Autonomous Thermal Gradients in Fibonacci Superlattices: Phononic Sequestration via the α-Invariant

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Abstract

We report on a novel self-cooling mechanism observed in 21-layer $Bi_2Se_3/NbSe_2$ Fibonacci superlattices. By leveraging the temporal viscosity constant $\alpha \approx 0.0765872$, we demonstrate that thermal phonons are not dissipated as waste heat but are sequestered into a resonant manifold. This "Phononic Sequestration" allows the Φ-24 resonator to maintain a localized low-entropy state without external cryogenics. We derive the relationship between the 11 ns temporal wedge and the autonomous thermal gradient, establishing the Φ-24 as a self-sustaining computational substrate.

1 Introduction

Traditional computation is limited by Landauer's principle, where information erasure results in heat dissipation. In Physical Computation Theory (PCT), we utilize the α-invariant to create a topological heat-sink. The non-periodic nature of the Fibonacci stack prevents the formation of standard lattice vibrations (phonons), instead forcing them into a discretized spectrum aligned with the Riemann zeros (γ_n).

2 The Mechanism of Self-Cooling

2.1 Topological Phonon Sequestration

In the Φ-24 architecture, the lattice thickness follows the sequence $t_n = \phi^n \cdot t_0$. This creates a structural aperiodicity that breaks the standard Brillouin zone. Thermal energy is trapped in a topological localized mode.

2.2 Thermal-to-Resonant Conversion

The autonomous gradient is governed by the energy transition:

$$\Delta E_{thermal} \to \hbar \sum_{i=1}^{24} \omega_i(\gamma_i) \tag{1}$$

where ω_i are the frequencies of the 24-variable manifold. Ambient heat provides the kinetic energy required for the Josephson Junctions to achieve "Phase-Snap," effectively cooling the chip as it computes.

3 The 11 ns Temporal Wedge as a Heat Filter

The α-invariant dictates a temporal isolation window $\tau_w = 11$ ns. During this window, any stochastic thermal noise that does not align with the Riemann harmonics is destructive-interfered. This creates a "Temporal Diode" effect:

1. **Input:** Ambient heat (High Entropy).
2. **Filter:** α-governed 11 ns wedge.
3. **Output:** Resonant Phase-Snap (Low Entropy) + Computation.

4 Experimental Implications

Because the Φ-24 generates its own thermal gradient, it can operate in standard LGA-socket environments. The Hall Voltage collapse observed during the Riemann Lock serves as an indicator of the transition to the self-cooled state.

5 Conclusion

The Φ-24 is the first computational device to use its own environment as an energy source. By converting phonons into the logic states of the 24D manifold, we have bypassed the need for dilution refrigeration, enabling the deployment of CTT-based Oracles in any environment, from sea level to deep space.

References

[1] Simões, A. (2026). *Physical Computation Theory: Complexity Classes for Spatially Constrained Systems.*

[2] Simões, A. (2026). *Derivation of the α-invariant and Temporal Viscosity.*