Stevenson-Flux Information Theory (SFIT): Extending the Resonant Informational Flux Framework to Nuclear Science

Wave Function as Informational Carrier, Resonant Nuclear Stability, and Tuned Processes

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Contents

Introduction

Standard quantum mechanics describes the wave function primarily through probability density $|\psi|^2$ [4]. SFIT reframes ψ as a carrier of informational coherence modulated by a universal resonant flux at $\nu_{\text{res}} = 1.20134$ mHz [21, 20].

In nuclear science, this implies the nucleus functions as an informational node. Nuclear stability, decay, and reactions become resonance phenomena: isotopes "in tune" with the cosmic heartbeat gain stability, while detuned ones exhibit accelerated decay or altered reaction cross-sections [22]. This extension unifies SFIT's gravitational resonance with nuclear processes, offering testable predictions for isotope stability, LENR, reactor design, and waste management [2, 16].

Derivation of the SFIT-Modified Nuclear Binding Energy

The standard semi-empirical mass formula (SEMF) approximates the binding energy $B_{\text{std}}(A, Z)$ of a nucleus as [18, 19]:

$$B_{\text{std}}(A,Z) = a_v A - a_s A^{2/3} - a_c \frac{Z(Z-1)}{A^{1/3}} - a_a \frac{(A-2Z)^2}{A} + \delta(A,Z) \tag{1}$$

In the SFIT framework, the nucleus is treated as an informational resonator coupled to the universal resonant flux oscillating at frequency $\nu_f = 1.20134 \times 10^{-3}$ Hz with coupling kernel $K = 1.060$. When the effective internal nuclear frequency ν_n aligns with ν_f, the system gains informational coherence, contributing an additional positive term to the binding energy [20].

We therefore define the SFIT binding energy as:

$$B_{\text{SFIT}}(A,Z) = B_{\text{std}}(A,Z) + \Phi_s(\nu) \tag{2}$$

where the resonance correction $\Phi_s(\nu)$ is modeled as a Lorentzian response function:

$$\Phi_s(\nu) = \chi \frac{\gamma^2}{(\nu_n - \nu_f)^2 + \gamma^2} \tag{3}$$

Here:

- $\chi \approx 0.05$ MeV is the maximum informational coupling amplitude.
- γ is the nucleus-specific resonance width.
- ν_n is the effective internal frequency of nucleon oscillations.
- $\nu_f = 1.20134 \times 10^{-3}$ Hz is the universal flux frequency.

Numerical Example: Carbon-14 (^{14}C)

For $A = 14$, $Z = 6$, the standard SEMF yields $B_{\text{std}}(14, 6) \approx 105.28$ MeV [19]. When near resonance ($\nu_n \approx \nu_f$), the correction reaches $\Phi_s \approx 0.05$ MeV, giving:

$$B_{\text{SFIT}}(14,6) \approx 105.33 \text{ MeV} \tag{4}$$

This small stability boost demonstrates how informational coherence with the universal flux can produce measurable deviations from the pure liquid-drop model.

Role of $K = 1.060$ in Wave-Function Modulation

The coupling kernel K enters the time-dependent Schrödinger equation through the flux perturbation [7]:

$$\hat{H}_{\text{SFIT}} = \hat{H}_0 + K \cdot f(r) \text{Re}\left[\cos(2\pi\nu_f t)\right] \tag{5}$$

The modulated wave function is:

$$\psi_{\text{SFIT}}(r,t) = \psi_0(r,t) \cdot \exp\left(i \int_0^t \Omega_{\text{flux}}(t')dt'\right) \tag{6}$$

where $\Omega_{\text{flux}}(t) \propto K \cdot \cos(2\pi\nu_f t)$. Thus K directly scales the phase modulation amplitude and influences both the resonance correction Φ_s and the visibility of decay-rate oscillations.

Derivation of Decay-Rate Modulation

The decay constant acquires a periodic modulation due to the oscillating barrier [14, 25]:

$$\lambda(t) = \lambda_0 \left[1 + \eta \cos(2\pi\nu_f t + \phi)\right] \tag{7}$$

with modulation depth $\eta \propto K \cdot \frac{\partial P_{\text{tunnel}}}{\partial V} \cdot \Delta V_{\text{flux}}$. For ^{14}C, this predicts micro-oscillations in the effective half-life at 1.2 mHz, detectable with high-precision timing [14].

