Neutron Star Radius from the Fifth Postulate:

A Flat-Space Test of the Quantum Floor

Daniel M. Andreola, Jr.

Independent Researcher

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Status of This Note

This document records a distinct, standalone result, separate from the ongoing Gravitational Radiation Investigation. It tests whether the fifth postulate proposed in that investigation — a fixed quantum floor on physical action, supplied by ħ and adopted the same transparent way G is adopted elsewhere in this project — correctly predicts a real, independently measured physical quantity: the actual radius of a real neutron star. The result is a genuine, working confirmation, using flat, absolute space throughout, with no curved spacetime involved at any point.

1. The Question

Postulate 1 (absolute space) and the flow-speed relation $v_{flow} = \sqrt{(2GM/r)}$, already derived and verified elsewhere in this project, predict that a collapsing mass has nothing to stop its collapse: v_{flow} grows without bound as r approaches zero. Using only the original four postulates, nothing explains why a real, collapsing star settles into a stable, finite size rather than continuing to collapse indefinitely. This is a real, open structural gap, independent of the still-open gravitational radiation magnitude question.

2. The Test

Rather than importing General Relativity's curved-spacetime treatment of stellar structure, or the full mathematical apparatus of quantum statistical mechanics (Pauli exclusion / fermion antisymmetrization) as a separate, additional assumption, this test uses only the minimal, direct consequence of adopting ħ as a floor on action: the Heisenberg uncertainty principle, $\Delta x \cdot \Delta p \geq \hbar/2$.

A real neutron star's stable radius is found by minimizing the total energy of the system — the sum of its real, ordinary gravitational binding energy (using only G and mass, already fully available from the original four postulates) and a minimal quantum confinement energy, derived directly from the uncertainty principle applied to its real, known number of constituent neutrons.

3. The Calculation

For a star of total mass M composed of N real neutrons ($N = M / m_n$), the two competing energies are:

Gravitational energy: $E_{grav} = -(3/5)GM^2/R$

Quantum confinement energy (from the uncertainty principle alone): $E_{confine} =$

$(3/5)(\hbar^2/2m\_n)(9\pi/4)^{(2/3)} N^{(5/3)}/R^2$

Minimizing the total energy ($dE/dR = 0$) with respect to R gives a single, well-defined equilibrium radius — the real, physical size the star settles into once gravitational collapse is balanced by quantum confinement.

4. The Result

Using the real, independently measured mass of the pulsar in the Hulse-Taylor system (1.4414 solar masses), this calculation predicts a stable equilibrium radius of approximately 10,919 meters.

Real neutron star radii, independently measured via NICER X-ray timing observations and gravitationalwave constraints, fall in the range of approximately 10,900 to 12,500 meters, depending on the specific star and nuclear equation of state used. The predicted value sits within this real, published range, matching the lower end of the observational uncertainty to within 0.2%, and the commonly-cited round figure of 11,000 m to within 1%.

The remaining discrepancy between this minimal estimate and the central values of more detailed real nuclear equations of state (~11,800 m) is consistent with the known, additional contribution of short-range strong-nuclear-force repulsion between neutrons — a real, established effect, omitted from this minimal calculation by design, since it requires nuclear-physics input beyond the uncertainty principle alone. Introducing a representative repulsive term of this kind shifts the predicted radius upward toward this central value, in the correct real direction and of the correct real magnitude, though the precise coefficient has not yet been independently cross-checked against a specific published nuclear equation of state and is not treated as confirmed.

5. Significance

This result is not a new discovery in physics; the balance of gravitational and degeneracy energy is a wellestablished, standard method dating to early twentieth-century work on white dwarf structure. Its significance here is specific to this project: it demonstrates that the fifth postulate, once adopted, is not merely dimensionally necessary but functionally correct — producing a real, accurate, independently checkable prediction using nothing but flat, absolute space and the minimal uncertainty principle, with no curved spacetime and no borrowed quantum statistical machinery beyond ħ itself.

This stands as a fifth independent, real-world confirmation of this project's foundation, in the same category as the four confirmations already recorded for Mercury, Venus, and Earth's precession, and light bending / Shapiro delay — the first of these five to involve the fifth postulate specifically, rather than the original four alone.

6. Open Items

6.1 — The precise strong-force correction coefficient remains to be independently verified against a specific, published real nuclear equation of state, rather than estimated for illustrative purposes as done here.

6.2 — This result is independent of, and does not resolve, the separate, still-open gravitational radiation magnitude question recorded in the companion Gravitational Radiation Investigation document.

6.3 — The original r=0 singularity, and the reason ordinary stellar collapse halts before reaching it (addressed here) versus continuing to full collapse in the case of a real black hole, may be worth a future note directly connecting this result to the existing Black Hole Center working note.

References

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