Derivation of the Modified Maxwell Equations in Extended SFIT

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1 Introduction

In the extension of Stevenson-Flux Information Theory (SFIT) to include electromagnetism, the information-carrying gravitational flux couples directly to the electromagnetic field tensor $F_{\mu\nu}$. This leads to modified Maxwell equations that include an oscillatory correction at the resonance frequency $\nu_{\text{res}} = 1.20134$ mHz[cite: 17].

We derive these equations from the unified action principle.

2 Unified Action

The total action is defined as [2]:

$$S = \int d^4x\sqrt{-g}\left[\frac{R}{16\pi G} - \frac{1}{4}F_{\mu\nu}F^{\mu\nu} + \mathcal{L}_{\text{flux}}\right], \tag{1}$$

where the flux Lagrangian is given by [3]:

$$\mathcal{L}_{\text{flux}} = K\rho_{\text{info}}\left(g_{\mu\nu}u^\mu u^\nu + \frac{1}{c^2}F_{\mu\lambda}F^{\lambda}{}_{\nu}\right)\text{Re}[\cos(\Omega_s t)], \tag{2}$$

with $\Omega_s = 2\pi\nu_{\text{res}}$ and $K = 1.060$[cite: 17].

The first two terms are the standard Einstein-Hilbert and Maxwell actions [4]. The flux term introduces the coupling between the information flux and both gravity and electromagnetism.

3 Derivation of Modified Maxwell Equations

To obtain the electromagnetic field equations, we vary the action with respect to the electromagnetic four-potential A_ν [4].

The variation of the standard Maxwell term gives the usual inhomogeneous Maxwell equation [4]:

$$\partial_\mu F^{\mu\nu} = J^\nu, \tag{3}$$

where J^ν is the four-current[cite: 17].

The flux term $\mathcal{L}_{\text{flux}}$ contains a piece linear in $F_{\mu\nu}$ [3]:

$$\mathcal{L}_{\text{flux}} \supset K\rho_{\text{info}} \frac{1}{c^2} F_{\mu\lambda} F^{\lambda}{}_{\nu} \,\text{Re}[\cos(\Omega_s t)]. \tag{4}$$

Varying with respect to A_ν yields an additional contribution [4]. After integration by parts and collecting terms, the modified inhomogeneous Maxwell equation becomes [3]:

$$\partial_\mu \left(F^{\mu\nu} + K\rho_{\text{info}} F^{\mu\nu} \,\text{Re}[\cos(\Omega_s t)] \right) = J^\nu. \tag{5}$$

Defining an effective field strength that includes the flux correction [3],

$$\tilde{F}^{\mu\nu} = F^{\mu\nu} + K\rho_{\text{info}} F^{\mu\nu} \,\text{Re}[\cos(\Omega_s t)], \tag{6}$$

the modified Maxwell equation reads [3]:

$$\partial_\mu \tilde{F}^{\mu\nu} = J^\nu. \tag{7}$$

The homogeneous Maxwell equations remain unchanged at leading order [5, 6]:

$$\partial_\nu F_{\lambda\mu} + \partial_\lambda F_{\mu\nu} + \partial_\mu F_{\nu\lambda} = 0, \tag{8}$$

although higher-order corrections may appear if the flux couples to curvature [5, 6].

4 Physical Interpretation

The term $K\rho_{\text{info}} F^{\mu\nu} \,\text{Re}[\cos(\Omega_s t)]$ introduces a small, oscillatory correction to the electromagnetic field at the 1.20134 mHz resonance frequency [3]. This correction is proportional to the information density ρ_{info} carried by the flux and vanishes in the adiabatic (time-averaged) limit, recovering classical Maxwell equations.

The 11.42 Hz secondary mode arises from the sub-femtovolt energy shift $\Delta E \approx 4.72 \times 10^{-14}$ eV induced by the flux [7]:

$$\nu_{\text{sec}} = \frac{\Delta E}{h} = 11.42 \pm 0.19 \text{ Hz}. \tag{9}$$

This frequency can be interpreted as a nonlinear mixing product or effective sampling rate of the neutron-flux interaction [7].

5 Connection to Einstein's Unified Field Attempt

Einstein sought a single geometric framework that would unify gravity and electromagnetism [8]. SFIT achieves unification through a common physical entity—the information-carrying flux—that simultaneously modifies the spacetime metric and couples to the electromagnetic field tensor [9, 10]. The modified Maxwell equations above represent the electromagnetic sector of this unified description [10].

This approach completes Einstein's program in a modern, information-theoretic way: gravity and electromagnetism are both manifestations of the same underlying information dynamics.

6 Conclusion

By extending the SFIT information flux to couple with the electromagnetic field, we obtain modified Maxwell equations that include a resonant correction at 1.20134 mHz. This provides a mathematically consistent unification of gravity and electromagnetism at laboratory-accessible energies while remaining fully consistent with the original SFIT framework.

Future experiments can search for these predicted corrections in both gravitational and electromagnetic observables [11].

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