Coupled Temporal, Optical, and Electromagnetic Signatures of a Localised Fold-Density Anomaly: A VERSF Analysis of Reported Emitter-Induced Effects

VERSF Theoretical Physics Programme
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General Reader Abstract

Imagine a device that, when switched on, causes a nearby candle flame to freeze in mid-flicker — not to go out, but simply to stop moving, as if time itself had paused inside a small region of space. At the same time, a pinpoint of pure blackness appears where the device's output is focused, surrounded by a faint bright halo. And at the edge of the affected zone, a blue glow pulses with a faint crackling sound. When the device is switched off, all three effects vanish instantly — the flame resumes flickering, the dark point disappears, the glow fades.

This paper asks a precise scientific question: is there a single underlying physical configuration that could simultaneously produce all three of those effects, and if so, what would it have to look like?

Within the Void Energy-Regulated Space Framework (VERSF), the answer is yes. The framework describes space not as an empty backdrop but as a field of *commitment capacity* — a measure of how rapidly irreversible physical events occur at each point in space. Normally this field is uniform everywhere. But a device that locally suppressed it would create a pocket of "slow space" — a region where physical processes, including light propagation and combustion, are sluggish relative to the outside world.

We show that a single mathematical description of such a suppressed region — governed by just two parameters, its depth and its spatial extent — accounts for the frozen flame (sluggish time), the black dot (light unable to escape), and the glowing boundary (the sharp edge between slow and normal space). Crucially, all three effects share the same spatial scale, with predicted fixed ratios between the measurements from each channel. This mutual consistency requirement is what makes the analysis genuinely testable rather than merely descriptive. We identify the specific experimental tests — particularly the instantaneous disappearance of all effects upon deactivation — that would most sharply distinguish this physical interpretation from conventional explanations.

Technical Abstract

We analyse a structurally specific set of reported bench-top observations attributed to a localised field emitter: (i) arrest of rapid temporal processes within a confined region (frozen flame); (ii) formation of a black focal point consistent with light-path closure (black dot); and (iii) a luminous corona at the field boundary accompanied by electromagnetic discharge. We demonstrate that within the Void Energy-Regulated Space Framework (VERSF), all three phenomena arise naturally and simultaneously from a single localised anomaly in commitment-capacity density $\kappa(x)$. The frozen flame is identified as temporal suppression of the local commitment rate, producing an observable slowing of physical processes as seen from outside the region. We distinguish three observational regimes: detectable slowdown ($A \geq 0.5$), visually striking slowdown ($A \approx 0.875$), and full apparent arrest over a 10-second window ($A \geq 0.99$ at the source centre). The black dot is analysed in two physically distinct regimes — strong lensing with a dark core ($A < 1$) and true micro-horizon ($A \to 1$) — and the observable distinctions between regimes are specified. The corona is derived as a commitment-boundary discharge at the gradient maximum of the κ-depression ($r = \sigma$). The effective refractive index $n_{eff} = n_0 \cdot (\kappa_0/\kappa)^{1/2}$ is shown to be the unique admissible exponent within the VERSF optical response class, fixed by metric-conformal consistency, null-cone compatibility, and recovery of the gravitational optical limit. The central falsifiability criterion is that the three independently measured channel scales — the temporal half-depth radius σ_τ, the optical annulus radius σ_{opt}, and the corona peak radius σ_{em} — must satisfy $\sigma_\tau/\sqrt{2 \ln 2} = \sigma_{opt} = \sigma_{em} \equiv \sigma$, with the predicted ratio $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ constituting a testable cross-channel quantity. A four-argument case against the thermal and refractive artefact interpretation is presented. A tiered experimental protocol applicable to any controllable localised field perturbation, regardless of source mechanism, is proposed, with the deactivation test identified as the decisive first-tier discriminator.

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1. Introduction

In plain language: This section explains what we are trying to do and why it matters. We are not claiming the reported effects definitely happened, or that we know how the device works. We are asking a narrower question: if such a device existed and produced those effects, would there be a single coherent physical explanation for all of them together? We show that the answer, within the VERSF framework, is yes — and we specify what experiments would test that claim.

Within the Void Energy-Regulated Space Framework, physical structure — spacetime geometry, gravity, temporal flow, and optical propagation — co-emerges from gradients and configurations of the commitment-capacity density field $\kappa(x)$. This field encodes the local rate at which physical facts become irreversibly determined. In the bulk, $\kappa(x)$ is approximately uniform at the ambient value κ_0. The framework predicts that a sufficiently localised anomaly in $\kappa(x)$ — whether naturally occurring or artificially induced — would produce a coupled and internally constrained signature across multiple observable channels simultaneously.

Reports exist of bench-top experiments in which a single localised emitter produced the following simultaneous effects:

1. A candle flame placed within the emitter's focused output appeared arrested — frozen mid-flicker — as observed from outside the region.
2. A small black dot appeared at a focal point of the emitter output, at which light did not propagate normally.
3. A blue luminous corona accompanied by an audible electromagnetic discharge was observed at the field boundary during activation.

These observations were privately communicated and remain unpublished; the analysis is conducted solely as a theoretical consistency investigation and does not depend on the evidential status of any particular report. The specific observational set considered here is treated as a representative configuration of coupled temporal, optical, and electromagnetic anomalies. The analysis does not depend on the validity of any particular report, but on the internal consistency constraints such a configuration would impose.

These three observations are structurally constraining. They engage optical, temporal, and electromagnetic channels simultaneously from a single stable source. Within VERSF, all three are governed by the same two field parameters: the depression amplitude A and the spatial extent σ. Independent measurements from each observable channel must be consistent with a single underlying σ, with the ratio between the temporal and optical channel measurements predicted exactly as $\sqrt{2 \ln 2} \approx 1.18$ — a strong and experimentally accessible constraint.

The aim of this paper is to formalise this identification with carefully derived and numerically explicit predictions for each observable, to distinguish the physically distinct optical regimes relevant to the black dot, and to establish the experimental programme under which the full set could be confirmed or falsified.

We make no claim regarding the provenance or ultimate interpretation of the reported observations, and explicitly do not attempt to identify the internal mechanism by which any emitter produces a κ-depression: the source mechanism is intentionally out of scope. This paper establishes the observable consequences *if* such a configuration exists, and specifies the experimental conditions under which those consequences could be confirmed or falsified. This framing is standard practice in phenomenological physics: one may derive the observable consequences of a magnetic monopole, a cosmic string, or a Bose-Einstein condensate without possessing a complete theory of their laboratory production. The question we address is narrower and precisely defined: does VERSF admit a single field configuration that simultaneously and quantitatively accounts for all three reported signatures? We show that it does, and specify what experimental results would demonstrate that it does not.

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2. VERSF Background

2.1 Commitment-Capacity Density

In plain language: Think of commitment-capacity density as a measure of how "active" space is at any given point — how rapidly events happen, how quickly time flows, how freely light travels. In normal empty space, this density is uniform everywhere. A mass (like a planet) increases the density in its neighbourhood, pulling things toward it. The device we are studying does the opposite: it creates a pocket of *reduced* density, a localised region of "quiet space."

The fundamental field of VERSF is the commitment-capacity density $\kappa(x, t)$, defined as the local rate of irreversible fact-formation per unit volume. In the bulk, κ takes the uniform ambient value κ_0. The fold density $\rho\_f(x)$ is defined as:

$$\rho\_f(x) = \kappa(x)/\kappa_0$$

so that $\rho\_f = 1$ in the unperturbed bulk. Departures from unity characterise anomalies.

In the standard VERSF derivation of gravity, mass concentrations act as commitment concentrators — regions that draw in and stabilise fold structure — so that κ increases toward a mass source and ∇κ points inward. The gradient force on a test body is thereby directed inward, recovering gravitational attraction. A κ-depression, as studied here, reverses this gradient and is expected to produce qualitatively distinct signatures, as derived below.

2.2 Proto-Time and Local Temporal Rate

In plain language: In VERSF, time does not flow at a fixed rate everywhere — it flows faster where more events are happening. In a region of suppressed κ, fewer irreversible events occur per second, so time passes more slowly there. An outside observer watching a candle inside such a region sees the flame moving in slow motion — or, in the extreme case, apparently frozen.

In VERSF, time is not a background parameter but an emergent count of irreversible commitment events. The local proto-time rate $\dot{\tau}(x)$ is proportional to $\kappa(x)$:

$$\dot{\tau}(x) = \kappa(x)/\kappa_0$$

so that $\dot{\tau} = 1$ in the unperturbed bulk. A region where $\kappa(x) < \kappa_0$ has $\dot{\tau} < 1$: physical processes within it proceed more slowly relative to the ambient rate as measured by an external observer. This is the VERSF analogue of gravitational time dilation, arising from a local κ-depression rather than from a mass concentration.

The observed duration of any internal process is stretched by the reciprocal of the local proto-time rate:

$$\Delta t\_observed = \Delta t\_intrinsic / \dot{\tau}(x)$$

As $\dot{\tau} \to 0$, $\Delta t\_observed \to \infty$: processes appear to halt completely to the external observer.

2.3 Optical Propagation

In plain language: To describe how light behaves in a suppressed-κ region, we first ask a more general question: if the effective refractive index depends on κ, what functional dependence is actually allowed? Rather than assuming an answer from the start, we show that the square-root form is the *unique* choice compatible with the internal geometric and causal requirements of the VERSF framework. This is a stronger claim than simply preferring one form over another.

Light propagation in VERSF is governed by the null structure of the emergent spacetime, which is itself determined by the local commitment-capacity density $\kappa(x)$. To identify the admissible optical response, consider the general local ansatz:

$$n\_eff(x) = n_0 \cdot (\kappa_0/\kappa(x))^\gamma$$

with exponent γ to be determined. The value of γ is fixed by three independent internal consistency requirements.

Requirement (1) — Metric-conformal consistency. In the weak-field limit of VERSF, the emergent line element takes the conformal form $ds^2 = \Omega^2(x) \cdot \eta\_\mu\nu \cdot dx^\mu dx^\nu$, with conformal factor satisfying:

$$\Omega^2(x) \propto \rho\_f(x) = \kappa(x)/\kappa_0 \Longrightarrow \Omega(x) \propto (\kappa(x)/\kappa_0)^{1/2}$$

The local propagation speed of a massless mode is set by the conformal light-cone scale:

$$c\_local(x) \propto \Omega(x) \propto (\kappa(x)/\kappa_0)^{1/2}$$

Therefore:

$n\_eff(x) = c_0/c\_local(x) = n_0 \cdot (\kappa_0/\kappa(x))^{\wedge}½$

This fixes **$\gamma = 1/2$**.

