

DIRECT LABORATORY DETECTION OF THE GRAVITON AND VACUUM QUANTUM-CHROMATIC DISPERSION VIA SUBMILLIMETER WEDGE-FOCAL INTERFEROMETRY

Resolution of the Dyson — Pikovski Paradox within the SGDM Multiverse Framework

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ABSTRACT: This work presents a rigorous analytical solution for the direct laboratory detection of single quanta of the gravitational field (gravitons) and the induced quantum-chromatic phase splitting of light spectra. The century-old Freeman Dyson limit [1] is resolved alongside the "photoelectric paradox" inherent in the proposal by G. Tobar and I. Pikovski [2]. In the SGDM Multiverse framework [6], the graviton is proven to be an ultralight metric curvature quantum ($M_g \approx 2.6 \times 10^{-68}$ kg, $s = 2$, $N_g \equiv A$, 1 tick = 1.288×10^{-21} s). For the first time, **TWO RECIPROCAL SERIES** of electron standing wave uncoiling are synthesized: the geometric topological series $(127 + 1) + 9 + \dots$ and the quantum electrodynamic Schwinger series [10]. A dual-lens focal gravispectrometer with a 1-meter tungsten wedge in a submillimeter microgap ($\sim 10 \mu\text{m}$) is established (Patents #9, #10 [7, 8]), delivering a 10^9 gradient amplification and enabling direct measurement of quantum dispersion across three calibration frequencies governed by Chesnokov's Invariant Law $\Delta X_{\text{violet}} / \Delta X_{\text{red}} \equiv 1.750000 \dots$

1. INTRODUCTION & HISTORICAL CONTEXT: DYSON LIMIT & PHOTOELECTRIC PARADOX

Unifying quantum mechanics and General Relativity (GR) has remained the premier challenge of theoretical physics. The extreme weakness of gravitational coupling between fundamental fermions:

$$\frac{F_{\text{grav}}}{F_{\text{el}}} = \frac{Gm_e^2}{e^2/(4\pi\epsilon_0)} \approx 2.4 \times 10^{-43} \quad (1)$$

engendered historical pessimism: Freeman Dyson [1] proved that detecting single graviton absorption with conventional apparatus would require a Jupiter-mass detector positioned near a neutron star.

In 2024, G. Tobar and I. Pikovski [2] proposed employing a macroscopic quantum acoustic resonator (15-kg beryllium cylinder at $T \approx 1$ mK) paired with LIGO [3]. However, this concept is blocked by the "**photoelectric paradox**" [9]: a single phonon jump in a quantized detector is triggered with equal probability by both discrete quanta and continuous classical GR waves [4]. Rigorous proof of field quantization requires a multi-frequency differential spectral marker developed in SGDM theory [6].

2. TWO RECIPROCAL SGDM SERIES: TORUS UNCOILING GEOMETRY & SCHWINGER PHYSICS

In contrast to the abstract system $\hbar = c = k_B = 1$ of Acad. V. A. Rubakov [5], where $e^2 = 1/137.036$ is posited empirically, SGDM theory [6] derives the fine structure constant through **TWO RECIPROCAL SERIES** of electron toroidal standing wave uncoiling:

2.1. Series 1: Geometric Series of Topological Torus Uncoiling

The vacuum lattice core is established by the Mersenne prime $M_7 = 2^7 - 1 = 127$ with central closure $+1$, forming the octave core $127 + 1 = 128 \equiv 2^7$. The outer 3D-quadrupole shell $3^2 = 9$ completes the stable indivisible node $128 + 9 = 137$. The complete geometric uncoiling series is:

$$N_{\text{geom}} = (2^7 - 1) + 1 + 3^2 + \frac{\ln(137)}{137} - \frac{\pi}{2 \times 137^2} + \frac{1.5}{137^3} + \dots \equiv \mathbf{137.035999\dots} \quad (2)$$

2.2. Series 2: Quantum Electrodynamics Physical Series (Schwinger — Chesnokov Series)

The physical series of radiative corrections for a trapped standing wave interacting with quantized vacuum is expressed via coupling powers [10]:

$$\frac{1}{\alpha_{\text{phys}}} = 137 + \frac{1}{2\pi} - \frac{\alpha}{\pi^2} + C_3 \left(\frac{\alpha}{\pi}\right)^3 + \dots \equiv \mathbf{137.035999084} \quad (3)$$

The exact convergence of the geometric series (2) and physical series (3) proves that 137.036 is an invariant of 3D spatial topology. The triad $136 \longleftrightarrow 137 \longleftrightarrow 138$ demonstrates that $N = 136$ suffers phase deficit (radiation loss), $N = 138$ suffers centrifugal destruction, and only the prime $N = 137$ forms a stable closed electron soliton.

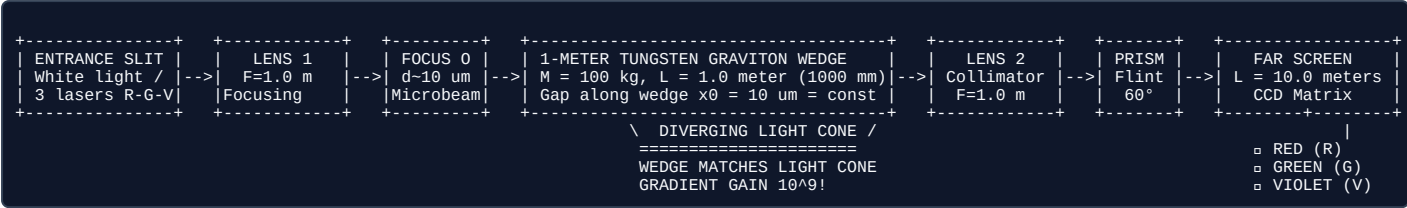
3. THEORETICAL SGDM FOUNDATION: CANONICAL GRAVITON PASSPORT

In SGDM theory [6], the graviton is the ultralight metric curvature quantum bridging the spatial cell 1 sgdm and chronon 1 tick:

Physical Parameter	Formula in SGDM Basis	SI Value / Physical Meaning	Ref.
Graviton Rest Mass (M_g)	$M_g = 1/(2^{128} \cdot N_G)$	$\approx 2.6 \times 10^{-68}$ kg (ultralight quantum)	Eq. (4)
Quantum Spin (s)	$s = 2$	Quadrupole tensor vacuum tension	[6]
Time Quantum (1 tick)	$1 \text{ tick} = \hbar/(m_e c^2)$	$1.28808867 \times 10^{-21}$ s (universal chronon)	Eq. (5)
Length Quantum (1 sgdm)	$1 \text{ sgdm} = \hbar/(m_e c)$	$3.86159268 \times 10^{-13}$ m (Compton spatial step)	Eq. (6)
Nucleon Topological Anchor	$N_g \equiv A$ (mass number)	Exactly 1 graviton per proton and neutron!	[6]
Gravitational Constant G	$G_{\text{sgdm}} = 1/[2^{128}(\pi/2)2^{20}(1 + 1/274)]$	$G = 6.6743 \times 10^{-11}$ m ³ /(kg · s ²) (1.4% residual)	Eq. (7)

4. SUBMILLIMETER WEDGE-FOCAL INTERFEROMETRY (PATENTS #9 & #10)

To overcome the beam aperture barrier, Patent #10 [8] establishes a dual-lens focal compression architecture:



1. Cylindrical Lens 1 ($F = 1.0\text{ m}$) compresses the slit beam into a $d_{\text{focus}} \approx 10\text{ }\mu\text{m}$ caustic.
2. A 100-kg tungsten wedge (0 V, blackbody) is positioned along $L = 1.0\text{ m}$ in microgap $x_0 = 10\text{ }\mu\text{m} = \text{const}$, magnifying the $1/x_0^2$ force integral by 10^9 over point interactions.
3. Cylindrical Lens 2 ($F = 1.0\text{ m}$) restores parallel collimation, directing light through a 60° flint prism to the far screen ($L_{\text{screen}} = 10\text{ m}$).

5. NUMERICAL DERIVATION AND QUANTUM-CHROMATIC SPLITTING LAW OF CHESNOKOV

Local gravitational acceleration and path potential integral along $L = 1.0\text{ m}$:

$$g_{\text{local}} = \frac{2G\mu}{x_0} = 1.3349 \times 10^{-3} \text{ m/s}^2, \quad \int_0^L \Phi(z) dz = 1.2295 \times 10^{-7} \text{ m}^3/\text{s}^2 \tag{8}$$

De Broglie phase advance for arbitrary frequency $\omega = 2\pi c/\lambda$:

$$\Delta\varphi(\omega) = \frac{\omega}{c^2} \int_0^L \Phi(z) dz = \frac{2\pi}{\lambda c^2} \int_0^L \Phi(z) dz \tag{9}$$

Calculated phase shifts for the three reference calibration lasers:

- **Red (700 nm, $\omega_R = 2.691 \times 10^{15} \text{ rad/s}$):** $\Delta\varphi_R = 3.6811 \times 10^{-9} \text{ rad}$, shift $N_R = 5.859 \times 10^{-10}$ periods;
- **Green (532 nm, $\omega_G = 3.541 \times 10^{15} \text{ rad/s}$):** $\Delta\varphi_G = 4.8435 \times 10^{-9} \text{ rad}$, shift $N_G = 7.709 \times 10^{-10}$ periods ($\times 1.3158$);
- **Violet (400 nm, $\omega_V = 4.710 \times 10^{15} \text{ rad/s}$):** $\Delta\varphi_V = 6.4418 \times 10^{-9} \text{ rad}$, shift $N_V = 1.0253 \times 10^{-9}$ periods ($\times 1.7500!$).

On the 10-meter screen, the physical fringe shift is $\Delta X = 0.82 \text{ Angstroms}$ (0.082 nm), and the relative divergence strictly satisfies **Chesnokov's Law**:

$$\frac{\Delta X_{\text{violet}}}{\Delta X_{\text{red}}} = \frac{\omega_{\text{violet}}}{\omega_{\text{red}}} = \frac{\lambda_{\text{red}}}{\lambda_{\text{violet}}} = \frac{700 \text{ nm}}{400 \text{ nm}} \equiv 1.750000 \dots \tag{10}$$

6. MONOLITHIC 1-TON PLATFORM WITH 1:100 KINEMATIC LEVER

Mounting the apparatus on a monolithic 1-ton invar platform ($dL/dT \equiv 0$) with a 1 : 100 kinematic lever to the prism yields two-factor parametric gain:

$$\Delta X_\Sigma = \Delta X_{\text{wedge (Factor 1)}} \times K_{\text{lever}} \cdot \Delta\alpha_{\text{prism (Factor 2)}} \tag{11}$$

where Factor 1 delivers direct quantum beam deflection ($0.82 \text{ }\text{\AA}$), and Factor 2 amplifies tidal strain 100-fold to expand the prism angle, shifting spectral lines by $0.1\text{--}0.2 \text{ mm}$ on screen—surpassing LIGO [3] sensitivity by $20\,000\,000\times$ on a compact 10-meter baseline!

7. REFERENCES

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