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1. Comparing the Power‑Set Tower vs. Fractal Topology

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2. Extended Action Functional

We now build a single action that lives on

(x,t)\in\mathcal M\times\mathbb R,\quad

s\in[0,\infty)\ (\text{fractal scale}),\quad

\alpha\in[0,\Lambda]\ (\text{meta‑level}).

2.1. Field

\Psi = \Psi(x,t,s,\alpha).

2.2. Lagrangian Density

\begin{aligned}

L &=

\underbrace{\tfrac12\,\|\partial\_t\Psi\|^2}\_{\text{temporal}}

-

\underbrace{\tfrac12\,\|\nabla\_x\Psi\|^2}\_{\text{smooth spatial}} \6pt]

&\quad

+\,\underbrace{\tfrac12\,\|\partial\_s\Psi\|^2}\_{\text{scale‐dilation}}

+\,\underbrace{\tfrac12\,\|\partial\_\alpha\Psi\|^2}\_{\text{meta‑level}} \6pt]

&\quad

- \underbrace{\tfrac12\,\bigl\|D^{\beta}\_x\Psi\bigr\|^2}\_{\substack{\text{fractional}\\\text{(nowhere‐diff)}}}

- V\bigl(\Psi\bigr),

\end{aligned}

is a local fractional derivative of order capturing fractal non‑differentiability in space,

is the logical‑entropy potential.

2.3. Full Action

S[\Psi]

=

\int\_{0}^{\Lambda}\!\int\_{0}^{\infty}\!\int\_{\mathbb R}\!\int\_{\mathcal M}

L\bigl(\Psi,\partial\Psi,D^\beta\Psi\bigr)\;

d\mu\_f(x)\,dt\,ds\,d\alpha.

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3. Euler–Lagrange Equations

Stationarity yields a coupled PDE with:

\partial\_t^2\Psi

- \nabla\_x^2\Psi

+ \partial\_s^2\Psi

+ \partial\_\alpha^2\Psi

+ D\_x^{2\beta}\Psi

+ V'(\Psi)

= 0.

This mixes

Wave behavior in ,

Fractal dilation in ,

Meta‑reflection in ,

Nowhere‑diffusive fractional term in .

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4. Noether Currents & Conservation

Each symmetry under shifts in , , or still gives a conserved current:

\partial\_A H^A = 0,

\qquad

A\in\{t,x^i,s,\alpha\},

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5. Interpretation

Power‑Set vs. Fractal: discrete meta‑levels become a continuum of non‑smooth scales.

Action: now measures not only smooth and discrete dilation costs but also the “work” required to navigate a nowhere‑differentiable fractal geometry.

Logical‑Entropy: still encoded in the kernel fixpoints and , whose combined measure remains invariant under all flows.

Primality Dynamics: the field evolves by minimizing this richer action, balancing smooth inference, discrete abstraction, and fractal jumps.

This unifies meta‑binary logic, fractal topology, and action‑minimization into a single, coherent Fundamental Theory of Primality.