Requirement (2) — Null-cone compatibility. In VERSF, the commitment-propagation cone at a point x is defined independently of the optical response function as the set of directions along which irreversible commitment events can propagate, determined by the local fold density gradient structure of $\kappa(x)$ alone. In the unperturbed bulk this cone coincides with the null cone of the emergent metric. Null-cone compatibility requires that the optical null cone — defined by the condition for zero phase accumulation in the propagating mode — likewise coincides with the commitment-propagation cone at every point in the anomalous region. Any choice $\gamma \neq 1/2$ causes the inferred optical light-cone scaling to diverge from the conformal scaling of the emergent metric, breaking this identification. In particular, the linear choice $\gamma = 1$ would imply a propagation-speed suppression stronger than the metric permits, over-closing the null cone in the transition region and generating spurious horizons at finite $A < 1$.

Requirement (3) — Recovery of the gravitational optical limit. The same framework must reproduce the known weak-field optical behaviour for κ-concentrations (ordinary gravitating sources). Consistency with the Schwarzschild optical analogue in the VERSF gravitational sector requires:

$n\_eff \propto (1 - r\_s/r)^{\wedge}(-½)$

which corresponds to $\gamma = 1/2$. Internal consistency therefore demands that both κ-concentrations and κ-depressions are governed by the same exponent.

Taken together, these three requirements do not merely motivate the square-root form — they uniquely select it within the admissible VERSF optical response class. We therefore adopt throughout this paper:

$n\_eff(x) = n_0 \cdot (\kappa_0/\kappa(x))^{\wedge}½$

A full derivation of the complete dispersion relation from the VERSF field equations — including sub-leading corrections and back-reaction — remains an open task. However, within the phenomenological and geometric consistency conditions of the present framework, the exponent 1/2 is fixed uniquely. The outstanding open task is therefore not exponent selection, which is settled by internal consistency, but derivation of the full dispersion relation including sub-leading terms.

When $\kappa(x^*) \to 0$, $n\_eff \to \infty$: the local propagation speed vanishes and outgoing null paths are closed. This is the VERSF micro-horizon condition.

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3. The Field Configuration

3.1 Localised κ-Depression Profile

In plain language: We need to choose a mathematical shape for the suppressed region. We use a bell curve (Gaussian), centred on the emitter, which is deep in the middle and fades smoothly to normal space at large distances. The depth of the bell is A (with A = 1 meaning complete suppression at the centre) and its width is σ. All the effects we calculate will depend on these two numbers.

We model the emitter-induced anomaly as a localised depression in κ of the Gaussian form:

$$\kappa(r) = \kappa_0 \cdot [1 - A \cdot e^{(-r^2/2\sigma^2)}],\ A \in (0, 1],\ \sigma > 0$$

where $r = |x - x_0|$ is the distance from the source centre x_0. This profile satisfies:

- **Far field**: $\kappa(r) \to \kappa_0$ as $r \to \infty$ (ambient bulk recovered).
- **Centre**: $\kappa(0) = \kappa_0(1 - A)$ (maximum suppression). For $A = 1$, $\kappa(0) = 0$.
- **Gradient**: $\nabla\kappa$ points radially outward from x_0, opposite to the gradient produced by an ordinary mass concentration.
- **Gradient magnitude**: $|\nabla\kappa| = \kappa_0 A (r/\sigma^2) e^{(-r^2/2\sigma^2)}$, which vanishes at $r = 0$ and $r \to \infty$, and reaches its maximum at $r = \sigma$ (verified below).

Verification of gradient maximum. Setting $d|\nabla\kappa|/dr = 0$:

$$d/dr\ [(r/\sigma^2) \cdot e^{(-r^2/2\sigma^2)}] = (1/\sigma^2) \cdot (1 - r^2/\sigma^2) \cdot e^{(-r^2/2\sigma^2)} = 0 \Longrightarrow r = \sigma\ ✓$$

The gradient peaks precisely at $r = \sigma$. This result is used in both the optical (§5) and corona (§6) analyses.

3.2 Yukawa Extension

The Gaussian profile is adopted for analytical tractability. The VERSF field equation for a localised source S(x) is:

$$\nabla^2\kappa - \mu^2(\kappa - \kappa_0) = -S(x)$$

For a point source $S(x) = q\ \delta^3(x - x_0)$, this yields the Yukawa solution:

$$\kappa(r) = \kappa_0 - (q/4\pi) \cdot e^{(-\mu r)}/r$$

where μ^{-1} is the range of the anomaly and q is the source strength. The Gaussian profile is recovered in the limit $\mu \to 0$ at fixed integrated source strength, with $\sigma \sim \mu^{-1}$. All qualitative features carry over to the Yukawa form with the substitution $\sigma \to \mu^{-1}$; the Gaussian results below are therefore not artefacts of the profile choice.

3.3 Dynamical Status: Driven Steady State

In plain language: This suppressed region is not stable by itself — it needs the emitter to actively maintain it, like pressing down on a spring. When the emitter is switched off, the field relaxes back to normal. This is why all three effects should vanish immediately upon deactivation — a crucial experimental prediction.

The κ-depression is not a free vacuum solution of the VERSF field equations: it requires the emitter to act as an active source continuously maintaining the depression against the ambient relaxation dynamics. This is analogous to a driven steady state. The reported observations — effects present during activation and absent after deactivation — are consistent with this interpretation. A complete stability analysis under the VERSF field equations, including the relaxation timescale after source removal, is reserved for subsequent work. For the Yukawa profile, the relaxation is governed by the characteristic time μ^{-1}/c_κ, where c_κ is the signal propagation speed of the κ-field — here taken to be the vacuum speed of light c as an estimate, pending a derivation of c_κ from the complete VERSF dynamical equations. For a bench-top experiment ($\mu^{-1} \sim 10$ cm, $c_\kappa \sim c$), this gives a relaxation timescale of order 0.3 ns — effectively instantaneous on human observational timescales, consistent with the reported instantaneous cessation of effects.

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4. Observable 1 — The Frozen Flame

4.1 Physical Identification

In plain language: A candle flame flickers because combustion involves thousands of tiny irreversible chemical reactions per second — exactly the kind of events that VERSF counts as "commitments." In a region of suppressed κ, these reactions occur more slowly, so the flame appears to slow down or stop when viewed from outside. It is not that the chemistry has changed — it is that time itself, in the VERSF sense, is running slowly in that region.

A candle flame is a dense cascade of irreversible chemical and radiative transitions — bond cleavage, radical formation, oxidation, recombination, and photon emission — each of which constitutes a commitment event in the VERSF framework. The flame is therefore not merely influenced by the local commitment-capacity density κ(x); it is physically constituted by a sustained stream of commitment events. A suppression of κ(x) directly suppresses the rate at which the flame can evolve, making visible slowdown or apparent arrest a natural consequence of the framework rather than an incidental one.

This identification is more precise than simply noting that combustion is "irreversible." Each individual transition in the flame chemistry — each bond that breaks, each radical that forms, each photon that is emitted — is a distinguishable, irreversible state change of the substrate, and therefore maps directly onto the VERSF commitment ontology. The flame is not an approximate or metaphorical test process; it is an exceptionally dense, optically accessible, and continuously self-renewing source of commitment events, making it well suited as a temporal channel diagnostic.

The flickering rate is governed by the local commitment rate $\dot{\tau}(x_c)$, where x_c is the candle position. An external observer watching a candle at distance r_c from the source centre sees all internal processes stretched by:

$$\Delta t_{observed} = \Delta t_{intrinsic} / \dot{\tau}(r_c) = \Delta t_{intrinsic} / [1 - A \cdot e^{(-r_c^2/2\sigma^2)}]$$

4.2 Thresholds for Observable Temporal Suppression

In plain language: The key point is not that the field must nearly stop time in order to be measurable. Much smaller suppressions already produce visible slowing. The near-unity threshold ($A \geq 0.99$) arises only if one asks for the most extreme effect: a flame that appears fully frozen to the naked eye over several seconds. Weaker effects — slowing by factors of two or eight — are accessible at substantially lower amplitudes.

A candle flame flickers at approximately 10–25 Hz under normal conditions, giving an intrinsic flicker period:

$$\Delta t_{intrinsic} \approx 40\text{–}100 \text{ ms}$$

If the local proto-time rate at the candle position is $\dot{\tau}(r_c)$, the observed flicker period becomes $\Delta t_{observed} = \Delta t_{intrinsic} / \dot{\tau}(r_c)$. It is useful to distinguish three observational regimes.

Regime (1) — Detectable slowdown. A twofold stretch of the flicker period requires:

$$\dot{\tau}(r_c) \leq 0.5 \Longrightarrow A \geq 0.5 \text{ at } r_c = 0$$

This is substantial but far from extreme. Detectable temporal suppression is accessible across a wide range of amplitudes.

Regime (2) — Visually striking slowdown. An 8-fold stretch — unmistakable to the naked eye and readily captured on standard video — requires:

$$\dot{\tau}(r_c) \approx 0.125 \Longrightarrow A \approx 0.875 \text{ at } r_c = 0$$

Such an effect constitutes a highly unusual and reproducible anomaly without requiring full arrest.

Regime (3) — Apparent arrest over a macroscopic observation window. The much stronger condition that the flame appear essentially frozen throughout an observation interval T_{obs} requires:

$$\Delta t_{observed} \geq T_{obs} \Longrightarrow \dot{\tau}(r_c) \leq \Delta t_{intrinsic} / T_{obs}$$

For $T_{obs} = 10$ s and $\Delta t_{intrinsic} = 100$ ms:

$\dot{\tau}(r_c) \leq 0.1\ \text{s} / 10\ \text{s} = 0.01$

At the source centre ($r_c = 0$), where $\dot{\tau}(0) = 1 - A$:

$1 - A \leq 0.01 \Longrightarrow \mathbf{A \geq 0.99}$

This threshold should be interpreted narrowly: it is the requirement for complete apparent arrest over a 10-second human observation window at the source centre, not the general threshold for measurable or dramatic temporal suppression.

The radius within which full arrest ($\dot{\tau} < 0.01$) is maintained for $A = 0.99$ satisfies:

$1 - 0.99 \cdot e^{(-r^2/2\sigma^2)} \leq 0.01\ e^{(-r^2/2\sigma^2)} \geq 0.990$

$r_c < \sigma \cdot \sqrt{(-2 \ln 0.990)} \approx 0.14\sigma$

Accordingly, the relevant experimental space is broader than the full-arrest limit alone suggests. Amplitudes $A \sim 0.5$–0.9 produce detectable to visually striking slowdowns accessible to straightforward measurement, while $A \geq 0.99$ applies only to the most extreme visual regime and constrains the source-candle geometry to within $\sim 0.14\sigma$ of the source centre.

4.3 Inferring σ from the Temporal Profile

In plain language: By measuring how much the flame slows at different distances from the emitter, one can reconstruct the shape of the κ-depression and extract σ directly.

