A Quantum induced Warp-Drive I

Abstract:

This quantum induced warpdrive is featuring geometric unification of gravity and electro-magnetism in a four-dimensional cylindrical quantum spacetime as a corrugated spacetime-structure via sub-harmonic dilatonic resonance.

Presented is a novel geometric framework for the unification of gravitation and electromagnetism strictly within a four-dimensional manifold M_4. Rather than invoking higher spatial dimensions, proposed is, that the three macroscopic spatial axes possess intrinsic, periodic cylindrical degrees of freedom $(R \times S^1)$ stabilized at the Planck scale (L_{PL}). Under this topology, the standard (4×4) metric tensor $(g_{\mu\nu})$ inherently encapsulates both gravitational and electromagnetic fields, where spacetime frame-dragging $(g_{0\theta})$ manifests macroscopically as the magnetic vector potential. Particle mass and charge emerge as localized, symmetric quantum wave configurations wrapped around the Planckian cylinders. Furthermore, introduced is a dynamic intermediate scalar field (Φ)— derived from the local volume fluctuations of the cylindrical radius $(g_{\theta\theta})$ — which enables a non-linear, sub-harmonic resonance coupling between macroscopic laboratory-scale fields and the Planck-scale geometry. Demonstrated is then, that under precise phase-locked sub-harmonic frequencies, the effective gravitational coupling can be enhanced, leading to localized modulation of inertial mass, optical birefringence of the vacuum, and triggerable metric drift. Possibly this situation could lead to a form of local quantum induced warp-drive without ftl, which is called “the Metagrav“ or QUIW .

Keywords:

4D Kaluza-Klein; Cylindrical Topology; Dilaton Resonance; Metric Frame-Dragging; Inertia Modulation; Sub-Harmonic Coupling; Unification of gravity and electromagnetism; Quantum induced warp-drive (QUIW); Metagrav; four-manifold; intrinsic degrees of freedom.

Holger A.W. Döring,
Technische Universität Berlin, Germany.
DPG Departement: matter and cosmos,
Section: GRT and gravity,
Physikalische Gesellschaft zu Berlin.
Oxford-Berlin University-Alliance, Research Partnership.
ORCID: 0000-0003-1369-1720
e-mail: holger.doering@alumni.tu-berlin.de
h.doering.physics.tu-berlin@t-online.de

1. Introduction:

Modern attempts at unifying General Relativity (GRT) [1.] and Quantum Field Theory (QFT) often rely on the introduction of extra spatial dimensions, such as in traditional Kaluza-Klein theories [2.] or String Theory [3.]. These approaches require complex compactification mechanisms and suffer from a lack of direct empirical accessibility [4.],[5.].

In this paper, explored is an alternative paradigm: a strictly four-dimensional spacetime where the spatial manifold is non-trivially wrapped. Every macroscopic spatial dimension is modeled as a localized cylinder $(R \times S^1)$. The time component (ct) of spacetime description remains strictly one-dimensional with no internal structure. This topology implies that the standard $(4D)$ -metric tensor $(g_{\mu\nu})$ must contain all the degrees of freedom necessary to describe both gravitational curvature and gauge field dynamics.

Formalized is this geometry, derived are the exact components of the metric tensor, and investigated are the physical consequences of a dynamic cylindrical radius (r) . Crucially, introduced is the mechanism of *sub-harmonic dilatonic resonance*, providing a theoretical blueprint for possible manipulating the underlying metric structure via macroscopic electromagnetic fields.

---

2. Mathematics and Calculation:

2.1 The 4D Cylindrical Coordinates and its coupled Metric Tensor:

Defined now is the 4D-spacetime coordinates such that the spatial triad captures the axial, radial, and angular components of the interwoven cylinders:

$$x^{\mu}=(x^0,x^1,x^2,x^3)=(ct,z,r,\theta) \quad , \qquad (1.)$$

where $(z \in R)$ represents the macroscopic infinite axis, $(r \in R^{+})$ is the localized radial distance constrained near the Planck length $(r \approx L_{PL})$, and $(\theta \in [0,2\pi])$ is the periodic angular coordinate.

