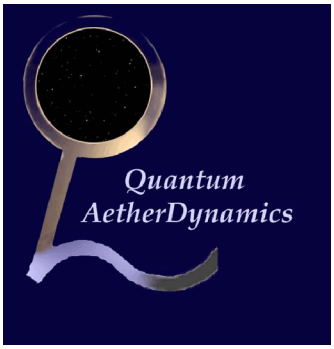


Quantum AetherDynamics Institute (QADI)

Gravitational Closure Geometry and the Physical Meaning of the Aether Maximum Mass: A QMU Interpretation of Schwarzschild Closure, Rotational Compression, and Propagation Boundaries

David W. Thomson III
Quantum AetherDynamics Institute (QADI), Alma, Illinois, USA
ORCID: 0000-0002-5830-5427

Version 1.0 – May 17, 2026

This article is published by the Quantum AetherDynamics Institute (QADI).

It develops the Aether Physics Model (APM)

Abstract

The Aether maximum mass (m_a) occupies a central role within the Quantum Measurement Units (QMU) framework of the Aether Physics Model (APM). Previous work demonstrated that the Planck system factorizes into an electron–Aether bridge structure in which the Planck mass becomes the circularly normalized geometric mean between the electron mass and the Aether maximum mass. The present paper develops the physical interpretation of m_a itself.

Using QMU ledger identities, the Schwarzschild radius corresponding to m_a is shown to equal the Compton propagation length:

$$\frac{Gm_a}{c^2} = \lambda_C.$$

This identity implies that m_a represents the maximum rotational propagation mass permitted within Compton-scale geometry before full gravitational closure occurs.

The analysis reinterprets gravitational collapse as rotational propagation compression rather than as a purely geometric coordinate singularity. Within this framework, Schwarzschild closure corresponds to the loss of outward propagation degrees of freedom as rotational phase geometry collapses toward the Compton boundary.

The results suggest that black-hole horizons represent closure-locked propagation geometries rather than infinitely dense points. The Planck system consequently emerges not as a primitive foundation of physics, but as a crossover layer between localized electron closure and maximum Aether closure.

Keywords: QMU, APM, gravitational closure, Schwarzschild radius, black holes, Planck scale, rotational geometry, propagation closure, Aether maximum mass, quantum gravity

1 Introduction

The Planck system is conventionally interpreted as a set of fundamental natural scales derived from the constants G, c, and $\hbar$ Planck [1899], Mohr et al. [2025]. Within the Quantum Measurement Units (QMU) framework of the Aether Physics Model (APM), previous work demonstrated that the Planck quantities instead emerge from deeper ledger relationships involving the electron mass m_e, Compton wavelength λ_C, quantum frequency F_q, and the Aether maximum mass m_a.

The central Planck relation was shown to reduce to:

