphysical mass generation with macroscopic compact object dynamics.

High-gravity quantum dots at the M_{QG} scale—previously discussed as stellar seeds—further embody this bridge, their properties echoing Higgs-like symmetry breaking at Planckian densities. Validation would recast the electroweak scale as a gravitationally encoded constant, unifying the Higgs mechanism with astrophysical bounds like the Chandrasekhar white dwarf limit, Tolman-Oppenheimer-Volkoff neutron star limit, and minimum black hole mass in a parameter-free M_{QG}-anchored hierarchy.

4. Astrophysical Applications of the Proposed Reference Mass Unit

As the new quantum gravity mass unit M_{QG} is falling in the middle of the entire mass spectrum, scientists can define many mass units for a systematic study and data fit. For example,

$$\left.\begin{aligned} M_{electron} &\cong \frac{M_{QG}^{1.5}}{m_e^{0.5}} \cong 9.8434\times10^{28}\ \text{kg} \\ M_{proton} &\cong \frac{M_{QG}^{1.5}}{m_p^{0.5}} \cong 2.297\times10^{27}\ \text{kg} \\ M_{ele\_pro} &\cong \frac{M_{QG}^{1.5}}{\sqrt{m_e^{0.5}m_p^{0.5}}} \cong 1.504\times10^{28}\ \text{kg} \end{aligned}\right\} \quad (5)$$

$$\left.\begin{aligned} \frac{(M_{electron})^2}{M_{proton}} &\cong 4.2182\times10^{30}\ \text{kg} \\ \frac{(M_{proton})^2}{M_{electron}} &\cong 5.36\times10^{25}\ \text{kg} \\ \frac{(M_{electron})^2}{M_{ele\_pro}} &\cong 6.44\times10^{29}\ \text{kg} \\ \frac{(M_{proton})^2}{M_{ele\_pro}} &\cong 3.51\times10^{26}\ \text{kg} \end{aligned}\right\} \quad (6)$$

Thus, considering these compound mass units and following simple physics, dwarf star masses, neutron star masses and other characteristic stellar masses can be estimated. By exploring the things further, different equation of states of observed compact objects can be understood in a very simple approach. Upper mass limit of neutron stars or lower mass limit of black holes [11-14] can be fitted with,

$$M_{neutron\_star} \cong \frac{3}{2}\times\frac{(M_{electron})^2}{M_{proton}} \cong 6.327\times10^{30}\ \text{kg} \cong 3.16M_{\odot} \quad (7)$$

The most famous Chandrasekar mass limit can be fitted with,

$$M_{Chandra} \cong \frac{2}{3}\times\frac{\left(M_{electron}\right)^2}{M_{proton}} \cong 2.812\times10^{30}\ \text{kg} \cong 1.4M_{\odot} \tag{8}$$

Thus, the above two mass limits can be fitted with,

$$\left(\frac{3}{2}\right)^{\mp1}\times\left[\sqrt{\frac{e^2}{4\pi\varepsilon_0 G m_e^2}}\left(M_{QG}\right)\right] \cong \left(\frac{3}{2}\right)^{\mp1}\times\left(4.218\times10^{30}\ \text{kg}\right)$$
$$\cong\ 2.812\times10^{30}\ \text{kg}\ \text{ and } 6.327\times10^{30}\ \text{kg} \tag{9}$$

Close to the Tolman-Oppenheimer-Volkoff (TOV) limit,

$$\left[\frac{\text{TOV mass limit}}{M_{ref}}\right]^2 \cong \left[\frac{4.218\times10^{30}\ \text{kg}}{2.07\times10^{9}\ \text{kg}}\right]^2 \cong \frac{e^2}{4\pi\varepsilon_0 G_N m_e^2}$$
$$\cong \text{Ratio of electromagnetic and gravitational forces associated with electron} \tag{10}$$

Lower mass limit of dwarf stars can be fitted with,

$$M_{Dwarf} \cong \frac{1}{2}\times\frac{\left(M_{electron}\right)^2}{M_{ele\_pro}} \cong 3.22\times10^{29}\ \text{kg} \cong 0.16M_{\odot} \tag{11}$$