The general slowdown as a function of distance is:

$\Delta t_{observed} / \Delta t_{intrinsic} = 1 / [1 - A \cdot e^{(-r^2/2\sigma^2)}]$

This is the primary measurable function for the temporal channel. Its spatial falloff encodes σ directly. The suppression depth function $D(r) \equiv A \cdot e^{(-r^2/2\sigma^2)}$ drops to half its central value ($A/2$) at the half-depth radius:

$D(r_{1/2}) = A/2 \Longrightarrow e^{(-r_{1/2}^2/2\sigma^2)} = 1/2 \Longrightarrow r_{1/2} = \sigma \cdot \sqrt{(2 \ln 2)} \approx 1.177\sigma$

This half-depth radius $r_{1/2}$ is the primary measurable quantity from the temporal channel, hereafter denoted σ_τ:

$\sigma_\tau \equiv r_{1/2} = \sigma \cdot \sqrt{(2 \ln 2)} \approx 1.18\sigma$

The underlying field scale σ is then inferred as $\sigma = \sigma_\tau / \sqrt{(2 \ln 2)}$. Note that σ_τ is larger than the underlying σ by the factor $\sqrt{(2 \ln 2)} \approx 1.18$; this predicted ratio between the temporal measurement and the optical and electromagnetic measurements is a testable consistency condition (§7.2).

4.4 Observational Criteria

The frozen flame observation is consistent with the VERSF κ-depression if and only if:

- The suppression profile is spatially bounded with a Gaussian envelope, and the half-depth radius σ_τ yields $\sigma = \sigma_\tau/\sqrt{2 \ln 2}$ consistent with the other channels.
- The effect is present regardless of the chemical composition of the flame (the suppression acts on the commitment rate, not on specific chemistry).
- **The flame resumes its normal flicker immediately upon emitter deactivation, with no thermal recovery time.** This is the sharpest distinguishing test from any fluid-dynamical or thermal cause.

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5. Observable 2 — The Black Dot

5.1 Physical Identification

In plain language: Light normally travels in straight lines, but it bends when it passes through regions of varying density — this is why lenses work, and why we see mirages on hot roads. In a region of suppressed κ, light travels more slowly, which causes it to bend strongly toward the source centre. For a deep enough suppression, light from behind the device is bent so severely that it never reaches your eyes — you see a dark spot. This dark spot is surrounded by a bright ring, because light that almost reaches the darkest zone gets deflected and concentrated into a halo.

The black dot represents a locus at which light does not emerge — not a region of absorption, but a region of null-path closure or extreme path bending. Two physically distinct VERSF regimes produce subtly different observational signatures and must be treated separately.

5.2 Deflection Angle Derivation

In plain language: We calculate, for each ray of light passing near the device at a given distance, by how much the varying κ-field bends it. This tells us where the bright ring appears and how dark the central spot is.

The effective refractive index in the κ-depression is:

$$n_{eff}(r) = n_0 \cdot [1 - A \cdot e^{(-r^2/2\sigma^2)}]^{(-1/2)}$$

For the weak-field case ($A \ll 1$), we expand:

$n_{eff}(r) \approx n_0 \cdot [1 + (A/2) \cdot e^{(-r^2/2\sigma^2)}]$

The deflection angle for a ray with impact parameter b (the perpendicular distance from the source centre to the undisturbed ray path, with z the coordinate along the unperturbed ray) is, to leading order in A:

$$\theta(b) = (1/n_0) \cdot \int_{-\infty}^{\infty} |\partial n_{eff}/\partial b| \, dz$$

With $r^2 = b^2 + z^2$:

$$\partial n_{eff}/\partial b \approx n_0 \cdot (A/2) \cdot (-b/\sigma^2) \cdot e^{(-(b^2+z^2)/2\sigma^2)}$$

Therefore:

$$\theta(b) = (A \cdot b / 2\sigma^2) \cdot e^{(-b^2/2\sigma^2)} \cdot \int_{-\infty}^{\infty} e^{(-z^2/2\sigma^2)} \, dz = (A \cdot b / 2\sigma^2) \cdot e^{(-b^2/2\sigma^2)} \cdot \sqrt{2\pi\sigma^2}$$

$$\boldsymbol{\theta(b) = (A \cdot \sqrt{2\pi}/2) \cdot (b/\sigma) \cdot e^{(-b^2/2\sigma^2)}}$$

(in units where $n_0 = 1$; the sign gives inward bending toward the source centre). This result is valid for $A \ll 1$; the full strong-field case requires numerical ray-tracing.

Location of maximum deflection. Setting $d\theta/db = 0$:

$$d/db \, [(b/\sigma) \cdot e^{(-b^2/2\sigma^2)}] = (1/\sigma) \cdot (1 - b^2/\sigma^2) \cdot e^{(-b^2/2\sigma^2)} = 0 \Longrightarrow \boldsymbol{b_{max} = \sigma}$$

The maximum deflection occurs precisely at impact parameter $b = \sigma$. Rays passing at $b < \sigma$ are bent inward and, for sufficient A, redirected away from the observer; rays passing at $b > \sigma$ are less strongly deflected. The caustic formed by rays near $b = \sigma$ produces the bright annular structure surrounding the dark core.

Maximum deflection angle:

$$\theta_{max} = \theta(b = \sigma) = (A \cdot \sqrt{2\pi}/2) \cdot e^{(-1/2)} = A \cdot \sqrt{2\pi} / (2\sqrt{e}) \approx 0.760A \text{ rad}$$

For $A = 0.5$ this gives $\theta_{max} \approx 0.38$ rad $\approx 22°$. For the physically relevant amplitude $A = 0.99$, $\theta_{max} \approx 0.760 \times 0.99 \approx 0.753$ rad $\approx 43°$. A deflection of 43° is far outside the weak-field regime, confirming that quantitative intensity predictions at the relevant amplitude require numerical ray-tracing.

Crucially, however, **the location of maximum deflection at $b = \sigma$ is independent of the weak-field approximation.** It is a property of the functional form of $\theta(b)$, which is proportional to $(b/\sigma) \cdot e^{(-b^2/2\sigma^2)}$ for any amplitude. Setting $d\theta/db = 0$ on this factor yields $b_{max} = \sigma$ exactly, with no dependence on A or on the weak-field expansion. The amplitude A sets the *magnitude* of the deflection; it does not shift its *location*. Accordingly, the present work makes a robust prediction for the spatial scale $\sigma_{opt} = b_{max} = \sigma$, while leaving detailed intensity and profile structure in the strong-field regime to numerical treatment.

5.3 Regime I — Strong Lensing with Dark Core (A < 1)

In plain language: When the suppression is deep but not complete, the dark central region is a shadow — lighter than true blackness, but distinctly darker than the background. It is surrounded by a bright halo. Think of it like a very strong gravitational lens, but in reverse: instead of bending light toward a focus, it bends light around a void.

For $A < 1$, $\kappa(r) > 0$ everywhere and there is no true micro-horizon. However, n_{eff} rises steeply toward the centre, bending rays strongly. Rays with $b < \sigma$ are deflected sufficiently inward that, for A approaching 1, they miss the observer entirely. This produces:

- A **dark core** of apparent radius $\propto \sigma$, whose depth increases with A but whose flux does not reach zero (background sources are dimmed, not blacked out).
- A **bright annulus** at angular radius corresponding to $b \approx \sigma$, where deflected rays accumulate.
- An **apparent size** of the dark core that grows with A and scales with σ.

5.4 Regime II — Micro-Horizon (A → 1)

In plain language: When the suppression is essentially complete at the centre, κ drops to zero there. A point of zero κ is a point where light cannot escape — a tiny black hole analogue. The dark core becomes truly black: no light whatsoever arrives from that direction. The bright ring persists and sharpens.

When $A \to 1$, $\kappa(0) \to 0$ and the micro-horizon condition is reached at the source centre. Outgoing null paths from x_0 have infinite effective optical path length: no light escapes from that point. An external observer sees a strictly black focal point. The bright annulus at $b \approx \sigma$ persists and sharpens, and background sources observed through the central region have exactly zero transmitted flux.

The transition between regimes is smooth in A. *In both regimes, immediate vanishing of all optical effects upon source deactivation is predicted (P6); this is a channel-independent prediction, not a regime distinction.* The regime-specific observational distinctions are:

Feature	Regime I (A < 1)	Regime II (A → 1)
Central flux	Reduced but nonzero	Zero (true null locus)
Bright annulus	Present	Present, sharper
Core depth	Increases with A	Maximum (black)
Background through core	Dimmed	No transmission

The reported black dot — described as a distinct, localised absence of light — is most naturally identified with high-A Regime I or Regime II.

5.5 Deactivation as Discriminating Test

In plain language: This is the most powerful test available without expensive equipment. An absorptive or thermal dark region would fade gradually after the emitter is switched off. A VERSF-predicted dark region would vanish instantaneously, because it is a property of the field configuration, not a persistent material change.

As noted in §3.3, the field relaxation time after source removal is effectively instantaneous on human observational timescales. Therefore:

The black dot must vanish completely and instantaneously upon emitter deactivation.

This is the primary discriminator against thermal lensing (thermal diffusion timescale), ionisation opacity (recombination timescale ~μs to ms), and any absorptive mechanism. It requires only a simple on/off switching test with video recording.

5.6 Measurement of σ from the Optical Channel

The bright annulus angular radius provides a direct measurement of σ. Defining the optical channel measurement σ_{opt} as the annulus impact parameter at maximum deflection:

$\sigma_{opt} \equiv b_{max}$ = (angular radius of annulus) × D

where D is the distance from the source to the observation plane. From §5.2, $b_{max} = \sigma$ exactly, so $\sigma_{opt} = \sigma$. This must be consistent with σ_τ from the temporal channel via the predicted ratio $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$.

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6. Observable 3 — The Blue Corona

6.1 Physical Identification

In plain language: At the edge of the suppressed region, the transition from "slow space" to "normal space" is steep. This edge is a surface where the rate of physical events changes sharply over a short distance — it is the boundary between two different rates of time. This sharp boundary acts like a kind of energy discontinuity, and in the VERSF framework it produces a glow at the edge of the field, not at the emitter itself.

At the boundary of the κ-anomaly, the commitment rate undergoes its steepest gradient. From §3.1, this gradient peaks at $r = \sigma$. The interface between the suppressed interior and the ambient exterior constitutes a commitment-rate discontinuity: physical processes on either side proceed at different rates. In VERSF, commitment-boundary events are concentrated at this layer.

The corona is not a surface emission from the emitter itself but a field-boundary phenomenon localised at $r \approx \sigma$. Its radius therefore encodes σ independently of emitter geometry.

6.2 Luminosity Profile

In plain language: We can calculate exactly where the glow is brightest. It turns out the luminosity is proportional to the square of the rate of change of κ. This peaks at r = σ, confirming that the corona appears at the edge of the suppressed region.

The commitment-event density at the boundary layer is proportional to $|\nabla\kappa|^2$:

$$|\nabla\kappa(r)|^2 = \kappa_0^2 A^2 \cdot (r^2/\sigma^4) \cdot e^{(-r^2/\sigma^2)}$$

(noting that $[e^{(-r^2/2\sigma^2)}]^2 = e^{(-r^2/\sigma^2)}$).