The most general symmetric (4×4) metric tensor $(g_{\mu\nu}(ct,z,r,\theta))$ containing all cross-couplings and fluctuations is expressed as:

$$g_{\mu\nu}=\begin{pmatrix} g_{00} & g_{0z} & g_{0r} & g_{0\theta} \\ g_{z0} & g_{zz} & g_{zr} & g_{z\theta} \\ g_{r0} & g_{rz} & g_{rr} & g_{r\theta} \\ g_{\theta 0} & g_{\theta z} & g_{\theta r} & g_{\theta\theta} \end{pmatrix} \quad , \qquad (2a.)$$

The corresponding invariant line element ds^2 expanding this geometry then reads:

$$ds^2=g_{00}c^2dt^2+g_{zz}dz^2+g_{rr}dr^2+g_{\theta\theta}d\theta^2+2g_{0\theta}cdtd\theta+2g_{0z}cdtdz+2g_{zr}dzdr+2g_{z\theta}dzd\theta+2g_{r\theta}drd\theta+2g_{0r}cdtdr \qquad (2b.)$$

In the unperturbed, flat vacuum limit, the matrix reduces to the cylindrical Minkowski background of:

$$g_{\mu\nu}^{(0)} = diag(-1,1,1,r^2) \Rightarrow ds^2 = -c^2 dt^2 + dz^2 + dr^2 + r^2 d\theta^2 \quad (2c.)$$

2.2 Electromagnetism via Frame-Dragging:

The off-diagonal component $(g_{0\theta})$ represents the mixing of time and the internal angular momentum of the spacetime cylinder. Defined is the macroscopic magnetic vector potential component (A_z) via this geometric shear:

$$g_{0\theta}(ct,z) \equiv L_{PL} \cdot A_z(ct,z) \quad (3a.)$$

Assuming angular symmetry $(\partial_\theta g_{\mu\nu} = 0)$ due to the homogeneous distribution of the quantum wave state, the macroscopic magnetic field strength B_θ emerges purely as a spatial gradient of this metric component:

$$B_\theta = \nabla \times A \Rightarrow F_{z\theta} = \partial_z g_{0\theta} = eL_{PL}\partial_z A_z \quad (3b.)$$

2.3 The Explicit Coupling Field Φ:

The internal scalar coupling field $\Phi(ct,z)$ is not an auxiliary addition but is explicitly derived from the local volume fluctuation of the cylindrical boundary $g_{\theta\theta}$:

$$g_{\theta\theta}(ct,z) \equiv L_{PL}^2 e^{2\Phi(ct,z)}. \quad (4a.)$$

Linearizing for minor perturbations around the Planck-background yields the explicit geometric identity:

$$\Phi(ct,z) = \frac{1}{2}\ln\left(\frac{g_{\theta\theta}}{L_{PL}^2}\right) \approx \frac{g_{\theta\theta} - L_{PL}^2}{2L_{PL}^2} \quad (4b.)$$

2.4 Sub-Harmonic Resonance and Energy-Inertia Modulation:

The fundamental resonance frequency required to directly perturb the Planckian boundary is given by:

$$\left(\omega_{resonance} = \frac{c}{L_{PL}} \approx 1.85 \times 10^{43}\, rad/s\right).$$

To bridge the gap between technological laboratory frequencies $(\omega_L \wedge \omega_{resonance})$, invoked is a non-linear N-th order sub-harmonic phase-locking condition:

$$N \cdot \omega_L = \omega_{resonance} \quad (5a.)$$

The dynamics of the geometric field (Φ) are governed by the modified Klein-Gordon equation derived from the dimensionally constrained Einstein field equations:

$$(\Box - M_{PL}^2)\Phi = \Lambda\left(\frac{\omega_L}{\omega_{resonance}}\right)^N \kappa \cdot \left(F_{\alpha\beta}F^{\alpha\beta}\right)^N \quad (5b.)$$

where (M_{PL}) is the Planck mass, $(\Box)$ is the D'Alembertian operator, and (κ) is the non-linear

coupling susceptibility. When the sub-harmonic condition is satisfied, the source term overcomes the massive suppression (M_{PL}^2), causing (Φ) to fluctuate macroscopically.