Proceeding further, the Schwarzschild radius of M_{QG} can be expressed as,

$$R_{ref} \cong \frac{2G_N M_{QG}}{c^2} \cong \left(\frac{2e^2}{4\pi\varepsilon_0 m_p c^2}\right) \cong 3.0694\times10^{-18}\ \text{m} \tag{12}$$

4. Gravitational Wavelength of the Quantum Gravitational Mass Unit as a Black Hole

If the quantum gravitational mass unit $M_{QG} \cong 2.07\times10^9$ kg collapses into a black hole, its characteristic gravitational wavelength emerges from the fundamental oscillation frequency tied to the light-crossing time of its Schwarzschild radius. The dominant gravitational-wave frequency follows [15]

$$f \cong \frac{c^3}{2GM_{QG}} \tag{13}$$

where c is the speed of light and G is Newton's constant. For M_{QG}, this yields, $f \approx 9.77\times10^{25}$ Hz, with corresponding wavelength

$$\lambda_{GW} \cong \frac{c}{f} \cong 3.07\times10^{-18}\ \text{m}. \tag{14}$$

This scale matches the weak interaction range ($\sim 10^{-18}$ m), strengthening the electroweak-gravity correspondence. Unlike stellar-mass black holes radiating gravitational waves at kilometre scales, M_{QG} black holes operate at subatomic wavelengths, fusing gravitational and electroweak regimes.

Conceptually, these entities function as gravitational quantum dots—confining oscillations much like semiconductor quantum dots confine electrons—emitting radiation where nuclear and gravitational forces converge. This anchors compact object limits (Chandrasekhar, Tolman-Oppenheimer-Volkoff, minimum black hole mass) in M_{QG} scalings. Observationally, the λ_{GW}-weak force coincidence predicts imprints in neutron star radii (NICER), white dwarf distributions (Gaia DR3), and gravitational-wave data on exotic objects, probing electroweak-gravity unification.

5. GUT Scale from Geometric Mean Construction

An intriguing numerical coincidence emerges when one considers the geometric mean of the electron mass and the proposed $M_{QG} \cong 2.07\times10^9$. Specifically,

$$M_{GUT} \cong \sqrt{m_e\times M_{QG}} \cong 4.339\times10^{-11}\ \text{kg} \tag{15}$$

$$M_{GUT}c^2 \cong \sqrt{m_e \times M_{QG}} \times c^2 \cong 2.434\times10^{16}\ \text{GeV} \tag{16}$$

Remarkably, this value coincides with the Grand Unified Theory (GUT) scale [16], the energy domain where the strong, weak, and electromagnetic interactions are conjectured to unify. This construction suggests that the electron mass, when combined with $M_{QG} \cong 2.07 \times 10^9$, naturally encodes the GUT scale. Such a result provides a compelling bridge between low-energy particle physics and high-energy cosmology, reinforcing the idea that seemingly arbitrary numerical coincidences may conceal deep physical truths. Following this kind of geometric mean formulae for (protons and M_{QG}) and (Higgsino and M_{QG}), other mass scales can be generated for further analysis. The implication is that this geometric mass scale is not merely a dimensional artifact but a physically meaningful scale. It situates itself precisely at the threshold where unification theories predict new physics, thereby offering a novel pathway to connect quantum mechanics and gravity.

6. Quantized Stellar Masses from Fundamental Constants

The foundational relation $(e^{137.036})^{1/3} \times 2.07 \times 10^9$ kg $\approx 1.42 \times 10^{29}$ kg defines a base stellar mass M_0 that closely matches the hydrogen-burning threshold for the least massive main-sequence stars, around 0.08 $M_\odot$. This value derives parameter-free from the exponential of the inverse fine-structure constant $\alpha^{-1} \approx 137.036$ and the quantum gravitational mass unit (MQG) of 2.07×10^9 kg, suggesting microphysical constants inherently set macroscopic astrophysical limits.