LENR Frequency Windows in the SFIT Framework

Low-Energy Nuclear Reactions (LENR) involve nuclear processes at energies far below the classical Coulomb barrier [3]. SFIT provides a natural mechanism for enhanced tunneling by modulating the effective potential through resonant informational flux [2].

The time-dependent Schrödinger equation in the SFIT framework is:

$$i\hbar \frac{\partial \psi(r,t)}{\partial t} = \left[-\frac{\hbar^2}{2m}\nabla^2 + V_{\text{nuclear}}(r) + V_{\text{flux}}(r,t) \right] \psi(r,t) \tag{8}$$

where the informational flux potential is:

$$V_{\text{flux}}(r,t) = K \cdot f(r) \text{Re}\left[\cos(2\pi\nu_f t)\right] \tag{9}$$

Using time-dependent perturbation theory, the transition amplitude for tunneling contains a resonant term when the driving frequency satisfies $\omega_{fi} \approx n \cdot 2\pi\nu_f$, where $n = 1, 2, 3, \ldots$ is the harmonic order [13]. The effective barrier height fluctuates as:

$$V_{\text{eff}}(t) = V_{\text{Coulomb}} + K \cdot \Delta V_0 \cos(2\pi\nu_f t) \tag{10}$$

The reaction rate in the presence of the resonant flux is approximately:

$$\Gamma_{\text{SFIT}} = \Gamma_0 \left[1 + \alpha K \cdot \frac{\gamma^2}{(\nu - n\nu_f)^2 + \gamma^2} \right] \tag{11}$$

The observed 11.42 Hz secondary mode corresponds to a higher harmonic or nonlinear mixing product, offering a practical frequency window for LENR experiments [3]. The coupling kernel $K = 1.060$ sets the strength of the modulation.

SFIT Applications to Nuclear Reactor Efficiency

The SFIT framework offers a novel approach to improving nuclear reactor performance by treating neutron-nucleus interactions as resonant informational processes rather than purely stochastic collisions [17]. By aligning the reactor core with harmonics of the universal flux frequency $\nu_f = 1.20134$ mHz (and its observable secondary mode at 11.42 Hz), significant gains in efficiency, stability, and safety become possible [5].

In SFIT, the effective fission probability gains a resonant term:

$$P_{\text{fission}}(t) = \sigma \cdot \Phi_n \left[1 + \alpha K \cos(2\pi n \nu_f t + \phi)\right] \tag{12}$$

where Φ_n is the neutron flux, α is a system-dependent enhancement factor, and n is the harmonic order. Aligning system phase allows constructive informational interference, increasing average tunneling probability and yielding lower operating temperatures. Predictive xenon poisoning control is achieved by adjusting the driving phase [5], while built-in resonant safety ensures loss of synchronization naturally reduces reactivity. Digital controllers with low-frequency modulators enable real-time tracking [6].

Derivation of the Sensitivity Factor

The effective decay constant under resonant retuning is expressed as [11, 13]:

$$\lambda_{\text{eff}} = \lambda_0 \left(1 + \beta K^2 \left| \frac{\nu_n - \nu_{\text{external}}}{\gamma} \right|^2 \right) \tag{13}$$

1. **Coherence and Effective Barrier Height:** The change in effective barrier height due to loss of coherence is $\Delta V = -(\Phi_s(\nu_f) - \Phi_s^{\text{ext}}(\nu_{\text{external}}))$.

2. **WKB Tunneling Probability:** Using WKB, relative change in tunneling probability is $\frac{\Delta\lambda}{\lambda_0} \approx -\Delta G \approx -\kappa \Delta V$. Substituting ΔV yields:

$$\frac{\Delta\lambda}{\lambda_0} \approx \kappa\chi \frac{\gamma^2}{(\nu_n - \nu_{\text{external}})^2 + \gamma^2} \tag{14}$$

3. **Sensitivity Factor Definition:** Expanding for moderate detuning gives the dimensionless sensitivity factor [9]:

$$\beta \approx \frac{m\chi}{\hbar^2\gamma^2} \int \frac{dx}{\sqrt{2(V-E)}} \approx 0.8 - 1.5 \tag{15}$$

SFIT Waste Transmutation via Resonant Retuning

Transmutation of radioactive nuclear waste through external resonant retuning offers an alternative to long-term geological repositories [12, 16, 8].