Verification of peak at r = σ. Setting $d|\nabla\kappa|^2/dr = 0$:

$$d/dr\, [r^2 \cdot e^{(-r^2/\sigma^2)}] = 2r \cdot (1 - r^2/\sigma^2) \cdot e^{(-r^2/\sigma^2)} = 0 \Longrightarrow r = \sigma \checkmark$$

The corona luminosity $L(r) \propto |\nabla\kappa(r)|^2$ peaks precisely at r = σ, with peak value:

$$L\_peak \propto \kappa_0^2 A^2 / (\sigma^2 \cdot e)$$

The peak luminosity scales as A^2/σ^2: a deeper or more compact depression produces a brighter corona. The full width at half maximum is determined by:

$$r^2 \cdot e^{(-r^2/\sigma^2)} = \sigma^2/(2e) \Longrightarrow \text{FWHM} \approx 0.64\sigma$$

(solved numerically). The corona is a relatively narrow annular feature.

6.3 Effective Potential Difference and Discharge Character

In plain language: Charged particles crossing the boundary between slow and normal space experience an effective energy difference proportional to the rate difference between the two sides. This is analogous to a voltage difference and drives charge separation and electromagnetic emission — explaining the crackling sound and the glow. Larger A means a larger effective voltage and more vigorous discharge.

At the corona radius r = σ, the local proto-time rate is (substituting r = σ into the field profile):

$$\dot{\tau}(r = \sigma) = 1 - A \cdot e^{(-\sigma^2/2\sigma^2)} = 1 - A \cdot e^{(-1/2)}$$

With $e^{(-1/2)} \approx 0.6065$:

$$\dot{\tau}(r = \sigma) = 1 - 0.6065\, A$$

This is an explicit evaluation at r = σ, not a general expression. The fractional rate discontinuity between the corona layer and the ambient bulk ($\dot{\tau} = 1$) is:

$\Delta\dot{\tau}|_{r=\sigma} = 0.6065\ A$

The effective potential difference experienced by charge carriers crossing this boundary is:

$\Delta V_{eff} \propto 0.6065\ A$

This increases linearly with A: stronger emitter activation produces larger effective potential difference and more vigorous discharge — an experimentally testable prediction.

6.4 On the Spectral Character of the Emission

In plain language: The blue colour of the corona is consistent with high-energy photon emission, but we cannot calculate the exact colour from our framework at this stage. The spatial predictions (where the corona appears and how bright it is) are robust; the spectral prediction is qualitative only.

The reported blue colouration is qualitatively consistent with high-frequency photon emission from high-density commitment-boundary events. A parameter-free derivation of the emission spectrum from κ-field parameters is not currently available. The spectral claim is therefore a qualitative consistency note, not a quantitative prediction. The falsifiable predictions for this observable are spatial (corona at $r \approx \sigma$) and dynamical (luminosity $\propto A^2$, radius tracking emitter power).

6.5 Measurement of σ from the Corona

The corona radius provides the third independent measurement of σ. Defining:

$\sigma_{em} \equiv r_{corona}$ = radius of peak luminosity

From §6.2, $r_{corona} = \sigma$, so $\sigma_{em} = \sigma$. This must agree with σ_{opt} (= σ) and be consistent with σ_τ (= $\sigma\sqrt{2 \ln 2}$) via the predicted ratio $\sigma_\tau/\sigma_{em} = \sqrt{2 \ln 2} \approx 1.18$.

6.6 Observational Criteria

The corona observation is consistent with the VERSF κ-depression if:

- The corona appears at radius $r \approx \sigma_{em}$, not at the emitter surface radius.
- **The corona radius increases as emitter power decreases** (lower A → shallower depression → gradient peak moves outward): opposite to a surface discharge, which would track emitter geometry.
- Discharge intensity scales as A^2 (from the luminosity relation).
- **The corona vanishes immediately upon deactivation.**
- Enclosure within a Faraday cage does not eliminate the corona: an electrostatic surface discharge would be suppressed by the cage; a field-boundary discharge at $r \approx \sigma >$ emitter radius would not.

7. Unified Constraint and Falsifiability

7.1 Why This Cannot Be a Refractive or Thermal Artefact

In plain language: A sceptical physicist will immediately ask: couldn't a hot emitter produce a refractive index gradient in the surrounding air that mimics all three of these effects? This subsection explains why that explanation fails — not just for one observable, but for all three simultaneously, and for a specific predicted ratio between channel measurements that no thermal model generates.

The most natural classical objection is that all three effects are artefacts of a localised refractive index gradient produced by heating or ionisation — a well-understood phenomenon in optics and atmospheric physics. We identify four independent arguments against this interpretation, each individually compelling and jointly decisive.

Argument 1: Deactivation timescale. A thermal or refractive index gradient produced by heated air or a plasma persists after source removal, decaying on the thermal diffusion timescale $\tau_{thermal} \sim L^2/\alpha$, where $L \sim \sigma$ is the length scale and $\alpha \sim 2\times10^{-5}$ m²/s is the thermal diffusivity of air. For $\sigma \sim 10$ cm, $\tau_{thermal} \sim 500$ s. Even for $\sigma \sim 1$ cm, $\tau_{thermal} \sim 5$ s. Ionisation recombination is shorter (μs to ms) but still measurable. The VERSF prediction is sub-nanosecond relaxation — effectively instantaneous on any recording timescale. **A single high-frame-rate video of the switch-off event discriminates decisively.**

Argument 2: Cross-channel scale consistency with a predicted ratio. A thermal gradient produces optical lensing at one spatial scale (set by the temperature profile), flame perturbation at a second scale (set by convective airflow), and corona discharge at a third scale (set by the ionisation zone or emitter geometry). These three scales are governed by entirely different physical processes and have no reason to be related. To make this concrete: thermal lensing from a heated element typically operates over millimetre-to-centimetre scales set by temperature gradient extent; convective flame suppression operates over centimetre-to-decimetre scales set by fluid dynamics; and ionisation corona discharge is localised to the emitter surface, typically at millimetre scale. The classical scale separation between these three effects spans one to two orders of magnitude with no predicted ratio between them. VERSF predicts $\sigma_{opt} = \sigma_{em} = \sigma$ and $\sigma_\tau = \sqrt{2 \ln 2} \cdot \sigma_{opt} \approx 1.18 \cdot \sigma_{opt}$ — a specific numerical ratio of 1.18 between independent channel measurements, all governed by the single Gaussian width σ. **No thermal model predicts this three-channel consistency or the specific ratio $\sqrt{2 \ln 2}$.**

Argument 3: Corona position and power dependence. A heated or electrically active emitter produces corona discharge at its own surface — at the emitter's physical radius, not at a field-determined scale σ in the surrounding space. The VERSF prediction is that the corona appears at $r \approx \sigma >$ emitter radius, and that this radius *decreases* with increasing emitter power (stronger depression → steeper gradient → more compact boundary layer). This is opposite to a surface discharge (stronger power → more extended plasma). **Measuring the corona radius as a function of emitter power distinguishes these behaviours unambiguously.**

Argument 4: Chemistry and fuel independence. A thermal artefact suppresses the flame via oxygen displacement, temperature change, or convective disruption — all fuel-dependent and chemistry-dependent. The VERSF suppression acts on the local commitment rate, which is a property of the κ-field, not of the chemistry. A suppressed region equally arrests a propane flame, a hydrogen flame, a non-combustion oscillating membrane, or any other rapid irreversible process. **Testing the slowdown on multiple process types, sealed from airflow, distinguishes rate suppression from chemical interference.**

The thermal/refractive artefact hypothesis must simultaneously explain: (i) instantaneous cessation upon deactivation; (ii) three-channel consistency with the specific predicted ratio $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$; (iii) a corona outside the emitter surface whose radius scales inversely with power; and (iv) suppression that is chemistry-independent. No combination of thermal physics accounts for all four simultaneously.

7.2 The Single-Field Requirement

In plain language: All three effects are produced by the same underlying field, described by the same two numbers A and σ. The measurements from each channel are not all equal — the temporal measurement σ_τ is predicted to be 1.18 times larger than σ_{opt} and σ_{em}, because these channels measure different geometric features of the same Gaussian profile. If the measured values are inconsistent with this predicted pattern, the VERSF explanation is falsified.

All three observables depend on the same underlying field parameters {A, σ}. The three directly measured channel quantities are:

- **σ_τ** $\equiv r_{1/2}$: the half-depth radius of the temporal suppression profile (§4.3). VERSF predicts $\sigma_\tau = \sigma \cdot \sqrt{2 \ln 2} \approx 1.18\sigma$.
- **σ_{opt}** $\equiv b_{max}$: the bright annulus angular radius from the optical channel (§5.6). VERSF predicts $\sigma_{opt} = \sigma$.
- **σ_{em}** $\equiv r_{corona}$: the corona peak radius from the electromagnetic channel (§6.5). VERSF predicts $\sigma_{em} = \sigma$.

The central falsifiability criterion is:

$$\sigma_\tau / \sqrt{2 \ln 2} = \sigma_{opt} = \sigma_{em} \equiv \sigma$$

equivalently:

$$\sigma_\tau = \sqrt{2 \ln 2} \cdot \sigma_{opt} \approx 1.18 \cdot \sigma_{opt} = 1.18 \cdot \sigma_{em}$$

These are three independent experimental measurements, each using a different physical channel. Their consistency — including the specific predicted ratio $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ — is not a model-fitting condition but a structural prediction. A coincidental set of unrelated classical effects would have no reason to satisfy it.

7.3 Amplitude Consistency

Beyond σ, the amplitude A must be consistent across observables:

- A_τ: amplitude inferred from the central temporal suppression depth: $A_\tau = 1 - \dot{\tau}(0)$
- A_{em}: amplitude inferred from the corona discharge intensity: $A_{em} \propto \sqrt{L_{peak} \cdot \sigma^2 \cdot e / \kappa_0^2}$

The consistency condition $A_\tau = A_{em}$ provides a further falsification condition independent of σ.

7.4 Consistency Summary Table

Measured quantity	Definition	VERSF prediction
σ_τ	Half-depth radius $r_{1/2}$ of temporal suppression profile	$\sigma \cdot \sqrt{2 \ln 2} \approx 1.18\sigma$
σ_{opt}	Bright annulus impact parameter b_{max}	σ
σ_{em}	Corona peak luminosity radius r_{corona}	σ
$\sigma_\tau / \sigma_{opt}$	Cross-channel ratio (primary consistency test)	$\sqrt{2 \ln 2} \approx 1.18$
A_τ	Central slowdown depth: $1 - \dot{\tau}(0)$	A
A_{em}	Corona peak intensity	A (via $L \propto A^2/\sigma^2 e$)

The ratio $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ reflects the geometric fact that σ_τ is the half-depth radius of the Gaussian while σ_{opt} is the radius of its maximum gradient. These measure different features of the same profile and are predicted to differ by this specific factor. This ratio is independently falsifiable without requiring knowledge of A or κ_0.

7.5 Classical Null Hypotheses

In plain language: Good science requires ruling out mundane explanations before claiming something unusual. For each reported effect, we list the most plausible conventional explanation and the specific test that distinguishes it from the VERSF prediction.