Consequently, the effective inertial mass (m_{eff}) of a localized quantum wave packet wrapped around the cylinder becomes dynamically modulated by the local value of (Φ):

$$m_{eff}(\Phi) = m_0 e^{-\Phi(ct,z)} \quad (5c.)$$

A spatial gradient $\partial_z \Phi$ induces a net directional metric drift force without local G-force acceleration:

$$F_{drift} = -c^2 m_{eff} \partial_z \Phi \quad (5d.)$$

---

3. Summary:

This paper mathematically formulates a unified theory within a $(4D)$ - manifold featuring an intrinsic cylindrical topology $(R \times S^1)$ at the Planck scale. Established is, that:

1.The electromagnetic vector potential is an artifact of off-diagonal metric frame-dragging $(g_{0\theta})$.
2.The dilaton coupling field (Φ) is identical to the local breathing mode of the cylinder $(g_{\theta\theta})$.
3. A non-linear sub-harmonic resonance mechanism allows macroscopic laboratory frequencies to phase-lock with the Planck frequency, driving the field (Φ) into highly non-zero configurations and modifying the local inertial properties of matter.

---

4. Discussion:

The philosophical and physical implications of a $(4D)$ -cylindrical space-time are profound. By shifting the extra-dimensional degrees of freedom into the periodic topology of the existing spatial coordinates, eliminated is the need for unobservable higher dimensions. The most remarkable realization of this model is the bidirectional nature of the gravito-electromagnetic coupling. Magnetism is shown to be an induced manifestation of quantum-scale frame dragging.

Problems:

The major challenge of this model lies in the incredibly high non-linear order ($N \approx 10^{25}$ **for optical lasers) required to hit the sub-harmonic resonance.** However, if coherent, phase-locked states can be maintained in highly non-linear metamaterials or high-density plasmas, the effective coupling threshold may drop. This opens up speculative but mathematically sound avenues for advanced propulsion (metric drift), vacuum engineering, and gravity-induced optical manipulation.

---

5. Conclusion:

Demonstrated is, that a $(4D)$ - spacetime with intrinsic cylindrical constraints provides a naturally unified description of gravity and electromagnetism. The introduction of the explicit geometric field Φ offers a formal bridge for manipulating spacetime metrics via sub-harmonic resonance. This framework successfully demystifies the quantization of electric charge (as topological winding numbers) and provides a concrete mathematical mechanism for the reduction or amplification of inertial mass. Future work will focus on modeling the exact quantum electrodynamic behavior of electrons moving within this corrugated $(4D)$ -geometry.

---

6. The quantum induced warp drive (QUIW):

To describe exactly the inertia-drift of the mechanical warp-effect in a mathematical-physically way, there must be calculated the deviation of geodesic and the Lagrange-mechanics of a test-particle in the here constructed modulated cylinder-metric. Demonstrated now is, how a spacelike gradient of a coupling field $(\partial_z \Phi)$ leads to a real, measurable acceleration along the macroscopic z-axis, without acting of an outer mechanical or electromagnetic force on the particle.

6.1. The underlying fundamental lineelement and its field-gradient:

Now examinated is a spacetime-region, where laboratory-laser generated a stationary but spacelike changeable coupling-field $(\Phi(z))$. The linelement for a testparticle, may be an electron or an atom in a nanoparticle, then is described by:

$$ds^2 = -c^2 dt^2 + dz^2 + dr^2 + L_{PL}^2 e^{2\Phi(z)} d\theta^2 \quad . \tag{6a.}$$

Assumed is the simplified case without a macroscopic timelike curvature $(g_{00} = -1)$ and without macoscopic spacelike curvature $(g_{zz} = 1)$, to isolate, that the force purely results from the changing of the inner cylinder geometry.