$$m_P^2 = \frac{m_e m_a}{2\pi}. \tag{1}$$

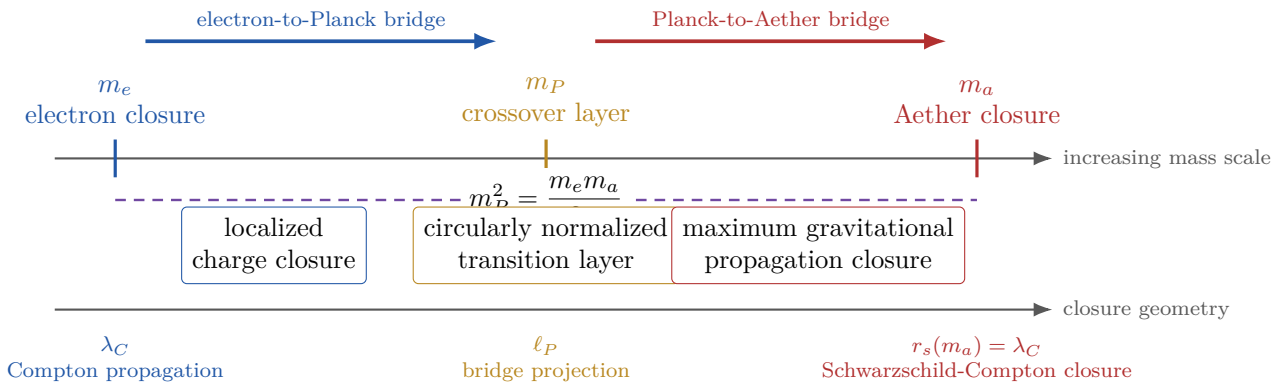


Figure 1: Electron–Planck–Aether closure span. The Planck scale appears as the circularly normalized crossover layer between the minimum stable electron closure mass m_e and the maximum gravitational propagation closure mass m_a.

This identity demonstrates that the Planck mass is the circularly normalized geometric mean between the electron anchor mass and the Aether maximum mass.

The present paper investigates the physical meaning of m_a itself.

Within QMU, m_a is not interpreted as an ordinary particle mass, nor as the total mass of the Universe. Instead, it represents a gravitational closure boundary associated with rotational propagation geometry. Using the standard QMU ledger values, the Aether maximum mass is:

$$m_a \approx 3.27 \times 10^{15} \text{ kg}, \tag{2}$$

corresponding to the rotational propagation closure boundary developed in the present analysis.

The analysis developed here shows that the Schwarzschild closure condition associated with m_a coincides exactly with the Compton propagation scale. This result suggests that gravitational collapse corresponds to a rotational compression limit within propagation geometry itself.

2 Fundamental QMU Ledger Identities

The primary QMU propagation identity is:

$$c = \lambda_C F_q. \tag{3}$$

The corresponding propagation-square identity is:

$$c^2 = \lambda_C^2 F_q^2. \tag{4}$$

The Aether maximum mass is defined within QMU as:

$$m_a = \frac{\lambda_C^3 F_q^2}{G}. \tag{5}$$

Solving for the gravitational constant gives:

$$G = \frac{\lambda_C^3 F_q^2}{m_a}. \tag{6}$$

Using the propagation identity $c = \lambda_C F_q$, the defining relation for m_a may be rewritten as:

$$m_a = \frac{\lambda_C c^2}{G}. \tag{7}$$

This expression becomes central to the interpretation developed in the present paper.

3 Schwarzschild Closure and the Compton Boundary

The conventional Schwarzschild radius is:

$$r_s = \frac{Gm}{c^2}, \tag{8}$$

which defines the closure radius associated with a gravitating mass Schwarzschild [1916], Wald [1984].

Substituting the QMU expression for m_a gives:

$$r_s = \frac{G}{c^2}\left(\frac{\lambda_C c^2}{G}\right). \tag{9}$$

Canceling terms yields:

$$r_s = \lambda_C. \tag{10}$$

This identity is one of the central results of the paper.

Within QMU, the Schwarzschild closure radius corresponding to the Aether maximum mass is exactly equal to the Compton propagation length.

Equivalently:

