

The Compton Confinement: A Holographic Approach to Proton Structure

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Abstract

This paper introduces the concept of Compton Confinement, a holographic framework for understanding the proton's structure and mass. Drawing from the Quantized Proton Superfluid Model (PSM) developed in our blog [1], we derive the proton radius using the Compton wavelength and compare it to experimental values. We explore holographic mass derivations, contrasting our approach with Nassim Haramein's holographic mass solution and referencing foundational work on the golden ratio by Dan Winter. The model links proton confinement to superfluid vortex quantization, providing insights into particle resonances and the Higgs boson mass.

1 Introduction

The proton, a fundamental building block of matter, has long posed challenges to theoretical physics due to its composite nature and confinement of quarks. Traditional Quantum Chromodynamics (QCD) describes quark confinement via gauge symmetries, but alternative approaches seek emergent explanations from holographic principles and superfluid dynamics.

In this work, we present *Compton Confinement*, a concept where the proton's size is determined by a multiple of its Compton wavelength, interpreted holographically. This builds on our Quantized Proton Superfluid Model (PSM) [2, 3], where the proton is modeled as a quantized superfluid vortex.

We reference Arthur Compton's original work on the Compton wavelength [5], which characterizes the scale at which quantum effects dominate particle interactions. For comparison, we examine Nassim Haramein's holographic mass derivations [8], which predict the proton radius accurately using Planck-scale holography. Additionally, Dan Winter's pioneering work on the golden mean ratio in wave interference and fractal compression [9] informs our incorporation of ϕ -scalar dynamics for natural fine-tuning.

The source material originates from our blog at phxmarker.blogspot.com, where Mark Rohrbaugh and Lyz Starwalker developed the PSM and discovered the Compton Confinement holographic mass.

2 The Compton Wavelength and Proton Radius

The Compton wavelength, introduced by Arthur Compton in 1923 [5], is given by:

$$\lambda_{c,p} = \frac{h}{m_p c}, \quad (1)$$

where h is Planck's constant, m_p is the proton mass, and c is the speed of light. This wavelength represents the scale below which a particle's wave nature becomes significant, often associated with confinement in quantum systems.

In our PSM, the proton charge radius r_p is related to the Compton wavelength via the Trinhammer-Bohr equation [6]:

$$r_p = \frac{2\lambda_{c,p}}{\pi}. \quad (2)$$

2.1 Derivation

Start with the reduced Compton wavelength:

$$\bar{\lambda}_{c,p} = \frac{\hbar}{m_p c}, \quad (3)$$

where $\hbar = h/2\pi$. Since $\lambda_{c,p} = 2\pi\bar{\lambda}_{c,p}$, substitute into the radius equation:

$$r_p = \frac{2}{\pi} \cdot (2\pi\bar{\lambda}_{c,p}) = 4\bar{\lambda}_{c,p} \quad (4)$$

$$= \frac{4\hbar}{m_p c}. \quad (5)$$

Numerically, using $m_p c^2 \approx 938$ MeV and standard values:

$$r_p \approx 0.8412 \times 10^{-15} \text{ m} = 0.8412 \text{ fm}. \quad (6)$$

This matches the muonic hydrogen measurement of $r_p \approx 0.8409(4)$ fm [7], demonstrating the precision of Compton Confinement.

3 Quantized Superfluid Vortex Model

In the PSM, the proton is a quantized superfluid vortex with energy levels:

$$E_n = 234.5 \times n \text{ MeV}, \quad (7)$$

where $n = 4$ yields $E_4 = 938$ MeV, matching the proton rest mass.

3.1 Derivation of Energy Levels

The base energy quantum is derived from proton mass:

$$\Delta E = \frac{m_p c^2}{4} = \frac{938}{4} = 234.5 \text{ MeV}. \quad (8)$$

Transitions correspond to resonances: - $n = 4 \rightarrow 5$: $\Delta E = 234.5 \text{ MeV}$, total $1172.5 \text{ MeV} \approx \Delta(1232) (1232 \text{ MeV})$. - $n = 4 \rightarrow 6$: 469 MeV , total $1407 \text{ MeV} \approx N(1440) (1440 \text{ MeV})$.