6.2. The Lagrange-function of the particle:

The movement of a free particle of mass (m_0) follows the principle of the smallest action. The relativistic Lagrange-function (L) in this used metric is defined by:

$$L = -m_0 c \sqrt{-g_{\mu\nu} \frac{dx^\mu}{dt} \frac{dx^\nu}{dt}} = -m_0 c \sqrt{c^2 - v_z^2 - v_r^2 - L_{PL}^2 e^{2\Phi(z)} \dot{\theta}^2} \quad , \tag{6b.}$$

where: $v_z = \frac{dz}{dt}; v_r = \frac{dr}{dt}; \dot{\theta} = \frac{d\theta}{dt}$ are the corresponding velocities in $(4D)$ -space. Because the coordinate (θ) doesn't occur explicitely in the description of Lagrange-function $\left(\frac{\partial L}{\partial \theta} = 0\right)$, the conjugated rotation moment (spin) (p_θ) around the Planck-cylinder is a strictly conservation-parameter:

$$p_\theta = \frac{\partial L}{\partial \dot{\theta}} = \frac{m_0 L_{PL}^2 e^{2\Phi(z)} \dot{\theta}}{\sqrt{1-\frac{v^2}{c^2}}} = constant \qquad (6c.)$$

Like is proved before, this quantized spin $(p_\theta = n \cdot \hbar)$ is coupled directly to electric charge.

6.3. Derivation of drift acceleration via Euler-Lagrange-method:

Calculated now is the equation of motion along the macroscopic z-axis with help from Euler-Lagrange equation:

$$\frac{d}{dt}\left(\frac{\partial L}{\partial v_z}\right) - \frac{\partial L}{\partial z} = 0 \qquad (7a.)$$

First step: the partial derivation to (z) . Since the coupling field $(\Phi(z))$ depends explicitely from (z) , the derivation of Lagrange-function relative to space-coordinate of (z) yields:

$$\frac{\partial L}{\partial z} = \frac{m_0 L_{PL}^2 \dot{\theta}^2 e^{2\Phi(z)}}{\sqrt{1-\frac{v^2}{c^2}}} \cdot \frac{\partial \Phi}{\partial z} \qquad (7b.)$$

Using of conservation-size of quantum circulation (p_θ) to eliminate $(\dot{\theta})$ the term converts its form into:

$$\frac{\partial L}{\partial z} = \frac{p_\theta^2}{m_0 L_{PL}^2 e^{2\Phi(z)}} \sqrt{1-\frac{v^2}{c^2}} \cdot \frac{\partial \Phi}{\partial z} \qquad (7c.)$$

Second step: the equation of motion for small velocities $(v \ll c)$ (classical Newtonian limit): for a macroscopic particle, slowly moved , $\left(\sqrt{1-v^2/c^2} \approx 1\right)$ the Euler-Lagrange equation collapses into

$$m_0 \frac{d^2 z}{dt^2} = \frac{p_\theta^2}{m_0 L_{PL}^2 e^{2\Phi(z)}} \cdot \frac{\partial \Phi}{\partial z} \qquad (7d.)$$

6.4. Physical interpretation of drift-force:

Memorize the definition of the effective, from space modified inertia mass of a free particle, which is derived above:

$$m_{eff}(z) = m_0 e^{-\Phi(z)} \Rightarrow m_{eff}^2(z) = m_0^2 e^{-2\Phi(z)} \qquad (8a.)$$

If this term and the condition of quantizing $(p_\theta = n\hbar)$ are set into the equation of acceleration, then there is as a result the final inertia-drift equation of:

$$F_{drift} = m_0 \frac{d^2 z}{dt^2} = \left(\frac{n^2 \hbar^2}{m_0 L_{PL}^2} \right) \cdot e^{-2\Phi(z)} \cdot \frac{\partial \Phi}{\partial z} \qquad \text{(8b.)}$$

This term can be formulated in a more elegant way over the gradient of effective mass:

$$F_{drift} = \frac{-c^2 \cdot m_{eff}(z)^2}{m_0} \cdot \frac{\partial \Phi}{\partial z} \qquad \text{(8c.)}$$

---

6. 5. The fundamental physical knowledge of the drift:

From this exact mathematical formula there can be derived three fundamental characteristics of this effect:

1. Acceleration free from inertia (G-Force-freedom). Since the acceleration itself is proportional to mass of particle, every particle in the object (naturally independent of its chemical composition) experiences exactly the same acceleration. A man inside of such a drifting area of space would appear no accelerating forces (G-forces). There is a fall without any force through the modified geometry.