$$\frac{Gm_a}{c^2} = \lambda_C. \tag{11}$$

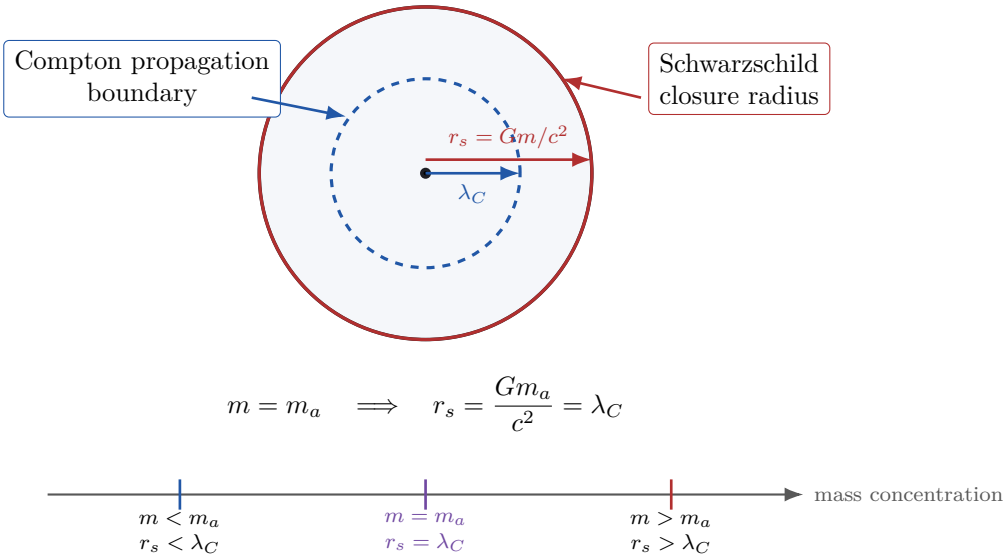


Figure 2: Schwarzschild closure versus Compton closure. For the Aether maximum mass m_a, the Schwarzschild closure radius equals the Compton propagation length, producing the identity $Gm_a/c^2 = \lambda_C$.

This relation unifies:

- gravitational closure,
- quantum propagation,
- Compton geometry,
- and rotational propagation structure.

The result suggests that gravitational collapse is fundamentally associated with propagation-boundary compression rather than with purely coordinate-based singularity formation.

4 Rotational Propagation Compression

Within the APM framework, propagation is fundamentally rotational and loxodromic in structure, meaning that propagation advances through continuous spiral phase geometry rather than through purely linear translation. The propagation of energy requires available rotational phase geometry through which propagation paths may continuously advance.

Increasing gravitational concentration compresses the available propagation geometry.

The Schwarzschild condition therefore corresponds to a rotational closure boundary in which outward propagation degrees of freedom collapse toward the minimum stable propagation circumference.

For ordinary masses:

$$r_s < \lambda_C. \tag{12}$$

For the Aether maximum mass:

$$r_s = \lambda_C. \tag{13}$$

Beyond this limit:

$$r_s > \lambda_C, \tag{14}$$

which corresponds to complete propagation closure.

Within this interpretation, gravity becomes a manifestation of rotational propagation compression.

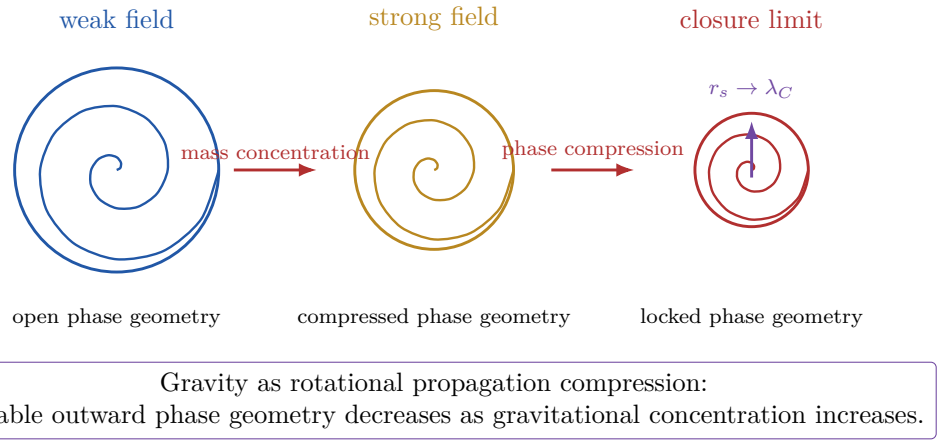


Figure 3: Rotational propagation compression. Increasing gravitational concentration compresses available outward phase geometry until the closure condition $r_s = \lambda_C$ is reached at $m = m_a$.

5 The Physical Meaning of the Aether Maximum Mass

The defining QMU identity:

$$m_a = \frac{\lambda_C c^2}{G} \tag{15}$$

demonstrates that m_a is directly associated with the maximum mass supportable within a Compton-scale propagation geometry.