Observable	Classical candidate	Discriminating test
Frozen flame	Thermal convection disruption; oxygen displacement	Sealed combustion chamber; multiple fuel types; non-combustion rapid processes (e.g. vibrating membrane)
Black dot	Thermal lensing; ionisation opacity	Deactivation test: thermal/ionic effects persist μs–s; VERSF effect vanishes sub-ns
Black dot size	Refractive index from emitter surface	Size must scale with σ_{opt} (field scale), not emitter aperture
Corona	Electrostatic surface discharge	Faraday cage enclosure; corona radius must exceed emitter radius

Observable	Classical candidate	Discriminating test
Corona power dependence	Emitter heating or direct radiation	Radius decreases with power (VERSF) vs. increases (surface discharge)
Cross-channel ratio	Independent unrelated mechanisms	$\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ predicted; any classical mechanism would require coincidence

The VERSF hypothesis requires that classical residuals remain after all known mechanisms are subtracted, and that the residuals are consistent with a single (A, σ) solution satisfying the cross-channel predictions of §7.2.

8. Open Problems and Limitations

In plain language: Honesty is a core scientific value. This section lists what our analysis has not yet achieved. The most important gaps are: the corona emission spectrum cannot be predicted; the strong-field optical intensity (as opposed to spatial scale) requires numerical work; and the internal mechanism of the emitter is deliberately not addressed.

1. n_eff full dispersion derivation. The exponent $\gamma = 1/2$ in the optical response law is fixed uniquely by the three internal consistency requirements of §2.3: metric-conformal consistency, null-cone compatibility, and recovery of the gravitational optical limit. The outstanding open task is not exponent selection — which is settled — but derivation of the full photon dispersion relation from the complete VERSF field equations, including sub-leading corrections and back-reaction terms in an anomalous κ-background.

2. Strong-lensing regime. The deflection angle formula (§5.2) was derived in the weak-field limit $A \ll 1$. At the physically relevant amplitude $A = 0.99$, the weak-field formula gives $\theta_{max} \approx 43°$, confirming the approximation has broken down. Numerical ray-tracing in the full $n_{eff}(r)$ profile is required for quantitative predictions of deflection magnitude, annulus angular brightness, and core depth. As established in §5.2, the spatial scale prediction $\sigma_{opt} = b_{max} = \sigma$ is invariant and does not depend on the weak-field approximation; it is the deflection magnitudes — not the spatial scale — that require numerical refinement.

3. Source mechanism (intentionally out of scope). The emitter is treated as a black box producing a κ-depression of given (A, σ). This is intentional: the present paper establishes the observable consequences of such a configuration, not the mechanism of its production. Whether and how a physical device creates and sustains a κ-depression is a separate theoretical problem — analogous to deriving the observable consequences of a magnetic monopole or domain wall without possessing a laboratory synthesis route.

4. Corona emission spectrum. A parameter-free derivation of the corona emission frequency from κ-field parameters is not available. The spectral prediction remains qualitative.

5. Formal stability analysis. The driven-steady-state interpretation (§3.3) provides qualitative consistency with instantaneous deactivation. A quantitative stability criterion and the precise field relaxation timescale are reserved for subsequent work.

6. Self-consistent back-reaction. All derivations assume the κ-field profile as given and derive observable consequences. A complete treatment requires solving the coupled field equations in which the observables back-react on κ(x) self-consistently.

7. κ-field propagation speed. The sub-nanosecond deactivation estimate (§3.3) assumes the κ-field propagates perturbations at the vacuum speed of light c. This is an assumption adopted for the present estimate, not a derived result. A derivation of the κ-field signal velocity from the complete VERSF dynamical equations is an open task.

8. Commitment-potential Φ(κ): form unspecified. The effective matter action of Appendix D.6.1 introduces a commitment potential Φ(κ) whose existence and sign properties resolve the acceleration coupling, but whose functional form is not derived from first principles. The sign of dΦ/dκ in each physical regime is physically motivated but not calculated; the magnitude of α in the linear limit $a = -\alpha\nabla\kappa$ is unconstrained. Deriving Φ(κ) from the VERSF fold energetics — specifically from how spatial variation in κ modifies the fold commitment barrier Φ_c — is the next necessary step before the propulsion law can be made quantitatively predictive.

9. κ-field ontology: foundational derivation. The commitment-capacity density κ(x) is treated throughout this paper as a well-defined physical field whose properties are assumed rather than derived from quantum mechanics or statistical mechanics. Within the VERSF programme, κ is grounded in fold density and commitment dynamics, but the precise relationship between κ(x) and the underlying substrate state — how it couples to matter at the quantum level, how it relates to the density matrix of the substrate, and whether it has an independent dynamical equation beyond the driven-source treatment of §3 — remains a foundational open question. This is the level at which the most fundamental criticism of the framework will be levelled: κ is still a postulated field whose microscopic derivation from first principles is not yet complete. The gravity papers (Taylor, K., "Gravity from Fold Density Gradients," AIDA Institute) provide the most complete treatment currently available, deriving the sourcing law from fold ontology; extending this to the full dynamical equation for κ(x) in the presence of anomalous sources is the priority foundational task.

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9. Discussion

In plain language: We step back and assess what the analysis has actually established. The key point is not that any of the three effects is individually explained — individually, each could have a mundane cause. The key point is that all three are governed by the same two numbers (A and σ), with specific predicted ratios between the channel measurements, so they cannot independently be assigned arbitrary classical explanations.

The three reported observables form a structurally coherent pattern. Within VERSF, all three trace to a single physical configuration — a localised κ-depression — governed by amplitude A and spatial scale σ. The non-triviality of this identification lies in the cross-channel consistency requirement: three qualitatively distinct measurements must be consistent with a single σ, with the ratio $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ predicted exactly. No classical explanation offers a reason for this. The four-argument case against the thermal/refractive artefact interpretation (§7.1) is particularly important: thermal explanations fail not merely on one observable but on the simultaneous conjunction of all three, and on the specific predicted ratio between the temporal and optical spatial scales.

The regime distinction (§5.3–5.4) is physically important. The transition from Regime I (dark lensing core) to Regime II (true micro-horizon) is continuous in A and cannot be resolved by a single observation without controlled variation of emitter power. At A = 0.99, the weak-field deflection formula gives $\theta_{max} \approx 43°$, confirming that numerical modelling is required for the high-A regime. The spatial scale prediction $\sigma_{opt} = \sigma$ is robust regardless.

The deactivation test is accessible without specialised equipment. A video recording at high frame rate of the simultaneous onset and cessation of all three effects, correlated with the emitter switching state, would provide a powerful first-tier experimental test. Classical effects relax on timescales from microseconds (ionisation) to hundreds of seconds (thermal); the VERSF prediction is sub-nanosecond relaxation — effectively instantaneous.

The corona's spatial position (r ≈ σ, not at the emitter surface) is the key electromagnetic discriminator. Measuring the corona radius and comparing it to the emitter's physical dimensions provides an immediate test of field-boundary origin versus surface discharge.

The minimum threshold A ≥ 0.99 for full apparent flame arrest (§4.2) is a strong constraint — but it applies only to the most extreme observational regime. Amplitudes as low as A ~ 0.5 already produce instrumentally detectable temporal suppression.

Two of the most load-bearing quantities in the present analysis are the optical response exponent and the arrest threshold amplitude. In both cases, the relevant claim is narrower than a first reading may suggest: the exponent 1/2 is fixed as a uniqueness condition within the admissible VERSF optical class (§2.3), not merely chosen for convenience; and A ≥ 0.99 applies only to full apparent arrest over macroscopic viewing times, while much weaker suppressions are already detectable (§4.2).

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10. Experimental Protocol

10.1 Experimental Setup

In plain language: We are not assuming any particular exotic device. The protocol is designed for any controllable system — natural or artificial — that produces a small, stable, localised disturbance in its surroundings. The experiment's purpose is to determine whether any such disturbance has the specific structure this paper predicts: three observables with a single underlying σ and specific ratios between channel measurements, all vanishing simultaneously upon deactivation.

The experimental configuration requires a controllable source capable of producing a localised, approximately stationary perturbation in the surrounding physical environment — hereafter the emitter — without assuming any specific underlying mechanism. The analysis is explicitly agnostic as to the origin of the perturbation. Examples of systems that produce strongly localised field perturbations within conventional physics include high-voltage electrodes generating corona discharge and localised electromagnetic gradients; focused laser systems producing confined regions of high optical intensity; and magnetically confined plasmas exhibiting sharp spatial boundaries. These demonstrate that bounded regions of altered physical behaviour can arise from field structure alone. The present protocol generalises this concept to a perturbation in κ(x), using the predicted signatures (§4–§6) and cross-channel consistency condition (§7.2) as the discriminating criteria.

Minimal Apparatus Requirements

Component	Function
Controllable emitter (any type)	Generates localised, reproducible perturbation
Enclosed observation volume	Eliminates thermal convection and airflow artefacts (§7.1, Argument 4)
Time-varying test process	Temporal channel: flame, driven oscillator, or mechanical oscillator
Calibrated background pattern	Optical channel: grid or point-source array for distortion mapping
High-speed imaging system (≥1000 fps)	Captures deactivation transients; resolves flicker suppression
Low-light photometric system	Electromagnetic channel: corona luminosity and radius measurement

Optional enhancements:

Enhancement	Classical mechanism addressed
Faraday cage enclosure	Eliminates electrostatic surface discharge as corona origin (§6.6)
Variable emitter power control	Tests A-dependence of all three observables
Collimated laser probes	Precise ray-path mapping for σ_opt independent of background illumination
Sealed combustion chamber	Eliminates airflow explanations for temporal suppression (§7.1, Argument 4)
Multiple test-process types	Tests chemistry independence (§4.4)

Operational Definition of the Emitter

For the purposes of this protocol, the emitter is defined operationally as:

A system whose activation produces a reproducible, spatially localised modification of observable behaviour across one or more measurement channels — temporal, optical, or electromagnetic — and which disappears upon deactivation.

No assumption is made regarding the internal mechanism. The experimental objective is solely to determine whether the resulting observables conform to the cross-channel consistency constraints of §7.2: specifically, whether $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ and $\sigma_{opt} = \sigma_{em}$, and whether all three observables vanish simultaneously and instantaneously upon deactivation (P6).

Measurement Hierarchy

Tier 1 — Deactivation test (P6). High-frame-rate video of a single switch-on/switch-off cycle capturing all three channels simultaneously. This test is decisive against all classical thermal and refractive artefacts and requires no specialised equipment. It should be the first experiment performed.

Tier 2 — Single-channel σ measurement. Measure σ_{em} from the corona radius and σ_{opt} from the bright annulus radius independently. Agreement between these two measurements already constitutes a non-trivial consistency test.

Tier 3 — Full cross-channel consistency. Measure σ_τ from the spatial falloff of the temporal suppression profile (§4.3). Verify that $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ and $\sigma_{em} = \sigma_{opt}$. This is the primary falsifiability test of the single-field hypothesis.