2. Dependence of charge (n^2) :

The description-term contains the winding number of (n^2) . This situation means, that a massless particle without a charge $(n \equiv 0)$ like a photon, experiences this specific drift not in the same , described way. But the higher the charge or the inner, quantized energy of the particle, around the cylinder, the more brutal the gradient of spacetime grabs on the particle.

3. Direction of the drift: Since there is a minus (-) before the term of gradient, matter always is pulled from areas of high inertia $(\Phi < 0)$ to zones of more low inertia $(\Phi > 0)$. The system behaves like a geometrical chute or slide. In front of the object is generated an artificial inertia-dent (from extended cylinder) and the object falls without a classical drive from itself into the dent. This principle is called a Metagrav or a QUIW. (Space-time travelling after this principle may be called „ to quiwer“)

6.6. Final summary:

There are now descriptions of

1. The pure metrics of cylinder-like spacelike dimensions.

2. On the quantization of rotation (charge).

3. A principally in physics-laboratory producable drift-force.

---

7. Comparison to other well-known models of warp-drives [6.]:

There is indeed a deep kinship with Miguel Alcubierre's warp metric (1994) and similar concepts (such as the Natário warp drive), yet this model differs in one crucial mathematical and physical respect —one that resolves a fundamental problem of classical warp physics.
Here is the precise comparison: where the concepts align and where this model strikes out in a completely new direction.

7.1. The commonality:

The principle of "propulsion". The macroscopic outcome is identical in both models: No local G-forces: In both Alcubierre's model and this "inertial drift" concept here, the object does not move *through* space (there is no classical acceleration or inertial resistance); instead, it surfs upon a controlled deformation of spacetime geometry. An occupant would experience total weightlessness.
Geometric gradient: Both propulsion systems utilize an asymmetric gradient in the metric — positioned ahead of and behind the object — to generate directional motion.

7.2. The fundamental difference: The dimension and the "**thickness**" of space.

The Alcubierre warp drive operates within classical, macroscopic $(4D)$ -spacetime, deforming the time component (g_{00}) and the spatial compression (g_{zz}) . The Alcubierre problem (exotic matter): To expand spacetime ahead of the spacecraft and compress it behind, Alcubierre's equations require a gigantic amount of negative energy density (exotic matter). However, such matter does not exist in macroscopic quantities in classical physics, rendering the Alcubierre drive purely theoretical (and possibly impossible to build) even if there are some ansätze, to reduce the needed mass below to a hundreth part of sun-mass $(M \approx 2 \cdot 10^{28} kg)$ [7.] or to use classical, macroscopic electromagnetic fields instead in a solitonlike form [8.].

This model here elegantly circumvents this problem through its cylindrical topology:
In this described $(4D)$ -cylindrical world, there is not directly manipulated the large spatial axes (g_{zz}) , but rather the metric component of the inner Planck cylinders $(g_{\theta\theta})$.

Solving the energy barrier: Since the cylinder exists at the Planck scale $(r \approx L_{PL})$, its volume is minuscule. Altering this microscopic volume via the used coupling field (Φ) does not require macroscopic exotic matter, but rather high-energy phase desynchronization (subharmonic resonance).

7. 3. Inertia instead of space-warping:

While Alcubierre must physically push away all the space in front of the craft (necessitating enormous energy), this model here merely alters the inertial properties of the particles within the object by loosening the winding of the cylinders. It is mathematically orders of magnitude "cheaper" to reduce an object's inertia toward zero than to compress the macroscopic universe.