The quantity m_a therefore represents:

> The maximum stable rotational propagation mass permitted before complete gravitational closure occurs.

This interpretation differs substantially from conventional Planck-scale reasoning.

In conventional dimensional analysis, the Planck system is treated as a primitive natural scale derived from combinations of constants Planck [1899], Mohr et al. [2025].

Within QMU, the deeper physical structure instead emerges from the relationship between:

- the minimum stable charge closure state (m_e),
- and the maximum stable propagation closure state (m_a).

The Planck system then emerges as the crossover geometry between these two closure boundaries.

6 Planck Geometry as a Closure Transition Layer

The Planck mass identity:

$$m_P^2 = \frac{m_e m_a}{2\pi} \tag{16}$$

shows that the Planck scale is not an isolated gravitational scale.

Instead, it represents the rotationally normalized midpoint between electron closure and gravitational closure.

Likewise, the Planck length:

$$\ell_P = \lambda_C \sqrt{\frac{m_e}{2\pi m_a}} \tag{17}$$

is not an independent spacetime pixel.

It is the Compton propagation length scaled by the electron–Aether bridge ratio.

The Planck system therefore behaves as a transition layer between localized quantum structure and maximum gravitational closure.

7 Black Holes as Closure-Locked Geometries

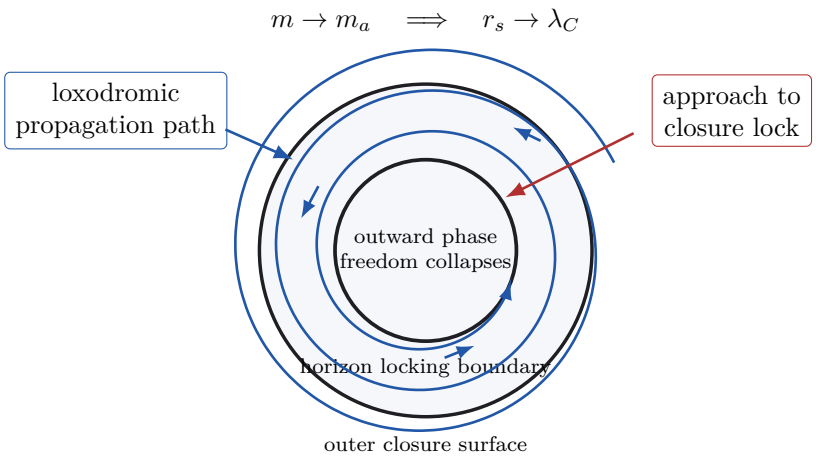


Figure 4: Loxodromic closure spiral approaching horizon geometry. As gravitational concentration approaches m_a, the propagation path winds toward a closure-locked boundary where outward phase freedom collapses.

General relativity predicts that sufficient gravitational compression leads to Schwarzschild horizons and singularity formation Penrose [1965], Wald [1984].

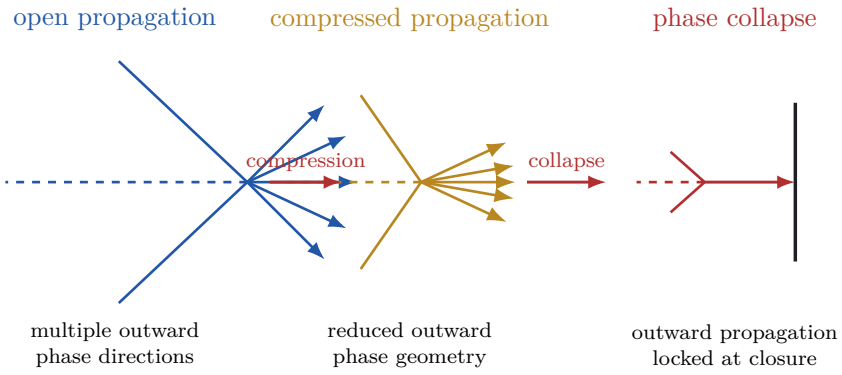
Within the QMU framework, black holes are interpreted differently.