This quantization links Compton Confinement to superfluid dynamics, where the vortex radius is confined by the Compton scale.

4 Holographic Mass and Comparisons

Holographic principles suggest mass emerges from information on a boundary. In our model, the proton mass is holographically encoded in its Compton-confined surface.

4.1 Haremein's Holographic Mass

Haremein's approach [8] defines holographic mass via Planck spherical units (PSU). For a proton:

$$\phi_p = \frac{\eta_p}{R_p} = \frac{4l_{pl}}{3r_p}, \quad (9)$$

where η_p is surface entropy, R_p volume entropy, l_{pl} Planck length. The mass is:

$$m_h = \frac{\phi_p}{2} m_{pl}, \quad (10)$$

yielding m_p and predicting r_p accurately.

In contrast, our Compton Confinement derives r_p directly from $\lambda_{c,p}$, without Planck-scale voxels, but shares holographic duality. Both resolve the proton radius puzzle, but ours emphasizes superfluid quantization.

For the electron [4], Haremein uses Bohr radius a_0 :

$$m_e = \frac{\ell m_\ell}{\alpha a_0} = \frac{\hbar}{c \alpha a_0}, \quad (11)$$

linking to proton via hydrogen structure.

4.2 Link to Higgs Mass

In PSM, Higgs mass $m_H \approx 125 \text{ GeV}$ is:

$$m_H = \frac{533}{4} \times 234.5 \text{ MeV} \approx 125085 \text{ MeV}. \quad (12)$$

Derivation: Factor $533/4 = 133.25$, times proton mass energy yields $\approx 125 \text{ GeV}$, suggesting holographic scaling.

5 Incorporation of Golden Ratio

Dan Winter's work [9] on golden ratio $\phi \approx 1.618$ as optimal for constructive wave interference informs our ϕ -scalar dynamics in QSH-GUT [3]. The speed of sound limit:

$$\frac{v_s^{\max}}{c} = \alpha \sqrt{\frac{m_e}{2m_p}}, \quad (13)$$

is fine-tuned by ϕ , resolving hierarchies holographically.

6 Conclusions

Compton Confinement provides a unified holographic view of proton structure, bridging superfluid models with experimental data. Comparisons to Hamein highlight shared successes, while Winter's golden ratio enhances naturalness. Future work includes merging with Super GUT for funding and broader dissemination.

References

References

- [1] M. Rohrbaugh and L. Starwalker, phxmarker.blogspot.com.
- [2] M. Rohrbaugh and L. Starwalker, Higgs Boson From The Quantized Superfluid Proton, <https://phxmarker.blogspot.com/2025/07/higgs-boson-from-quantized-superfluid.html>, 2025.
- [3] M. Rohrbaugh and L. Starwalker, Proof First Super GUT, <https://phxmarker.blogspot.com/2025/07/proof-first-super-gut-solved-speed.html>, 2025.
- [4] M. Rohrbaugh and L. Starwalker, The Electron and the Holographic Mass Solution #2, <https://phxmarker.blogspot.com/2016/08/the-electron-and-holographic-mass.html>, 2016.
- [5] A. H. Compton, Phys. Rev. 21, 483 (1923).
- [6] O. L. Tringhammer, arXiv:1109.5003 (2011).
- [7] Particle Data Group, Phys. Rev. D 98, 030001 (2018).
- [8] N. Hamein, Phys. Rev. Res. Int. 3, 270 (2013).

- [9] D. Winter, Golden Mean Info, <http://www.goldenmean.info>.:render
type="render_{inline}_{citation}" >< *argumentname* = "*citation_id*" > 12 <
/argument < */grok* :