Note on simultaneous measurement. For the cross-channel consistency test (§7.2), all three observables should ideally be monitored within a single activation event. Sequential measurements across separate activations cannot rule out run-to-run variation in the emitter state, and would weaken the single-field consistency argument.

Tier 4 — Amplitude scaling. Vary emitter power and measure corona intensity (should scale as A^2); corona radius (should increase as A decreases); temporal suppression depth at fixed position (should follow the Gaussian profile). This tier tests the functional form of the κ-depression, not merely its spatial scale.

10.2 Control Experiments

In plain language: Good experimental design requires comparing the emitter against a conventional source that produces similar amounts of heat, light, and electromagnetic output — but through known physics. Only effects that appear exclusively in the emitter-active configuration, survive the cross-channel consistency tests, and vanish instantaneously upon deactivation are relevant signals.

Baseline control runs must be conducted in which the emitter is replaced by a known classical source producing comparable thermal, optical, or electromagnetic output at the same energy scale:

Control source	Classical mechanism exercised	Channel(s) tested
Resistively heated element	Thermal convection; refractive index gradient from heated air	Temporal; Optical
Plasma discharge (e.g. Tesla coil, spark gap)	Ionisation corona; electromagnetic surface discharge	Electromagnetic
Focused optical beam (laser)	Refractive index gradient; optical trapping	Optical
Ultrasonic transducer	Acoustic pressure-driven refractive variation	Optical; Temporal

Residual signal definition. The relevant signal for comparison with VERSF predictions consists of phenomena observed in the emitter-active configuration that satisfy all three of the following conditions after subtraction of the control baseline:

1. **Present in emitter-active state** and absent (or at significantly different scale/timescale) in all matched-energy control runs.
2. **Deactivation-instantaneous**: vanishing within the frame resolution of the high-speed camera upon switch-off, while the matched classical source produces measurable persistence (§7.1, Argument 1; P6).
3. **Cross-channel σ-consistent**: residual spatial scales satisfy $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ and $\sigma_{em} = \sigma_{opt}$ within measurement uncertainty (§7.2; P7, P8).

A residual satisfying all three conditions constitutes the relevant experimental input for comparison with VERSF predictions. Satisfying only one or two conditions is insufficient: the classical null hypothesis is falsified only when all three conditions are met simultaneously, because each can in principle be satisfied independently by a different unrelated artefact.

This control structure directly implements the four-argument anti-thermal case of §7.1 as an experimental programme.

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11. Conclusion

We have demonstrated within the VERSF framework that a single localised κ-depression, parameterised by amplitude A and spatial extent σ, produces three qualitatively distinct but quantitatively linked observable signatures:

1. Frozen flame. Temporal suppression manifesting as apparent slowing of rapid physical processes, with three observational regimes: detectable ($A \geq 0.5$), visually striking ($A \approx 0.875$, ~8× slowdown), and full apparent arrest over a 10-second window ($A \geq 0.99$ within $r_c < 0.14\sigma$

of the source centre). The temporal half-depth radius $\sigma_\tau = \sigma \cdot \sqrt{2 \ln 2} \approx 1.18\sigma$ provides the primary temporal channel measurement of the underlying scale σ.

2. Black dot. In Regime I ($A < 1$): a dark lensing core surrounded by a bright annulus at $b \approx \sigma$, with the weak-field deflection angle $\theta(b) = (A\cdot\sqrt{2\pi}/2) \cdot (b/\sigma) \cdot e^{-b^2/2\sigma^2}$ derived explicitly. At the physically relevant amplitude $A = 0.99$, $\theta_{max} \approx 43°$, confirming the weak-field formula is in regime breakdown and that quantitative intensity predictions require numerical treatment. The spatial scale $\sigma_{opt} = b_{max} = \sigma$ is amplitude-invariant. In Regime II ($A \to 1$): a true micro-horizon with zero transmitted flux. In both regimes, **immediate vanishing upon deactivation** is the definitive discriminating test.

3. Blue corona. A commitment-boundary discharge at radius $r = \sigma_{em} = \sigma$ — verified as the gradient maximum analytically — with luminosity $\propto A^2/\sigma^2 e$ and effective potential difference $\Delta V_{eff} \propto 0.6065\, A$ evaluated at $r = \sigma$. Corona radius tracks field extent, not emitter geometry.

The primary falsifiability criterion is the cross-channel consistency condition:

$$\sigma_\tau / \sqrt{2 \ln 2} = \sigma_{opt} = \sigma_{em} \equiv \sigma$$

equivalently: $\sigma_\tau = 1.18 \cdot \sigma_{opt} = 1.18 \cdot \sigma_{em}$. The predicted ratio $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ is itself independently testable and predicted without any free parameters. The framework provides a unified and internally constrained account of a structurally specific set of reported phenomena, and establishes a clear experimental programme for their investigation.

Appendix A — Notation Summary

Symbol	Definition
$\kappa(x)$	Commitment-capacity density at position x
κ_0	Ambient bulk commitment-capacity density
$\rho_f(x)$	Fold density = $\kappa(x)/\kappa_0$
$\dot{\tau}(x)$	Local proto-time rate = $\kappa(x)/\kappa_0$
A	Depression amplitude $\in (0, 1]$
σ	Spatial extent of κ-anomaly (Gaussian width); the underlying field parameter
x_0	Source centre
r	Distance from source centre
b	Ray impact parameter
$n_{eff}(x)$	Effective refractive index = $n_0 \cdot (\kappa_0/\kappa)^{1/2}$
γ	Optical response exponent (uniquely fixed at $\gamma = 1/2$)
$\theta(b)$	Ray deflection angle at impact parameter b
μ^{-1}	Yukawa range parameter

Symbol	Definition
c_κ	κ-field signal propagation speed (assumed ~ c in §3.3)
σ_τ	Temporal channel measurement: half-depth radius $r_{1/2} = \sigma\sqrt{2 \ln 2} \approx 1.18\sigma$
σ_{opt}	Optical channel measurement: annulus radius $b_{max} = \sigma$
σ_{em}	Electromagnetic channel measurement: corona peak radius = σ
L(r)	Corona luminosity profile ∝
ΔV_{eff}	Effective potential difference at corona radius

Appendix B — Summary of Falsifiable Predictions

Label	Observable	VERSF Prediction	Experimental access
P1	Temporal suppression profile	Gaussian envelope; $\sigma_\tau = \sigma \cdot \sqrt{2 \ln 2} \approx 1.18\sigma$	Flame slowdown at multiple distances
P2	Temporal threshold — detectable	$A \geq 0.5$ at $r_c = 0$ gives ≥ 2× slowdown	High-speed video; frame-rate comparison
P3	Temporal threshold — striking	$A \approx 0.875$ at $r_c = 0$ gives ~8× slowdown; visually unmistakable	Standard video recording
P3a	Temporal threshold — full arrest	$A \geq 0.99$ required at $r_c < 0.14\sigma$ for apparent arrest over 10 s	High-speed video; candle position scan
P4	Black dot regime	Partial shadow (Regime I) or null locus (Regime II); distinguished by background flux through core	Background-source transmission measurement
P5	Black dot annulus	Bright annulus at $b_{max} = \sigma_{opt}$; size ∝ σ	Angular size measurement
P6	Deactivation test (Tier 1 priority)	All three effects vanish instantaneously upon source removal; no thermal recovery time	High-frame-rate video at switching event; first experiment to perform
P7	Cross-channel scale ratio (primary)	$\sigma_\tau / \sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$; $\sigma_{opt} = \sigma_{em}$	Ratio of independent channel measurements
P8	Spatial centre coincidence	All three observables centred on same x_0	Geometry of apparatus
P9	Corona radius vs emitter	σ_{em} > emitter physical radius; scales inversely with power	Physical measurement
P10	Corona intensity scaling	$L_{peak} \propto A^2$	Photometric measurement vs emitter power

Label	Observable	VERSF Prediction	Experimental access
P11	Corona Faraday test	Corona persists inside Faraday cage	Shielding experiment
P12	Effective potential scaling	$\Delta V_{eff} \propto 0.6065\ A$ (linear in A)	Discharge voltage vs power
P13	Anti-thermal conjunction	All four anti-thermal arguments (§7.1) must simultaneously fail; any classical rescue must account for all four constraints jointly	Multi-test experimental programme
P14	Simultaneous channel consistency	Cross-channel σ ratio verified within a single activation event	Three-channel simultaneous recording

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Appendix C — Mathematical Derivations at a Glance

C1. Gaussian gradient maximum at r = σ:

$\frac{d}{dr}\left[(r/\sigma^2) \cdot e^{(-r^2/2\sigma^2)}\right] = (1/\sigma^2) \cdot (1 - r^2/\sigma^2) \cdot e^{(-r^2/2\sigma^2)} = 0 \Rightarrow r = \sigma$

C2. Temporal half-depth radius:

$A \cdot e^{(-r_{1/2}^2/2\sigma^2)} = A/2 \Rightarrow r_{1/2} = \sigma \cdot \sqrt{2 \ln 2} \approx 1.177\sigma$

C3. Deflection angle (weak field) and maximum:

$\theta(b) = (A \cdot \sqrt{2\pi} / 2) \cdot (b/\sigma) \cdot e^{(-b^2/2\sigma^2)}$

$\theta_{max} = \theta(b = \sigma) = A \cdot \sqrt{2\pi} / (2\sqrt{e}) \approx 0.760\ A$ rad

At $A = 0.99$: $\theta_{max} \approx 0.753$ rad $\approx 43°$ (weak-field approximation broken)

C4. Amplitude-independence of b_max:

The deflection angle is proportional to $f(b) = (b/\sigma) \cdot e^{(-b^2/2\sigma^2)}$ for any A. Setting $f'(b) = 0$:

$f'(b) = (1/\sigma) \cdot (1 - b^2/\sigma^2) \cdot e^{(-b^2/2\sigma^2)} = 0 \Rightarrow b_{max} = \sigma$

This derivation contains no factor of A. The location of maximum deflection is a geometric property of the Gaussian profile, independent of amplitude and of the weak-field approximation.

C5. Corona luminosity peak at r = σ:

$\frac{d}{dr}\left[r^2 \cdot e^{(-r^2/\sigma^2)}\right] = 2r \cdot (1 - r^2/\sigma^2) \cdot e^{(-r^2/\sigma^2)} = 0 \Rightarrow r = \sigma$

C6. Effective potential at $r = \sigma$:

$\Delta V\_eff \propto \Delta\dot{\tau}|\_\{r=\sigma\} = A \cdot e^{(-½)} \approx 0.6065\ A$

C7. Temporal suppression at $r = \sigma/2$, $A = 0.99$:

$\dot{\tau}(\sigma/2) = 1 - 0.99 \cdot e^{(-1/8)} = 1 - 0.99 \times 0.8825 = 0.126 \Longrightarrow$ slowdown $\approx 7.9\times$

C8. FWHM of corona emission ring:

$r^2 \cdot e^{(-r^2/\sigma^2)} = \sigma^2/(2e) \Longrightarrow$ FWHM $\approx 0.64\sigma$ (solved numerically)

Appendix D — Origin of the Phenomenological Configuration and Interpretation of the Emitter

In plain language: This appendix explains where the idea for this paper came from, and what kind of physical mechanism would be required if such effects were ever observed. The key point is not whether any original report is true, but what this specific *combination* of effects would imply physically if it were reproduced under controlled conditions.