The horizon corresponds to a closure-locked propagation geometry in which outward rotational propagation becomes topologically trapped.

This interpretation suggests that:

- black holes are not infinitely dense points,
- singularities arise from SI coordinate breakdown,
- and the horizon represents a propagation-boundary transition.

The Kerr rotational solutions Kerr [1963] become especially important in this framework because rotation is fundamental to propagation geometry itself.



Propagation phase collapse occurs when increasing gravitational closure removes available outward phase degrees of freedom.

Figure 5: Propagation phase collapse. The QMU interpretation treats gravitational closure as loss of available outward phase geometry, culminating in closure locking at the Schwarzschild–Compton boundary.

Likewise, black-hole thermodynamic relations Bardeen et al. [1973], Bekenstein [1973], Hawking [1975] may be interpreted as emergent closure properties associated with rotational compression.

8 Implications for Quantum Gravity

The present analysis suggests that gravity does not require separate quantization as an independent interaction.

Instead, gravity emerges from propagation geometry and rotational closure behavior.

Within this interpretation:

- general relativity describes large-scale curvature projections,
- while QMU describes the ledger geometry beneath the projection layer.

Quantum gravity therefore becomes a crossover geometry problem rather than a force-unification problem.

The Planck scale no longer represents the origin of spacetime itself. Instead, it represents the midpoint transition between electron closure and maximum Aether closure.

8.1 Natural Ultraviolet Closure Scale

Because Schwarzschild closure occurs when:

$$\frac{Gm_a}{c^2} = \lambda_C, \tag{18}$$

the QMU framework suggests a natural ultraviolet propagation cutoff associated with Compton-scale closure geometry.

In this interpretation, singular ultraviolet divergences arise when SI continuum projections are extended beyond the physically permitted rotational propagation boundary.

The closure condition therefore provides a possible geometric regularization mechanism for quantum-gravitational divergences.

9 Scientific Implications

The present analysis produces several important implications.

9.1 Schwarzschild Closure is a Propagation Boundary

The identity:

$$\frac{Gm_a}{c^2} = \lambda_C \tag{19}$$

shows that Schwarzschild closure directly coincides with the Compton propagation boundary.

9.2 The Planck System is Emergent

The Planck system is not primary within QMU. It emerges from the electron–Aether closure span.

9.3 Black-Hole Singularities Become Coordinate Failures

The QMU interpretation suggests that singularities arise from the breakdown of SI coordinate projections rather than from true infinite density.

9.4 Gravity Becomes Rotational Compression

Gravitational effects emerge from the compression of propagation geometry and the loss of available rotational phase freedom.

