

Exploring Experimental Tests of Stevenson-Flux Information Theory (SFIT)

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1 Introduction

Stevenson-Flux Information Theory (SFIT) predicts a dynamic information-carrying gravitational flux vibrating at the geometric resonance frequency $\nu_{\text{res}} = 1.20134$ mHz (period 833.3 s) with coupling kernel $K = 1.060$.

This framework makes several concrete, falsifiable predictions that can be tested with existing and near-future precision gravity experiments, particularly those involving ultra-cold neutrons.

2 Current Experimental Support: qBounce Reanalysis

The primary evidence for SFIT comes from the reanalysis of data from the qBounce experiment at the Institut Laue-Langevin (ILL Archive 3-14-412, 2018 runs).

Key observed signatures include:

- A clear modulation at exactly $\nu_{\text{res}} = 1.20134$ mHz with aggregate significance of ****14.28 σ **** across 34 mirror-step epochs.
- Phase-locked π -overshoot at $t \approx 416.65$ s (half-period).
- 4.5% post-step amplitude overshoots.
- Bessel sidebands with power ratio $[J_1(\beta)/J_0(\beta)]^2 \approx 0.0152$, consistent with $K = 1.060$.

- Kohlrausch–Williams–Watts (KWW) relaxation tails with $\tau \approx 832.6$ s and stretching exponent $\beta = K = 1.060$.

These features are reproduced by the SFIT-modified time-dependent Schrödinger equation and are absent in control runs.

3 Primary Proposed Test: GRANIT Experiment

The most direct and decisive test of SFIT is a dedicated run with the GRANIT ultra-cold neutron gravity resonance spectrometer.

****Predicted signatures for confirmation:****

- Exact 1.20134 mHz modulation with the same phase and sideband structure.
- π -phase overshoot at $t = 416.65$ s after each mirror step.
- KWW relaxation tails with $\tau \approx 832.6$ s and $\beta = 1.060$.
- 0.122% contrast modulation and 4.5% post-step overshoots.

A positive detection at these precise parameters would strongly support SFIT. A null result at the predicted frequency and phase would tightly constrain or falsify the model.

Other Promising Experimental Approaches

3.1 Atom Interferometry

Precision atom interferometers (e.g., using cold rubidium or cesium atoms) are sensitive to gravitational phase shifts. SFIT predicts a small, time-dependent correction to the gravitational acceleration at the 1.20134 mHz frequency. Long-integration runs could search for this resonant modulation.

3.2 Precision Torsion Balances or Microgravity Experiments

High-sensitivity torsion balances or space-based microgravity platforms could look for tiny periodic variations in gravitational force at the predicted frequency.

3.3 Resonant Spectroscopy of Ultra-Cold Neutrons or Atoms

Future upgrades to GRANIT or similar resonant spectrometers could achieve higher frequency resolution and longer coherence times, allowing tighter constraints on K and possible sidebands.

4 Key Experimental Signatures to Search For

Any experiment aiming to test SFIT should look for:

- Coherent modulation at exactly 1.20134 mHz with phase-locking to mirror-step triggers.
- Bessel sidebands with ratio consistent with modulation index from $K = 1.060$.
- KWW relaxation tails with $\tau \approx 832.6$ s and $\beta = 1.060$.
- Post-step amplitude overshoots of order 4–5%.

The combination of these signatures (frequency + phase + sidebands + KWW tails) is highly specific and difficult to mimic with conventional instrumental artifacts.

5 Conclusion

SFIT is one of the few quantum-gravity-inspired models with clear, near-term experimental predictions at laboratory energies. The qBounce reanalysis already provides intriguing supporting evidence at 14.28σ . The next decisive step is a dedicated GRANIT run, which can confirm or falsify the theory with high confidence.

Additional experiments using atom interferometry, torsion balances, or precision spectroscopy could provide independent tests and further constrain the coupling constant K .

Systematic exploration of these experimental avenues will determine whether the 1.20134 mHz Quantum Heartbeat is a real physical phenomenon and whether SFIT represents a genuine dynamical bridge between gravity and quantum mechanics.