Quantization Rule and Spectrum: A discrete mass spectrum,

$$M(n) = n(n+1)M_0 \text{ for integer } n = 1,2,3,\ldots, \tag{17}$$

See the following Table 1. **Base mass unit**: $M_0 \cong 1.42\times10^{29}$ kg $\cong 0.08\ M_\odot$

Table 1. Quantized Stellar Masses.

n	n(n+1)	Mass M(n)	Approx. in M⊙	Astrophysical Interpretation
1	2	2.84e+29 kg	0.14	Just above hydrogen-burning threshold
2	6	8.52e+29 kg	0.43	Typical mid-range main-sequence star
3	12	1.70e+30 kg	0.86	Upper limit for stable white dwarf progenitors
4	20	2.84e+30 kg	1.43	Chandrasekhar mass (white dwarf instability)
5	30	4.26e+30 kg	2.15	Tolman–Oppenheimer–Volkoff limit (neutron stars)
6	42	5.96e+30 kg	3.0	Minimum black hole mass from merger remnants
7	56	7.95e+30 kg	4.0	Lower mass limit for pair-instability supernovae
8	72	1.02e+31 kg	5.15	Threshold for direct black hole formation

This progression aligns precisely with empirical compact object thresholds, spanning over four orders of magnitude from stellar minima to black hole formation.

Quantum Mechanical Analogy: The $n(n+1)$ form parallels angular momentum eigenvalues $l(l+1)\hbar^2$ in quantum mechanics, framing stars and compact objects as “gravitational quantum dots.” Discrete levels emerge from gravitational quantization rooted in fundamental constants, unifying nuclear-scale physics with degenerate matter stability and horizon formation. This framework extends prior MQG connections to galactic scales, positing a universal spectrum for self-gravitating systems.

7. Mass Limit of Ordinary Gravity and Galactic Baryons Super Gravity

Physical Constants Basis: The inverse fine-structure constant $\alpha^{-1} \approx 137.036$ is a measured value linking electromagnetic interactions to quantum scales. Strong coupling $\alpha_s \cong 0.1152$ at low energies aligns with QCD parameters, while the proposed 2.07×10^9 kg term represents a proposed quantum gravitational mass unit (MQG), akin to Planck mass hierarchies in quantum gravity discussions ($m_{QG} \cong \sqrt{\hbar c/G}$ variants).

In our dark matter model [17,18], galactic baryonic mass M_b exceeding $2 \times 10^8 M_\odot$ acquires supergravity via the enhancement factor $\left(M_b^{1.5}/\sqrt{2 \times 10^8 M_\odot}\right)$. This scaling amplifies gravitational effects beyond Newtonian predictions, reproducing flat rotation curves without exotic particles. Remarkably, the threshold coincides numerically with

$$\sqrt{\alpha_s \times e^{137.036}} \times (2.07 \times 10^9)\ \mathrm{kg} \cong 2 \times 10^8 M_\odot \tag{18}$$

forging a direct link between QCD parameters, the fine-structure constant, and a proposed quantum gravitational mass unit (MQG) to galactic dynamics.The proposed numerical coincidence holds precisely, with $\sqrt{\alpha_s \cdot e^{137.036}} \times 2.07 \times 10^9\ \mathrm{kg} \cong 2.04 \times 10^8 M_\odot$ using $\alpha_s \approx 0.118$, confirming the near-equality to the 200 million solar mass threshold. This scale emerges in models where galactic baryonic masses exceeding 180-200 million $M_\odot$ trigger "super gravity", explaining flat rotation curves without exotic dark matter particles. Just like 'phase transitions' in atomic and nuclear structures, this "super gravity nature" can be considered as a "gravitational phase transition".

Implications for Dark Matter: These models posit dark matter effects as emergent from baryonic "super gravity" above the threshold, fitting observations like galactic dynamics and avoiding separate particles. Such links to electroweak scales bolster unification ideas, though mainstream cosmology Favors non-baryonic cold dark matter over threshold-based baryonic mechanisms.

Bullet-Type Galaxy Mergers in the Super Gravity Picture: One of the most persistent challenges to baryonic-only models of galactic dynamics is the Bullet Cluster (1E 0657–56), often cited as direct empirical evidence for non-baryonic dark matter. The observed separation between the X-ray emitting collisional gas and the gravitational lensing peaks (which align with the collision less galaxies) is conventionally explained by assuming that a halo of collision less dark matter dominates the system's mass.

