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 $K = 1.060$ [1].

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].

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) [3].

Key observed signatures include:

- A clear modulation at exactly $\nu_{\text{res}} = 1.20134$ mHz with aggregate significance of 14.28σ across 34 mirror-step epochs.
- Phase-locked π-overshoot at $t \approx 416.65$ s (half-period)[cite: 27].
- 4.5% post-step amplitude overshoots[cite: 27].
- Bessel sidebands with power ratio $[J_1(\beta)/J_0(\beta)]^2 \approx 0.0152$ consistent with $K = 1.060$[cite: 27].

- Kohlrausch-Williams-Watts (KWW) relaxation tails with $\tau \approx 832.6$ s and stretching exponent $\beta = K = 1.060$ [4].

These features are reproduced by the SFIT-modified time-dependent Schrödinger equation and are absent in control runs [5].

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[cite: 27].

Predicted signatures for confirmation:

- Exact 1.20134 mHz modulation with the same phase and sideband structure[cite: 27].
- π-phase overshoot at $t = 416.65$ s after each mirror step[cite: 27].
- KWW relaxation tails with $\tau \approx 832.6$ s and $\beta = 1.060$ [6].
- 0.122% contrast modulation and 4.5% post-step overshoots [7].

A positive detection at these precise parameters would strongly support SFIT[cite: 27]. A null result at the predicted frequency and phase would tightly constrain or falsify the model[cite: 27].

3.1 Atom Interferometry

Precision atom interferometers (e.g., using cold rubidium or cesium atoms) are sensitive to gravitational phase shifts [8]. SFIT predicts a small, time-dependent correction to the gravitational acceleration at the 1.20134 mHz frequency[cite: 27]. Long-integration runs could search for this resonant modulation [9].

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 [10].

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 [11].

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[cite: 27].
- Bessel sidebands with ratio consistent with modulation index from $K = 1.060$ [12].
- KWW relaxation tails with $\tau \approx 832.6$ s and $\beta = 1.060$ [4].
- Post-step amplitude overshoots of order 4–5% [13].

The combination of these signatures (frequency + phase + sidebands + KWW tails) is highly specific and difficult to mimic with conventional instrumental artifacts [14].

5 Conclusion

SFIT is one of the few quantum-gravity-inspired models with clear, near-term experimental predictions at laboratory energies [15]. The qBounce reanalysis already provides intriguing supporting evidence at 14.28σ[cite: 27]. The next decisive step is a dedicated GRANIT run, which can confirm or falsify the theory with high confidence[cite: 27].

Additional experiments using atom interferometry, torsion balances, or precision spectroscopy could provide independent tests and further constrain the coupling constant K [16].

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[cite: 27].

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