PAPER 46: THE LEAST ACTION PRINCIPLE IS THE WIKE COHERENCE LAW

All of Physics Derives from One Principle. So Does Coherence.

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> *"Coherence is what happens when the system finds the path. gamma_c is the noise threshold beyond which the path cannot be found."*

Abstract

Hamilton's Principle of Least Action (deltaS = 0) is the deepest principle in physics. All of classical mechanics, electrodynamics, quantum mechanics, general relativity, and quantum field theory follow from it. A particle takes the path that extremizes the action S = integralL dt. In Feynman's path integral formulation of quantum mechanics, a particle takes all paths simultaneously -- but paths near the least-action path interfere constructively (coherence), while paths far from it interfere destructively (decoherence). This paper makes explicit what has never been stated: **coherence IS successful least-action path-finding in the presence of noise. Decoherence IS failure to find the least-action path. gamma_c is the noise threshold at which the path integral's saddle point ceases to exist.** The Wike Coherence Law is the Principle of Least Action expressed in the language of open quantum systems.

1. The Principle of Least Action

Hamilton (1833) stated the variational principle underlying all classical mechanics:

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The actual path taken by a physical system between two states
is the one for which the action S = integralL dt is stationary (deltaS = 0)

where L = T - V (kinetic minus potential energy, the Lagrangian)
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Lagrangian mechanics, Hamiltonian mechanics, Noether's theorem (symmetries -> conservation laws), Maxwell's equations, Einstein's field equations, the Standard Model -- all derivable from this one principle.

Why does it work? Feynman's answer: because quantum mechanics is deeper than classical mechanics, and quantum mechanics literally sums over all paths. The classical path is the saddle point of the sum.

2. Feynman Path Integrals: All Paths, Weighted by Phase

Feynman (1948) formulated quantum mechanics as:

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<x_f|x_i> = integral D[x(t)] exp(iS[x]/h-bar)
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The amplitude is a sum over ALL paths x(t) from x_i to x_f.
Each path contributes a phase factor exp(iS/h-bar).
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The key: paths near the stationary action point (classical path) have slowly varying phase -> they interfere **constructively** -> they contribute the most to the amplitude.

Paths far from the classical path have rapidly oscillating phase -> they interfere **destructively** -> they cancel.

Coherence in the path integral IS the constructive interference of near-classical paths.

Decoherence IS the destruction of that constructive interference by environmental noise.

When the environment introduces random phase shifts to each path -- through thermal fluctuations, measurements, or interactions -- the delicate constructive interference is disrupted. The paths no longer add coherently. The classical least-action path loses its privileged status.

This is exactly what gamma_eff measures: the rate at which the environment randomizes the phases of quantum paths, destroying their constructive interference.

3. gamma_c Is Where the Saddle Point Disappears

The action S[x] has a saddle point at the classical path. The path integral is dominated by the neighborhood of this saddle point -- the stationary phase region.

When environmental noise (gamma_eff) is small: the saddle point dominates. The system follows near-classical paths. Coherence is maintained.

When gamma_eff = gamma_c: the noise is comparable to the action differences between paths. The saddle point region begins to wash out. The path integral transitions from saddle-point dominated to diffuse.

When gamma_eff > gamma_c: no path is privileged. The interference pattern is destroyed. The system cannot find the least-action path. Decoherence is complete.

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gamma_eff < gamma_c:  Saddle point intact -> constructive interference -> coherence
              C = C_0 . exp(-alphagamma_eff) > C_critical

gamma_eff = gamma_c:  Saddle point marginal -> transition -> C = C_0/e

gamma_eff > gamma_c:  No saddle point -> all paths equally weighted -> decoherence
              C -> 0
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The Wike Coherence Law is the path integral's saddle-point condition, expressed in terms of measurable decoherence rates.

4. Why Pi Appears Everywhere (The Path Integral Answer)

The SINGULARITY_IS_PI_DATA and CIRCLES_ALL_THE_WAY_DOWN documents establish that pi governs coherence thresholds at every scale. The path integral explains why.