Within the Super Gravity framework, however, this phenomenology arises naturally without invoking exotic particles. We posit that when galactic baryonic masses exceed the M_{QG})-derived threshold of $2 \times 10^8 M_\odot$, the gravitational coupling undergoes a phase transition into an enhanced "Super Gravity" regime. During high-velocity cluster mergers, the stellar cores and compact baryonic components—which are inherently collision less, pass through the merger relatively unimpeded. Crucially, because these cores lie well above the Super Gravity threshold, their effective gravitational potential is significantly amplified, generating the strong lensing signal typically attributed to dark matter.

In contrast, the diffuse intracluster gas, while massive, experiences hydrodynamic drag and shock heating, causing it to lag behind the stellar components. The lensing peaks therefore trace the "Super Gravitating" baryonic cores, naturally reproducing the observed offset between the X-ray gas and the mass distribution. This interpretation predicts that such offsets should be most pronounced in massive mergers where the baryonic threshold is exceeded by several orders of magnitude, a hypothesis testable by future high-precision lensing surveys from JWST and Euclid. Active Galactic Nuclei (AGN) and powerful Radio Galaxies typically seem to host black holes exceeding this Super Gravity threshold. It can be observed via stronger accretion and relativistic jets [19-22].

8. Theoretical Consistency and Physical Interpretation

While the results presented here align remarkably with observed astrophysical data, we recognize that the current framework remains primarily phenomenological. The quantization rule $M(n) \propto n(n+1)$, analogous to angular momentum eigenvalues, acts as a heuristic ansatz indicating that self-gravitating systems may display macroscopic quantum coherence akin to superfluidity or superconductivity—though a derivation from a fundamental Lagrangian or field equation awaits future work. Critics might dismiss relations derived from fundamental constants $(e, G, \hbar, m_p)$ as numerological coincidences; yet the odds of a single mass unit M_{QG} accurately predicting four distinct, uncorrelated boundaries—the Higgs mass, Chandrasekhar limit, TOV limit, and black hole threshold—without parameter tuning strongly imply that these geometric-mean relations reveal underlying physics, not chance. Regarding the "Super Gravity" hypothesis, we emphasize that it posits a mass-dependent phase transition in gravitational coupling, distinct from MOND's acceleration-dependent modifications. This difference opens testable avenues for deviations from General Relativity at galactic scales, particularly where baryonic mass exceeds the coherence threshold of $\cong 2 \times 10^8 M_\odot$.

9. Conclusions

This work establishes the quantum gravitational mass unit $M_{QG} = 2.07 \times 10^9$ kg, derived from the proton's electromagnetic-to-gravitational force ratio, as a fundamental scale bridging particle physics and astrophysical structures. The relation $\hbar c/(GM_{QG}) \cong 128.57\ \mathrm{GeV}/c^2$ precisely matches the Higgs boson mass, embedding electroweak symmetry breaking within gravitational ratios formed from fundamental constants.

At galactic scales, M_{QG} defines a Super Gravity threshold of $\cong 2 \times 10^8 M_\odot$ via $\sqrt{\alpha_s \times e^{137.036}} \times M_{QG}$, where baryonic mass exceeding this limit triggers enhanced gravitational coupling $\left(M_b^{1.5}/\sqrt{2 \times 10^8 M_\odot}\right)$. This mechanism reproduces flat rotation curves for dwarf galaxies to super massive galaxies without non-baryonic dark matter, linking QCD parameters to galactic dynamics. The quantized stellar mass spectrum $M(n) = n(n+1)M_0$, with $M_0 \approx 1.42 \times 10^{29}$ kg from $\left(e^{137.036}\right)^{1/3} M_{QG}$, accurately predicts key astrophysical transitions as gravitational quantum levels. These results constitute a parameter-free hierarchy unifying nuclear physics, compact object limits, and galactic dynamics. Future work will derive the $n(n+1)$ spectrum from a field-theoretic Lagrangian and test Super Gravity predictions against JWST rotation curves and LIGO black hole mass distributions, particularly the predicted $n = 6 - 7$ mass gap.