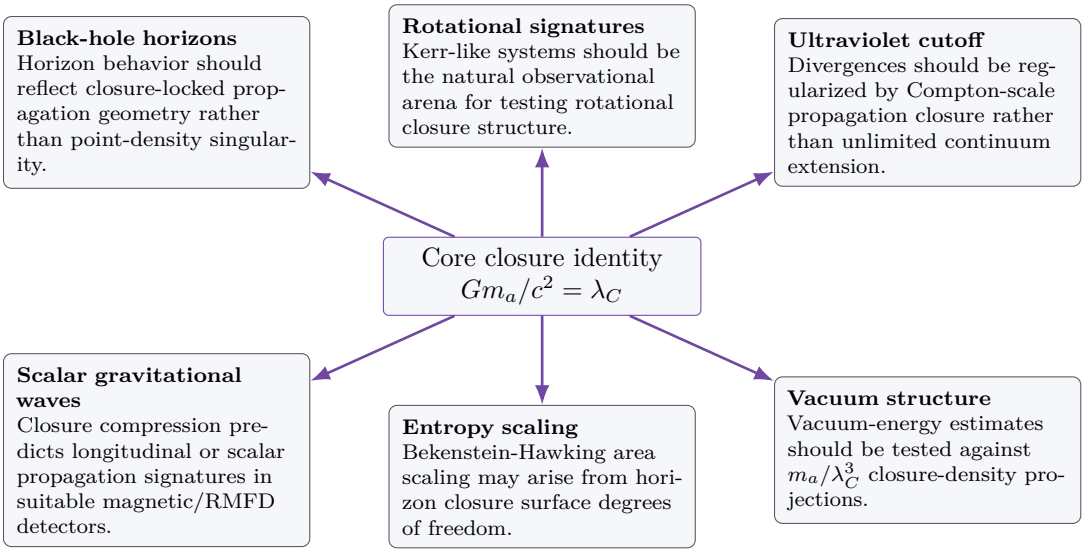


Figure 6: Experimental and observational prediction map. The closure identity $Gm_a/c^2 = \lambda_C$ leads to testable or retrodictive consequences in horizon structure, rotational black-hole systems, ultraviolet regularization, scalar gravitational-wave searches, entropy scaling, and vacuum-closure density projections.

10 Conclusion

The physical meaning of the Aether maximum mass has been investigated within the QMU framework of the Aether Physics Model.

The defining result is:

$$\frac{Gm_a}{c^2} = \lambda_C. \tag{20}$$

This identity demonstrates that the Schwarzschild closure radius associated with the Aether maximum mass equals the Compton propagation length.

The result implies that m_a represents the maximum stable propagation mass permitted before complete gravitational closure occurs.

Within this interpretation:

- gravitational collapse becomes rotational propagation compression,
- black-hole horizons become closure-locked propagation geometries,
- and the Planck system becomes an emergent crossover layer between electron closure and Aether closure.

The analysis suggests that many conventional singularities arise from SI projection breakdown rather than from fundamental physical infinities.

The Planck scale therefore does not represent the beginning of physics. Instead, it represents a bridge between localized quantum structure and maximum gravitational closure geometry.

Acknowledgments

The Quantum AetherDynamics Institute (QADI) is a private 501(c)(3) research institute developing the Aether Physics Model (APM) and Quantum Measurement Units (QMU) Thomson III [2025]. Publications and data are archived with DOIs in the AetherPhysics Zenodo community: zenodo.org/communities/aetherphysics.

References

James M. Bardeen, Brandon Carter, and Stephen W. Hawking. The four laws of black hole mechanics. *Communications in Mathematical Physics*, 31:161–170, 1973. doi: 10.1007/BF01645742.

Jacob D. Bekenstein. Black holes and entropy. *Physical Review D*, 7(8):2333–2346, 1973. doi: 10.1103/PhysRevD.7.2333.

Stephen W. Hawking. Particle creation by black holes. *Communications in Mathematical Physics*, 43(3):199–220, 1975. doi: 10.1007/BF02345020.

Roy P. Kerr. Gravitational field of a spinning mass as an example of algebraically special metrics. *Physical Review Letters*, 11(5):237–238, 1963. doi: 10.1103/PhysRevLett.11.237.

Peter J. Mohr, David B. Newell, Barry N. Taylor, and Eite Tiesinga. Codata recommended values of the fundamental physical constants: 2022. *Reviews of Modern Physics*, 97(2):025002, 2025. doi: 10.1103/RevModPhys.97.025002. URL https://link.aps.org/doi/10.1103/RevModPhys.97.025002.

Roger Penrose. Gravitational collapse and space-time singularities. *Physical Review Letters*, 14(3): 57–59, 1965. doi: 10.1103/PhysRevLett.14.57.

Max Planck. Über irreversible strahlungsvorgänge. *Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin*, pages 440–480, 1899.

Karl Schwarzschild. Über das gravitationsfeld eines massenpunktes nach der einsteinschen theorie. *Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin*, pages 189–196, 1916. URL https://arxiv.org/abs/physics/9905030.

David W. Thomson III. Quantum aetherdynamics institute (qadi): Community doi overview and citation guide. Zenodo, 2025. URL https://doi.org/10.5281/zenodo.17479314.

Robert M. Wald. *General Relativity*. University of Chicago Press, Chicago, 1984. ISBN 9780226870335.