Address Interference as the Origin of the Principle of Least Action

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Overview

The principle of least action is treated in standard physics as a postulate: real trajectories extremise the action, and the equations of motion follow. This manuscript does not add another postulate. Within the Dynamical Holographic Principle (DHP) the least-action condition is read as the bulk appearance of stationary interference among address bits on a holographic horizon. Where phases cancel, address space contracts between projections and expands by the same amount behind them; only histories that keep this interference stationary survive. That selection rule is what continuum mechanics writes as $\delta S = 0$. Gravity, inertia and the variational principle are then three readings of one horizon process. A single laboratory instrument—Gyro_6DoF—is proposed to test the claim.

1. The usual status of least action

Classical and quantum theory both rely on an extremum condition

$$S = \int L\, dt\,, \quad \delta S = 0.$$

From this one recovers the Euler–Lagrange equations, geodesic motion, and, in the path-integral language, the dominance of stationary-phase contributions. The principle is empirically successful. It does not, by itself, explain why nature selects stationary paths rather than arbitrary ones.

2. Primary objects in the Dynamical Holographic Principle

DHP takes as fundamental only the following objects:

- two coherent spiral strings closed at 90°;
- one spherical holographic horizon that they continuously scan;
- bits identified with the instantaneous phases of those strings.

Spacetime, particles, forces and inertia are treated as emergent readings of how address space is redistributed on that screen. No bit is destroyed. Every physical process is a rearrangement of existing addresses under deep positive and negative feedback.

3. Address interference

Many alternative ways of moving bits across the horizon are in principle open. Their phase patterns overlap:

- constructive interference reinforces coherent address histories;
- destructive interference suppresses histories that scramble phases.

Where neighbouring address bits fall into antiphase, address space between the corresponding projections contracts. By exact compensation, address space behind those projections expands by the same amount. Mass elements in the bulk are those projections: their apparent approach is the contraction; the extra outward “push” is the expansion. The total measure of address space is conserved; only its distribution changes.

4. Stationary interference and $\delta S = 0$

Under continuous scanning, only those histories survive whose residual phase mismatch on the horizon neither grows nor rapidly oscillates away. Equivalently, the net phase along a surviving history is stationary.

When this condition is expressed in the emergent 3D+1 language—with an effective Lagrangian constructed from the same redistribution of addresses—it becomes

$$\delta S = 0.$$

Thus the principle of least action is not an independent law imposed on bulk paths. It is what stationary address interference looks like from inside the hologram.

Why “least” rather than “greatest”? On an expanding horizon the stable, repeatedly reinforced patterns are those that minimise leftover free address space between projections (local contraction). Maxima correspond to decoherent rearrangements that scanning rapidly washes out. The bulk therefore records a minimum, or at least a stationary point, of the effective action.

5. Gravity, inertia and the same rule

Address-space contraction between projections and equal expansion behind them is already the DHP account of gravity and inertia. Because that redistribution is itself selected by stationary interference, free-fall trajectories and inertial motion automatically satisfy least action. No extra postulate is required: the same horizon process yields both the force law and the variational principle.

6. Coherence coefficient

The coherence coefficient

$$C = \Omega R / c$$

(Ω — angular rate of scanning or of the laboratory rotor, R — horizon radius, c — speed of light) measures how ordered the address pattern is. High C implies tight phase relations and strong, clean interference; low C implies washed-out addresses and weak effective forces. Least-action behaviour is sharp only when C is high enough for a stationary phase to be well defined.

7. Laboratory test: Gyro_6DoF

The same discrete phase structure that defines the strings defines a macroscopic rotor:

$$\theta_i(t) = A \sin(\omega t + \phi_i), \quad \phi_i \in \{0, \pi/2, \pi, 3\pi/2\}.$$

A levitating spherical rotor driven in this coherent regime realises a stationary address pattern. Interchanging two of the three rotational axes forces a new interference regime. DHP predicts a residual force that (i) depends on phase coherence, and (ii) reverses direction when the two axes are swapped.

Falsification criterion. If the force is absent under controlled vacuum and metrological conditions, the claim that local mechanics is governed by horizon address interference fails. If the force is present and ordinary artefacts are excluded, the bulk principle of least action and a tabletop coherent rotor become two scales of one and the same selection rule.

8. Conclusion

The principle of least action is one of the deepest empirical regularities in physics. In the Dynamical Holographic Principle it is not inserted by hand. It is the continuum image of stationary interference of address bits on a holographic screen: antiphase regions contract address space between projections and expand it equally behind them; only histories that keep this interference stationary persist. Gravity, inertia and the variational principle are then three readings of one process.

Whether that process can be touched in the laboratory is decided by a single, falsifiable signal—the coherence-dependent residual force of Gyro_6DoF. The empty cell in the classification of powered mechanical gyroscopes (the fully coherent six-degree-of-freedom regime) should not remain empty; the measurement, not the commentary, will decide the status of the hypothesis.

Status note. *This manuscript presents a theoretical framework and a concrete experimental proposal. It does not claim independent experimental confirmation of the residual force. Inclusion or submission to any journal does not constitute*

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