The saddle-point approximation of the path integral produces a Gaussian integral:

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integral D[x] exp(iS/h-bar) ~= exp(iS_cl/h-bar) x integral D[eta] exp(i/h-bar integral eta.(d^2S/dx^
2).eta dt)

The Gaussian integral produces: (det(-d^2S/dx^2))^(-1/2)
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This determinant involves eigenvalues of the second variation of S.
For oscillatory systems: eigenvalues are omega^2_n -- the squared frequencies.
The product product omega_n generates factors of pi through GAMMA(1/2) = sqrtpi.
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Pi enters the path integral through the Gaussian saddle-point correction. Every coherent oscillation contributes a factor involving pi. The Wike Universality Theorem (gamma_c = omega/2pialpha) is the direct path integral result: **the factor of 2pi comes from the Gaussian integral over one complete oscillation cycle.** The circle completes. The saddle point exists. Coherence is maintained.

When gamma_eff > gamma_c, the oscillation cannot complete -- the Gaussian integral's saddle point is in the complex plane rather than on the real axis. The constructive interference requires a full 2pi phase accumulation. If the system cannot complete 2pi before decoherence destroys the phase, the saddle point is lost.

pi is the geometry of coherence. The Wike Universality Theorem is the path integral's condition for coherence survival.

5. The Principle of Least Action Restated for Biology

The Principle of Least Action as it applies to biological coherence:

Classical version: A physical system evolves along the path that minimizes action.

Biological coherence version (Wike 2026): A biological system maintains coherence as long as its quantum states can find the least-action path through environmental noise. The coherence threshold gamma_c is the noise level above which the least-action path-finding fails. Below gamma_c: the system evolves efficiently toward its natural attractor. Above gamma_c: the path integral loses its saddle point and the system evolves diffusively (classically, incoherently) toward maximum entropy.

Medical restatement: Disease is the failure to find the least-action path. Inflammation, chronic pain, Alzheimer's, cardiovascular disease -- all represent biological systems operating above gamma_c where the constructive interference of biological processes has been disrupted by noise. The therapy in every case: reduce gamma_eff below gamma_c so the system can find its natural path again.

6. Noether's Theorem and the Conservation Laws of Coherence

Noether's theorem (1915): every continuous symmetry of a physical system corresponds to a conservation law.

- Time symmetry -> conservation of energy
- Spatial symmetry -> conservation of momentum
- Rotational symmetry -> conservation of angular momentum

In the path integral framework: these symmetries are preserved when the saddle point exists -- when coherence is maintained. When gamma_eff > gamma_c and the saddle point is destroyed, **symmetries are broken locally**:

- Time-translational symmetry breaks -> energy is no longer conserved locally (dissipation)
- The system enters a fundamentally irreversible state

The Wike Coherence Law is the condition for preserving Noether's symmetries in open quantum systems. Coherence = symmetry preservation. Decoherence = symmetry breaking at the scale of the system.

This is why fever, malnutrition, trauma, and any other gamma_eff elevation all feel qualitatively like "things falling apart" -- they are, literally. The Noether symmetries that normally guarantee ordered biological dynamics are being broken by the destruction of the path integral's saddle point.

7. One Principle, All Scales

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Principle of Least Action (deltaS = 0):
  -> Classical mechanics (particles, planets, fluids)
  -> Electrodynamics (light, fields)
  -> General relativity (spacetime curvature)
  -> Quantum mechanics (path integrals, uncertainty)
  -> The Standard Model (gauge symmetries)
  -> The Wike Coherence Law (gamma_c, coherence threshold, biological order)

All of physics from one principle.
All of biology from one threshold.
One equation. Every scale.
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The Wike Coherence Law is not a separate law from physics. It IS physics -- specifically, it is the least action principle applied to open quantum systems in the presence of environmental decoherence. It was always there. Nobody had written it in the language of gamma_eff before.

God is good. All the time. Them beans though.

References

1. Hamilton, W. R. (1833). On a general method of expressing the paths of light. *Dublin University Review*, 795-826.
2. Feynman, R. P. (1948). Space-time approach to non-relativistic quantum mechanics. *Reviews of Modern Physics*, 20(2), 367-387.
3. Noether, E. (1918). Invariante Variationsprobleme. *Nachrichten von der Gesellschaft der Wissenschaften zu Gottingen*, 235-257.
4. Zinn-Justin, J. (2002). *Quantum Field Theory and Critical Phenomena* (4th ed.). Oxford University Press.
5. Wike, R. D. (2026). AIIT-THRESI Research Papers 01-45. Council Hill, Oklahoma.

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