The configuration analysed in this work — the simultaneous presence of (i) apparent temporal suppression, (ii) a localised optical null or strong lensing feature, and (iii) a boundary-layer electromagnetic emission — was motivated in part by publicly described experimental accounts, most notably those attributed to Bob Lazar. These accounts describe a directed emitter producing three striking effects in a confined spatial region: a candle flame appearing frozen in place; a small, sharply defined dark focal region; and a surrounding luminous boundary accompanied by electromagnetic activity.

The present work does not rely on the validity of these accounts. They are treated here as a representative phenomenological configuration — a specific combination of temporal, optical, and electromagnetic anomalies that can be subjected to rigorous internal consistency analysis within a physical framework. The analysis stands or falls on the theoretical consistency conditions derived in §§4–7, not on any particular evidential claim.

D.1 Why This Combination Is Physically Significant

In plain language: Each of the three reported effects has a conventional explanation on its own. What is unusual is the *combination* — and the fact that, if they share a common cause, that cause must operate across temporal, optical, and electromagnetic channels simultaneously with a specific spatial relationship between them.

Individually, each reported effect admits conventional explanations:

- Flame suppression → airflow disruption or oxygen depletion
- Optical distortion → refractive index gradient from heated or ionised air
- Corona emission → ionisation or electrostatic surface discharge

However, the simultaneous occurrence of all three, with a shared spatial scale, a common source centre, and instantaneous disappearance upon deactivation, places strong constraints on any viable explanation. As established in §7.1, no combination of thermal or refractive mechanisms accounts for all three simultaneously — in particular, no classical mechanism predicts the specific ratio $\sigma_\tau/\sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$ between independent channel measurements.

Within VERSF, this combination arises naturally from a single localised depression in the commitment-capacity field $\kappa(x)$, characterised by amplitude A and spatial extent σ.

D.2 Interpretation of the Emitter Within VERSF

In plain language: If a system were capable of producing these effects, what would it have to be doing? In VERSF, the answer is: suppressing the rate at which irreversible physical events occur in a bounded region of space. Everything else — the frozen flame, the dark spot, the glowing edge — follows from that single modification.

If a system were capable of producing the described effects, its action can be interpreted within VERSF as follows: the emitter generates a localised suppression of $\kappa(x)$, creating a bounded region in which the rate of irreversible physical processes is reduced relative to the ambient environment. This single modification produces all three observable signatures — temporal suppression of the commitment rate (frozen flame), increased effective refractive index causing strong light-path bending and potential null-path closure (black dot), and a commitment-boundary discharge at the gradient maximum $r = \sigma$ (corona) — as derived in detail in §§4–6.

D.3 What the Emitter Would Have to Be Doing

In plain language: The emitter is not primarily a heat source, a light source, or a conventional electromagnetic device. If the VERSF interpretation is correct, it is a driver of the κ-field — a device that actively maintains a localised deviation from the ambient rate of physical processes.

From this perspective, the emitter would not be acting via:

- thermal output,
- optical emission,
- or conventional electromagnetic forcing.

Instead, it must be acting as an active driver of the κ-field, maintaining a localised, steady-state depression from the ambient value κ_0. In practical terms this implies:

- The effect is field-mediated, not material.
- The affected region is actively maintained, not passively generated.

- The disappearance of the effect upon deactivation reflects relaxation of $\kappa(x)$ back to κ_0, not decay of a thermal or plasma state.

The defining operational behaviour of such a system would therefore be: *a switchable, spatially localised modification of the rate at which irreversible physical processes occur.*

D.4 Relationship to the Present Analysis

The analysis presented in this paper proceeds independently of any specific implementation of such an emitter. The key theoretical result is that if a localised κ-depression exists, then the temporal, optical, and electromagnetic signatures must satisfy strict cross-channel consistency constraints — specifically:

$\sigma_\tau/\sqrt{2 \ln 2} = \sigma_{opt} = \sigma_{em} \equiv \sigma$

equivalently, the directly measured channel quantities satisfy the predicted ratio:

$\sigma_\tau / \sigma_{opt} = \sqrt{2 \ln 2} \approx 1.18$

These constraints provide a direct and parameter-free means of testing whether any observed system corresponds to this class of field configuration, regardless of the mechanism of the source or the provenance of any report that motivated the investigation.

D.5 On the Scope of the Propulsion Interpretation

In plain language: The analysis in §§1–11 concerns a static, symmetric κ-depression: a pocket of suppressed space with no preferred direction. Such a configuration produces temporal suppression, an optical dark region, and a glowing boundary — but no net motion. Propulsion requires breaking that symmetry. This section introduces the extension to directed, asymmetric κ-field configurations.

The bench-top configuration analysed in the main body of this paper corresponds to a localised, approximately symmetric κ-depression maintained by a stationary source. The field configuration is approximately spherically symmetric, producing no net translational force on the source itself. Directed propulsion requires a qualitatively different configuration: a sustained *asymmetric* gradient in $\kappa(x)$, preferentially lower in one direction than another. The following subsection develops the VERSF interpretation of this extension.

Appendix D.6 — Interpretation of "Gravity Emitters" and a Possible Propulsion Mechanism

Notation for Appendix D.6 (symbols used only in this appendix; not part of the main §§1–11 notation):

Symbol	Definition
$a(x)$	Effective acceleration field: $a = -(d\Phi/d\kappa)\nabla\kappa$
$\Phi(\kappa)$	Effective commitment potential (local function of κ only; see D.6.1)
α	Linear coupling constant in the approximation $\Phi(\kappa) = \alpha\kappa$
S	Effective matter action in κ-background

In plain language: If the reported system includes devices described as "gravity emitters," the key question is what that actually means physically. In VERSF, gravity is not a separate force but an effect of how space is structured — specifically, of how the κ-field varies from point to point. So instead of thinking about "emitting gravity," we reinterpret the device as one that shapes the κ-field. The propulsion mechanism then arises from controlled asymmetry in that shaping.

Note on scope: The authors have considered whether the propulsion content of this appendix belongs in the present paper or in a dedicated successor. The decision to include it here reflects the desire to make explicit the interpretive trajectory from the bench-top analysis to the broader system described in the motivating accounts. However, D.6 is interpretive rather than derived, and extends the VERSF framework to a qualitatively different regime — directed, large-scale κ-field manipulation — that goes beyond the static symmetric configuration rigorously analysed in §§1–11. The self-force and momentum conservation questions identified in D.6.3 are unresolved. Readers should treat this appendix as a prospective research direction, not as a completed derivation. A dedicated paper treating the propulsion regime from first principles is the appropriate venue for resolution.

In accounts attributed to Bob Lazar, the described craft is said to contain three "gravity emitters" mounted on its underside, capable of directing or amplifying gravitational effects. Within the VERSF framework, this description can be reinterpreted in a more precise and unified way:

A "gravity emitter" corresponds to a device capable of generating controlled spatial gradients in the commitment-capacity field κ(x).

D.6.1 Gravity as a κ-Gradient: Derivation of the Effective Acceleration

Previous VERSF work has already identified spatial variation in commitment-capacity as a determinant of interaction strength and constraint propagation — specifically through the commitment-potential equation and gradient-driven flux derived in the gravity papers. The present work extends this principle by deriving the equation of motion for matter in a spatially varying κ-field from a minimal phenomenological action.

Effective matter action. Take a point particle with trajectory $x^i(t)$ moving through a region of varying κ(x). In VERSF, κ(x) sets the local rate of irreversible physical evolution, so the effective rest-energy of matter depends on the local field. The minimal VERSF-compatible action is:

$$S = \int dt \left[\tfrac{1}{2} m \dot{x}^2 - m \Phi(\kappa(x)) \right]$$

where $\Phi(\kappa)$ is the effective commitment potential — the local energetic condition for irreversible evolution — and m is the inertial mass. Two scope conditions are adopted here explicitly: (i) Φ is taken to be a *local* function of $\kappa(x)$ only, with no dependence on $\nabla\kappa$ or higher derivatives of the field. If Φ depends on $|\nabla\kappa|^2$, the equation of motion acquires additional terms analogous to polarisation forces in an inhomogeneous dielectric; these are likely negligible in the linear regime but not derived here. (ii) No assumption is imposed on the functional form of Φ beyond locality.

Euler–Lagrange equation. Varying with respect to x^i:

$$d/dt\,(\partial L/\partial \dot{x}^i) - \partial L/\partial x^i = 0$$

The two terms are $d/dt(m\dot{x}^i) = m\ddot{x}^i$ and $\partial L/\partial x^i = -m(d\Phi/d\kappa)\partial_i\kappa$, giving:

$$m\,\ddot{x}^i = -m\,(d\Phi/d\kappa)\,\partial_i\kappa$$

Cancelling m and writing in vector form:

$$\mathbf{a} = -(d\Phi/d\kappa)\,\nabla\kappa$$

The commitment gradient $\nabla\kappa$ is the fundamental driver of motion. The sign and magnitude of the acceleration are determined by the functional dependence of Φ on κ — not by convention.

Sign resolution. The sign ambiguity that arises from any raw schematic $a \propto \pm\nabla\kappa$ is now resolved:

- If $d\Phi/d\kappa > 0$: acceleration points down the κ-gradient (toward lower κ)
- If $d\Phi/d\kappa < 0$: acceleration points up the κ-gradient (toward higher κ)

Different physical regimes correspond to different effective potentials $\Phi(\kappa)$, not to different laws. What determines which Φ applies is the physical constitution of the coupling system: for ordinary gravity, $\Phi(\kappa)$ is set by how the committed fold structure of a mass distribution modifies the local energetic conditions for irreversible evolution (this is the content of the gravity papers' Postulate 3 and field equation); for propulsion, $\Phi(\kappa)$ is set by the emitter's design — how it couples the craft's energy output to the κ-field in its neighbourhood. Φ is not freely choosable; it is determined by the physical system. The framework is underdetermined only insofar as $\Phi(\kappa)$ has not yet been derived from fold energetics for either regime from first principles (§8, item 8).

Linear regime. In the simplest first-order approximation, $\Phi(\kappa) = \alpha\kappa$ for coupling constant α. Then $d\Phi/d\kappa = \alpha$ and:

$$a = -\alpha\,\nabla\kappa$$

This recovers the schematic $a \propto -\nabla\kappa$ as the linear-coupling limit of the general result, valid when $\alpha > 0$ and the configuration produces motion toward lower κ.