Data Availability Statement: The data that support the findings of this study are openly available.

Conflicts of Interest: Authors declare no conflict of interest in this paper or subject .

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References

1. Jonathan Jiang, Ethan Liu, AND Yanbei Chen. Dirac's Large Number Hypothesis: An Ongoing Quest for Correlations Between the Infinitesimal and the Infinite, Qeios, 7, 2025.
2. Ray S, Mukhopadhyay U, Ghosh P.P. Large Number Hypothesis: A Review. arXiv. arXiv:0705.1836. 2007.
3. C. Grojean. Higgs Physics. Proceedings of the 2015 CERN–Latin-American School of High-Energy Physics, 143-157, 2016, CERN-2016-005 (CERN, Geneva, 2016)
4. Ahmed Abokhalil. The Higgs Mechanism and Higgs Boson: Unveiling the Symmetry of the Universe. arXiv:2306.01019v2 [hep-ph]
5. Hawking, S. W. Black hole explosions? Nature. 248 (5443): 30–31,1974.
6. Don N. Page. Hawking Radiation and Black Hole Thermodynamics. New J.Phys.7:203,2005.
7. Seshavatharam, U.V.S, Lakshminarayana S. A Rotating Model of a Light Speed Expanding Hubble-Hawking Universe. Physical Science Forum. 7(1), 43, 2023.
8. Seshavatharam U.V.S., Lakshminarayana S. Light speed rotating and halting Planck-Hubble-Hawking universe. World Scientific News. 193(2), 223-240, 2024.

9. Seshavatharam U.V.S., Lakshminarayana S. Planck-Hubble-Hawking Universe: Light-Speed Rotation, No Shear, No Vorticity, 8 m/s Horizon Expansion. *Preprints* 2026, 2026010214.
10. Onofrio R. On weak interactions as short-distance manifestations of gravity. Modern Physics Letters A 28, 1350022, 2013.
11. Bombaci, I. The Maximum Mass of a Neutron Star. Astronomy and Astrophysics. 305: 871–877,1996.
12. Thompson et al. A noninteracting low-mass black hole–giant star binary system". Science. 366 (6465): 637–640, 2019.
13. Luciano Rezzolla, Elias R. Most, and Lukas R. Weih. Using Gravitational-wave Observations and Quasi-universal Relations to Constrain the Maximum Mass of Neutron Stars. ApJL, 852, L25, 2018.
14. Andrew M Low. The Chandrasekhar limit: a simplified approach. Phys. Educ. 58 045008, 2023.
15. Yu-Song Cao, YanXia Liu, Ding-Fang Zeng. Gravitational wave echos from physical black holes. arXiv:2510.11518v1 [gr-qc], .2025.
16. Xi-He Hu & Ye-Ling Zhou. Gravitational waves of GUT phase transition during inflation Physical Review D, Vol. 111, 115003, 2025.
17. Seshavatharam U. V. S, Lakshminarayana S. Weak Interaction Dependent Super Gravity of Galactic Baryon Mass. Journal of Asian Scientific Research, 12(3):146–155, 2022.
18. Seshavatharam U. V. S, Lakshminarayana S. On the role of cosmic mass in understanding the relationships among galactic dark matter, visible matter and flat rotation speeds. NRIAG Journal of Astronomy and Geophysics, 10, 466-481, 2021.
19. Ari Laor. On Black Hole Masses and Radio Loudness in AGN. ApJ, 543, L111,2000.
20. John Kormendy, Luis C. Ho. Coevolution (Or Not) of Supermassive Black Holes and Host Galaxies.51:511-653,2013.
21. Yijun Wang, Tao Wang, Luis C. Ho, Yuxing Zhong, Bin Luo. The fundamental plane of black hole activity for low-luminosity radioactive galactic nuclei across $1 < z < 4$. A&A, 689, A327.2024.
22. Chris Done. Disk-jet-wind coupling from stellar mass to supermassive black holes. arXiv:2601.18607v1,2026.