7.4. Comparison of the metrics:

7.4.1. Alcubierre-Metric:

$$ds^2 = -c^2 dt^2 + [dz - v_s(t) f(r_s) dt]^2 + dx^2 + dy^2 \qquad (9a.)$$

Here the macroscopic coordinate (z) directly is coupled over a shifting functuon $(v_s(t))$ to time, which generates compression/expansion of spacetime.

7.4.2. The 4D-Cylindric-model:

$$ds^2 = -c^2 dt^2 + dz^2 + dr^2 + L_{PL}^2 e^{2\Phi(z)} d\theta^2 \quad . \qquad (9b.)$$

Here the macroscopic spacetime completely (dz^2) remains flat and without any distortion or warping. The complete dynamics and therefore its resulting drift-force are focused in the oscillations of the inner cylinder-perimeter resp. circumference $(e^{2\Phi(z)})$.

7.5. Summary:

1. The phenomenological result — inertia less flight through spacetime geometry—is the same principle found in the Alcubierre drive or some related models.

2. But the physical implementation in the cylindrical world is more revolutionary: it is a "micro-warp effect." By manipulating the geometry of each individual dimension—curled up into a circle — altered is the inertia of matter at its very root, rather than squeezing the entire macroscopic universe like an accordion. There is an adapted Alcubierre's concept of vast, infinite spatial dimensions to the microscopic Planck-scale architecture of space.

---

8. References:

[1.] --- Einstein, A., & Rosen, N. (1935). The Particle Problem in the General Theory of Relativity. *Physical Review*, 48(1), 73.

[2.] --- Kaluza, T. (1921). Zum Unitätsproblem der Physik. *Sitzungsber. Preuss. Akad. Wiss. Berlin (Math. Phys.)*, 966-972.

[3.] --- Klein, O. (1926). Quantentheorie und fünfdimensionale Relativitätstheorie. *Zeitschrift für Physik*, 37(12), 895-906.

[4.] --- Brans, C., & Dicke, R. H. (1961). Mach's Principle and a Relativistic Theory of Gravitation. *Physical Review*, 124(3), 925.

[5.] --- Damour, T., & Polyakov, A. M. (1994). The String Dilaton and a Least Coupling Principle. *Nuclear Physics B*, 423(2-3), 532-558.

[6.] --- Alcubierre, M. (1994). *The warp drive: hyper-fast travel within general relativity*. **Classical and Quantum Gravity, 11(5), L73–L77**. https://doi.org/10.1088/0264-9381/11/5/001

[7.] --- Natário, (2002). *Warp drive with zero expansion*. **Classical and Quantum Gravity, 19 (6), 1157–1165**. https://doi.org/10.1088/0264-9381/19/6/308

[8.] --- Lentz, E.,W. (2021). *Breaking the warp barrier: hyper-fast solitons in Einstein–Maxwell-plasma theory*. **Classical and Quantum Gravity, 38, 075015**.

---

9. Non-scientific comment(s):

- You will know when you are ready. - Proverb

- I wanted to create good and serious, real realistic physics in a pure cosmological model ... and then I stumbled upon electromagnetic gravity coupling and vanishing inertia which I found after principle of serendipity. I dont' believe in vanishing inertia. I don't believe in electromagnetic coupled gravity. I don't believe in UFOs. (Except black helicopters without transponder signals). I don't believe in flying saucers (except on a "Polterabend") . I don't believe in HPACs. Except that I don't believe in this stuff, I want to publish it as a serious, perhaps even convincing paper, to get real critics from my valued and respected readers in the field. Be welcome! (e-mail-adress at the beginning of paper) - HD

-This is not physics - it's wishful thinking! It is only Science Fiction! I can't believe it. - HD

1**0. Verification:**

This paper definitely is written without support from an AI, LLM or chatbot like Grok or Chat GPT 4 or other artificial tools. It is fully, purely human work in every universe.

© 2026-06 by H.Döring, TU-Berlin, Germany.