Connection to the VERSF gravity derivation. The gravity papers establish $g(x) = -\nabla\Phi\_bound(x)$ from Postulate 3, with Φ_bound sourced by $\rho\_bound \propto \kappa$ via $\nabla^2\Phi\_bound = 4\pi\lambda c^2\xi\ \rho\_bound$. These two derivations are consistent. In the regime where the potential is a local function of κ — $\Phi\_bound = \Phi\_bound(\kappa(x))$ — the chain rule gives:

$$\nabla\Phi\_bound = (d\Phi\_bound/d\kappa)\ \nabla\kappa$$

and therefore:

$$g = -\nabla\Phi\_bound = -(d\Phi\_bound/d\kappa)\ \nabla\kappa$$

This is the same general structure as the derived result above. For a κ-concentrator (mass), $d\Phi\_bound/d\kappa < 0$ locally — the potential deepens toward higher κ — so g points toward higher κ: attraction ✓. For a κ-depression (emitter), $d\Phi\_bound/d\kappa > 0$ locally, so g points toward lower κ: repulsion ✓. In both cases the sign comes from the local shape of $\Phi\_bound(\kappa)$, not from a separate rule.

Propulsion as an engineered coupling regime. Directed propulsion corresponds to engineering the κ-configuration so that $\Phi(\kappa)$ in the craft's neighbourhood has $d\Phi/d\kappa > 0$, producing acceleration toward the low-κ region generated ahead. This is not a second law — it is the same general result $a = -(d\Phi/d\kappa)\nabla\kappa$ operating in a regime where the coupling is shaped by the emitter configuration rather than by ambient mass density.

What this derivation achieves and does not achieve. The derivation establishes gradient-driven acceleration from a minimal action principle, gives the sign a physical meaning, and provides a phenomenological bridge between spatial variation in κ and effective acceleration. It does not yet derive the exact form of $\Phi(\kappa)$ from first principles; does not treat momentum conservation in the κ-field (the self-force problem of D.6.3); and does not provide a relativistic closure. These remain the primary tasks of the dedicated propulsion treatment.

A "gravity emitter" in this framework is a device that engineers the local $\Phi(\kappa)$ coupling — shaping the κ-field so that the effective commitment potential drives the craft in the desired direction. It is a κ-field gradient generator operating under a controlled coupling regime.

Predictive status of Φ(κ). The derivation establishes the sign structure and the linear limit, but leaves the functional form of $\Phi(\kappa)$ unspecified. This is the principal remaining gap: the magnitude of the coupling constant α, and the conditions under which the linear approximation $\Phi(\kappa) = \alpha\kappa$ holds versus a more complex nonlinear $\Phi(\kappa)$, cannot be determined without deriving Φ from the VERSF fold energetics — specifically from how spatial variation in κ modifies the fold commitment barrier. Until that derivation is complete, the law $a = -(d\Phi/d\kappa)\nabla\kappa$ explains the sign and the structure of the coupling, but the magnitude of the acceleration for a given κ-gradient remains a free parameter. This is noted as open item 8 in §8.

D.6.2 From Local Anomaly to Directed Motion

The static, symmetric κ-depression of the bench-top configuration produces:

- temporal suppression
- optical distortion
- boundary emission

but no net translational force on the source, because the gradient is radially symmetric and integrates to zero. Propulsion requires breaking this symmetry.

If the emitter can produce a directional κ-gradient — lower in front of the craft, higher behind — then:

$\nabla\kappa \neq 0$ (directed)

This corresponds to an effective acceleration directed along $-(d\Phi/d\kappa)\nabla\kappa$ — which in the linear-coupling limit $\alpha > 0$ points toward the region of lower κ ahead of the craft. The craft falls toward the self-generated depression along the engineered gradient.

D.6.3 Propulsion Mechanism (VERSF Interpretation)

The propulsion mechanism can be understood as:

The craft moves by continuously generating and maintaining an asymmetric κ-field configuration, effectively falling along a self-generated gradient.

This differs from conventional propulsion in structure:

Feature	Conventional propulsion	VERSF κ-gradient interpretation
Mechanism	Force applied against reaction mass	Motion follows engineered field gradient
Reaction mass	Required from material medium	Field carries momentum (see note below)
Acceleration limit	Structural and reaction-mass constraints	Achievable κ-gradient magnitude
External medium	Interaction with ambient medium	Field-mediated; medium-independent

Note on momentum conservation and the self-force problem. The description above — the craft falling along a gradient it generates — raises an immediate question: how does momentum conservation operate in this regime? In standard field theory, a system cannot accelerate by coupling to a field it generates without that field carrying and transferring momentum to or from the surrounding medium or vacuum. Within VERSF, if the κ-field carries momentum density (analogous to the electromagnetic Poynting vector), then the craft's forward momentum could be balanced by rearward momentum flux in the κ-field itself — preserving conservation globally while producing net craft acceleration locally. However, this mechanism is not derived within the present framework. The momentum content of the κ-field, the coupling of the craft's own structure to its self-generated gradient (the analogue of radiation reaction in electrodynamics), and the global conservation accounting remain open problems. The propulsion interpretation is therefore physically motivated but not yet self-consistent at the level required for a complete dynamical treatment. This gap is explicitly noted as a priority for the VERSF programme.

Propulsion as an extension of gravity. The propulsion mechanism described here is structurally analogous to gravity, in that both arise from motion along a spatial gradient in an underlying field — the general derived law $a = -(d\Phi/d\kappa)\nabla\kappa$ governs both. In conventional gravity, this gradient is generated by mass concentrations, which produce regions of elevated commitment-capacity density $\kappa(x)$, and matter evolves toward those regions. In the present VERSF interpretation, the same gradient-based mechanism is employed deliberately: the craft generates an asymmetric κ-field configuration, with a region of reduced κ ahead, and evolves along the resulting gradient under the appropriate coupling regime. The system does not produce thrust in the conventional reaction-mass sense; instead it follows a self-engineered field slope. Propulsion is therefore not a separate physical principle but an extension of the same gradient-driven dynamics that manifest as gravity, with the key distinction that the field configuration is actively controlled rather than passively generated by mass.

D.6.4 Role of Multiple Emitters

The reported use of three emitters can be interpreted geometrically. A single emitter produces an approximately symmetric field — useful for the bench-top anomalies studied here, but insufficient for directional control. Multiple emitters allow superposition of κ-field contributions:

- **Two emitters**: establishes a directional gradient, producing net motion along the gradient axis.
- **Three emitters**: provides full three-dimensional control of the κ-field geometry, enabling directional control, stabilisation, rotation, and reorientation.

This is consistent with the functional requirement to tilt the effective field, control trajectory, and maintain stability during motion.

D.6.5 Thermodynamic Coherence as a Structural Requirement

In plain language: Generating a precise, stable, directed gradient in the κ-field is likely not something a noisy or thermally disordered system could do. If the propulsion mechanism depends on maintaining a controlled commitment gradient, then the craft's internal state — its geometry, thermal regularity, and the coherent coupling between emitters — may not be incidental to the mechanism but integral to it. The craft may function as a field-shaping structure rather than merely housing a device.

If directed motion in VERSF depends on maintaining a controlled, asymmetric commitment gradient, then the generating structure cannot be arbitrary. In the VERSF framework, κ-field gradients are produced by the spatial distribution of irreversible commitment events. A noisy or thermally disordered source would produce a disordered κ-field — one lacking the spatial regularity, stability, and directional coherence needed for sustained propulsion. This suggests that a system operating via this mechanism would require: low internal entropy (to maintain a coherent committed fold distribution throughout the structure); thermal and vibrational stability (to prevent transient commitment events from modulating the κ-field on short timescales); and coherent coupling between emitters (so that the three superposed κ-field contributions add constructively to produce a directed gradient rather than a disordered interference pattern).

Beyond individual emitter performance, if the κ-field is shaped by the entire committed fold distribution of the system, then the geometry of the structure itself may function as part of the field-shaping mechanism. In this view, propulsion would not be produced by isolated emitters housed in an arbitrary container, but by a coherent system-scale configuration in which emitter placement, internal thermodynamic order, and structural geometry jointly determine the field boundary conditions. For any implementation of this mechanism, one would therefore predict: (i) significant sensitivity of propulsion performance to internal thermodynamic state; (ii) coupling between emitter synchronisation and field coherence; and (iii) dependence on the full system geometry rather than on individual components in isolation.

These are forward-looking structural predictions from the VERSF framework, not derived quantitative results. The present analysis does not calculate the specific thermodynamic tolerances or the coupling between internal disorder and κ-field fidelity — that would require a complete treatment of how the committed fold distribution of an extended structure sources κ(x). The correct epistemic status is: such requirements are *consistent with* the framework and *likely necessary* if the mechanism is configurational, but the precise conditions under which the mechanism degrades with increasing disorder cannot be stated without a full dynamical treatment.

D.6.6 Relationship to the Bench-Top Effects

The bench-top effects described in the main paper — temporal suppression, the optical dark region, and the boundary corona — correspond to a low-power, approximately symmetric κ-depression in which no directional gradient is established. They represent the near-field, static-configuration limit of a more general κ-field manipulation capability.

Propulsion would require:

- larger-scale field shaping (σ comparable to or larger than the craft dimensions)
- controlled asymmetry (gradient directed, not radial)
- continuous modulation of κ(x) to maintain directed motion

The bench-top anomalies can therefore be interpreted as a measurable, laboratory-accessible instance of the same class of field manipulation — a low-power symmetric case of a phenomenon whose asymmetric, high-power version would produce directed motion.

D.6.7 Summary

Within the VERSF framework:

- "Gravity emitters" are most precisely interpreted as κ-field gradient generators.

- Gravitational effects correspond to gradients in $\kappa(x)$; the rigorous relation is $g = -\nabla\Phi\_bound$ with Φ_bound sourced by $\rho\_bound \propto \kappa$ (Postulate 3 of the VERSF gravity derivation).
- Propulsion arises from controlled, sustained asymmetry in the κ-field gradient. The general derived law is $a = -(d\Phi/d\kappa)\nabla\kappa$; in the linear coupling regime this gives $a = -\alpha\nabla\kappa$, pointing toward the lower-κ region the craft generates ahead.
- Propulsion is structurally the same mechanism as gravity — motion along a commitment-capacity gradient — with the distinction that the field configuration is actively controlled rather than passively generated by mass.
- Three foundational gaps remain (§8, items 8–9): the functional form of the commitment potential $\Phi(\kappa)$ is unspecified; momentum conservation in the κ-field is unresolved; and the full microscopic derivation of κ as a physical field from fold ontology is incomplete. These are the critical points at which the present interpretation will face foundational scrutiny.
- The reported three-emitter configuration is geometrically consistent with full three-dimensional field-shaping requirements.
- The craft's internal thermodynamic coherence — low entropy, thermal stability, coherent emitter coupling, and geometry — may be integral to the field-shaping mechanism rather than incidental to it.
- The bench-top anomalies analysed in §§1–11 are interpretable as the symmetric, static, low-power limit of this class of field manipulation.

This interpretation does not depend on the validity of any specific account. It provides a coherent physical meaning for the described system within the VERSF framework, and establishes a theoretical basis for connecting the measurable bench-top signatures to a broader class of field-mediated phenomena.