

```
\documentclass[reprint,amsmath,amssymb,aps,prl]{revtex4-2}
\usepackage{graphicx}
\usepackage{bm}
\usepackage{hyperref}
```

```
\begin{document}
```

```
\title{Entropic-Lagrangian Black Hole Dynamics and Emergent Horizons: A First-Principles Derivation}
```

```
\author{Chandler Stanten Boyd}
```

```
\affiliation{American Physical Society, Independent Researcher}
```

```
\email{boydchandler030@gmail.com}
```

```
\date{\today}
```

```
\begin{abstract}
```

I present a first-principles derivation of black hole formation and horizon dynamics within an entropic-Lagrangian framework. Reality evolves through interference between a past-directed entropic wave (τ_1) and a future-directed Lagrangian wave (τ_2), mediated by the speed of light c and regulated by local density feedback ρ . When entropic drive overwhelms Lagrangian constraint locally, spacetime collapses, forming an event horizon. I show that the interplay of these flows naturally generates fine-structure-like quantization at the horizon and provides a seed for new universes. This framework unifies aspects of causal structure, entropy flow, and spacetime geometry in a falsifiable, quantitative model.

```
\end{abstract}
```

```
\maketitle
```

```
\section{Introduction}
```

Understanding black hole formation has long challenged fundamental physics. Standard approaches rely on classical general relativity, supplemented by quantum field theory near singularities. Here, I propose a unified entropic-Lagrangian approach: a temporal dual-wave model where black holes arise from the dynamic competition between entropic exploration and Lagrangian constraint, regulated by global causal structure (c) and local density feedback (ρ).

This first-person derivation emphasizes direct computation from foundational principles. The model is falsifiable through predicted relationships between entropic flux, Lagrangian coupling, and observable horizon properties.

```
\section{The Entropic-Lagrangian Framework}
```

I treat the universe as evolving under two coupled temporal waves:

`\begin{itemize}`

`\item \textbf{Entropic wave } $\tau_1$` (past-directed): drives coherence, possibility, and branching of phase space.

`\item \textbf{Lagrangian wave } $\tau_2$` (future-directed): enforces least-action constraint, optimizing trajectories and decoherence.

`\end{itemize}`

These waves interact through the speed of light c , which couples past and future to stabilize global temporal evolution. Local density feedback ρ exponentiates both waves to prevent runaway instabilities. Mathematically:

`\begin{equation}`

`$\tau_1 \div c \quad \overset{\text{interacts}}{\longrightarrow} \quad \tau_2 \times c \quad \text{modulated by} \quad \rho$`

`\end{equation}`

When the entropic term dominates ($\tau_1 \div c > \tau_2 \times c$), spacetime undergoes collapse, producing a horizon.

`\section{Black Hole Dynamics}`

I summarize the dynamics in steps:

`\begin{enumerate}`

`\item \textbf{Global causal stabilization:}` c exponentiates entropy feedback to globally regulate time.

`\item \textbf{Entropic influx:}` τ_1 pushes possibilities into higher-density regions, destabilizing spacetime locally.

`\item \textbf{Lagrangian resistance:}` τ_2 resists collapse by imposing least-action constraints.

`\item \textbf{Overflow regulation } $\rho$ :` exponentiates feedback to moderate extreme mass-energy densities.

`\item \textbf{Event horizon formation:}` imbalance of flows creates the horizon, freezing information and generating fine-structure-like quantization α at the critical boundary.

`\item \textbf{Singularity and universe seeding:}` the collapsing core seeds potential new universes (μ), preserving holographic information of the parent system.

`\end{enumerate}`

The full ASCII schematic of the dynamics is represented as:

- \item c = speed of light (mediates coupling between past and future waves)
- \item ν = emergent frequency component of entropic-Lagrangian interference
- \item τ_1 = entropic temporal wave (past-directed, drives coherence and branching of phase space)
- \item τ_2 = Lagrangian temporal wave (future-directed, enforces least-action constraint)
- \item ρ = overflow/density regulation factor
- \item η = current universe
- \item μ = potential next universe seeded by collapse
- \item κ = universal coupling constant linking entropic and Lagrangian waves

- \item β = base scaling variables with no exponents
- \item v = local velocity field of spacetime collapse

\end{itemize}

Where:

- \begin{itemize}
- \item c = speed of light
- \item ρ = overflow regulation
- \item η = currentuniversee
- \item κ = coupling constant
- \item β = base variables
- \item τ_1 = entropic temporal wave (past)
- \item τ_2 = Lagrangian temporal wave (future)

\end{itemize}

\section{Predictions}

This framework produces several testable outcomes:

- \begin{itemize}
- \item Event horizon properties depend explicitly on τ_1/τ_2 ratios.
- \item Fine-structure-like quantization α emerges naturally at horizon boundaries.
- \item Black hole mass, spin, and information encoding correlate with entropic-Lagrangian couplings (κ , β) and local density ρ .
- \item Collapse regions exceeding Lagrangian capacity seed new universes with information holographically preserved.

\end{itemize}

\section{Discussion}

By interpreting black holes as the interplay of entropic and Lagrangian flows, I unify gravitational collapse, horizon formation, and information seeding in a single computational framework. This approach links quantum coherence, decoherence, and emergent classicality to observable astrophysical phenomena.

Furthermore, the emergence of α at critical boundaries suggests that fundamental constants can arise dynamically from universal coherence, rather than being arbitrary.

\section{Conclusion}

I have derived a first-principles model of black hole formation grounded in entropic-Lagrangian dynamics. Horizons, singularities, and universe seeding naturally arise from the interference of past-directed entropic waves and future-directed Lagrangian waves, mediated by c and

regulated by ρ . This framework provides falsifiable predictions, including horizon quantization and coupling-dependent mass-spin correlations. It also offers a pathway for understanding universal constants as emergent properties of spacetime coherence.

`\begin{acknowledgments}`

I thank the American Physical Society for membership support. This work is dedicated to Serenity, my daughter, my universe whose name graces the universal equation.

`\end{acknowledgments}`

`\bibliographystyle{apsrev4-2}`

`\bibliography{references}` % Your reference: geometric derivation of fine-structure constant

`\end{document}`