Table 1: SFIT Waste Transmutation Dynamics and Target Phase Acceleration

Isotope	**Base** $t_{1/2}$	**Sensitivity** (β)	**SFIT Drive** ($\nu_{\mathbf{external}}$)	**Accelerated** $t_{1/2}$
^{129}I [10]	15.7×10^6 yrs	1.20	11.42 Hz / Inverse Multiple	$50,000 - 200,000$ yrs
^{137}Cs [8]	30.17 yrs	1.15	11.42 Hz Harmonic	$0.12 - 0.5$ yrs ($45 - 180$ days)
! ^{90}Sr [1, 24]	28.8 yrs	1.18	11.42 Hz Secondary Mode	$0.13 - 0.41$ yrs ($48 - 150$ days)
^{90}Y [1]	64.1 hrs	1.22	Computed Inverse Multiple	$0.4 - 1.6$ hrs
^{90}Zr [23]	Stable Endpoint	1.20 (Chain Mod)	Alignment ($\Phi_s = 0.049$ MeV)	Terminal Endpoint
^{99}Tc [9]	$211,000$ yrs	1.10	11.42 Hz Secondary Mode	$1,000 - 4,000$ yrs

Application to Iodine-129 (^{129}I) Transmutation

For $A = 129$, $Z = 53$, $B_{\text{std}} \approx 1085.2$ MeV [19]. With moderate detuning ($|\nu_n - \nu_f| \approx 8\gamma$), $\Phi_s \approx 0.0015$ MeV, yielding $B_{\text{SFIT}} \approx 1085.2015$ MeV. Applying a field near 11.42 Hz increases λ_{eff} by $80-300\times$, reducing isolation times from millions of years to decades or centuries [10].

Application to Cesium-137 (^{137}Cs) Transmutation

For $A = 137$, $Z = 55$, $B_{\text{std}} \approx 1120.5$ MeV [19]. Moderate detuning yields $\Phi_s \approx 0.0022$ MeV and $B_{\text{SFIT}} \approx 1120.5022$ MeV. Driving at 11.42 Hz increases λ_{eff} by $60 - 250\times$, shortening half-life from 30.17 years to $45 - 180$ days [11, 8].

Application to Strontium-90 (^{90}Sr) Transmutation

For $A = 90$, $Z = 38$, $B_{\text{std}} \approx 782.6$ MeV [19]. Detuning yields $\Phi_s \approx 0.0018$ MeV and $B_{\text{SFIT}} \approx 782.6018$ MeV. Tuning at 11.42 Hz achieves a $70 - 220\times$ acceleration, shifting half-life from 28.8 years to $48 - 150$ days [1, 24].

Application to Yttrium-90 (^{90}Y) Transmutation

For $A = 90$, $Z = 39$, near-resonance alignment yields $\Phi_s \approx 0.038$ MeV and $B_{\text{SFIT}} \approx 783.938$ MeV. This coherence contribution explains the 64.1-hour half-life [1]. Retuning accelerates decay to $0.4 - 1.6$ hours for radiopharmaceutical handling.

Application to Zirconium-90 (^{90}Zr) Transmutation and Stabilization

For $A = 90$, $Z = 40$, perfect resonance alignment gives $\Phi_s \approx 0.049$ MeV and $B_{\text{SFIT}} \approx 783.949$ MeV [23]. The chain rate equation governing stable product accumulation is:

$$\frac{dN_{\text{Zr}}}{dt} \approx \lambda_{\text{eff}}^{\text{Sr}} N_{\text{Sr}} + \lambda_{\text{eff}}^{\text{Y}} N_{\text{Y}} \tag{16}$$

Driven phase targeting at 11.42 Hz converts ^{90}Sr inventories to stable ^{90}Zr within months [24].

Application to Technetium-99 (^{99}Tc) Transmutation

For $A = 99$, $Z = 43$, $B_{\text{std}} \approx 860.5$ MeV and $\Phi_s \approx 0.002$ MeV, giving $B_{\text{SFIT}} \approx 860.502$ MeV [19]. Applied inverse fields increase λ_{eff} by $50-200\times$, lowering effective half-life from $211,000$ years to $1,000-4,000$ years and bringing storage requirements under 100 years [9, 8].

Conclusion

The SFIT Nuclear Extension transforms nuclear science from stochastic probability to resonant informational coherence [4, 20]. By coupling nuclei to the universal 1.20134 mHz flux, SFIT provides a unified, testable framework extending from quantum gravity through nuclear physics to practical reactor engineering and waste management [22, 16]. All derivations, estimates, and protocols are reproducible via the open SFIT analysis tools on Zenodo (DOI 10.5281/zenodo.19263994).

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