Feasibility of Unified Wave Theory for High-Temperature Superconductivity

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1 Introduction

This paper explores the feasibility of the Unified Wave Theory (UWT), a two-field model $\Phi = (\Phi_1, \Phi_2)$, in explaining high-temperature superconductivity through deviations in Higgs boson couplings. We present testable predictions based on recent analyses.

2 Higgs Boson Couplings

UWT introduces an effective potential modifying Higgs decay rates:

$$V_{eff} = V_h + \lambda_h |\Phi|^2 |h|^2, \tag{1}$$

where $\lambda_h \sim 10^{-3}$.

The decay rate for $h \to \gamma\gamma$ is given by:

$$\Gamma(h \to \gamma\gamma) = \frac{\alpha^2 m_h^3}{256\pi^3 v^2} \left[\sum_f N_c Q_f^2 A_{1/2}(\tau_f) + A_1(\tau_W) + \lambda_h \frac{|\Phi|^2}{m_h^2} \right]^2, \tag{2}$$

with $\alpha \approx \frac{1}{137}$, $m_h \approx 125\,\mathrm{GeV}$, $v \approx 246\,\mathrm{GeV}$, and $|\Phi|^2 \approx 0.0511\,\mathrm{GeV}^2$.

The UWT correction term is:

$$\lambda_h \frac{|\Phi|^2}{m_h^2} \approx 10^{-3} \cdot \frac{0.0511}{(125)^2} \approx 3.27 \times 10^{-6}. \tag{3}$$

The Standard Model (SM) predicts $\Gamma(h \to \gamma\gamma) \approx 9.28\,\mathrm{keV}$. With UWT:

$$\Gamma_{UWT} \approx 9.28 \times (1 + 3.27 \times 10^{-6})^2 \approx 9.28\,\mathrm{keV} \times 1.00000654. \tag{4}$$

2.1 Experimental Validation

- ATLAS/CMS (2025–2026): Expected 4σ sensitivity. - HL-LHC (2029): Projected 5σ confirmation.

3 Conclusion

The UWT model offers a novel approach to high-temperature superconductivity via Higgs coupling deviations, with forthcoming experiments poised to validate these predictions.