# Addendum: Cooper Pair Coherence in Unified Wave Theory for High-Temperature Superconductivity

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August 19, 2025

**Abstract**

This addendum to the paper "Feasibility of Unified Wave Theory for High-Temperature Superconductivity" details how the Unified Wave Theory (UWT) two-field model ($\Phi = (\Phi_1, \Phi_2)$) enhances Cooper pair coherence in high-temperature superconductors through scalar field oscillations. It complements the Higgs boson coupling mechanism and provides clarity for experimental validation. The full UWT framework is available at `https://github.com/Phostmaster/Everything`.

## 1 Cooper Pair Coherence Mechanism

The Unified Wave Theory (UWT) posits that the Golden Spark, a phase transition at $t \approx 10^{-36}$ s, splits the scalar field $\Phi$ into $\Phi_1, \Phi_2$, driving cosmological and quantum phenomena. In high-temperature superconductivity, $\Phi_1, \Phi_2$ oscillations enhance Cooper pair coherence, enabling robust electron pairing at elevated temperatures.

The scalar fields evolve as:

$$\Phi_1(x,t) \approx \phi_1 e^{i(k_{\text{wave}} x - \omega t)}, \quad \Phi_2(x,t) \approx \phi_2 e^{i(k_{\text{wave}} x - \omega t - \pi)}, \tag{1}$$

with $\phi_1 \approx 0.00095$, $\phi_2 \approx 0.00029$, and $k_{\text{wave}} \approx 0.0047$. These oscillations, coupled to the Higgs field via the effective potential:

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

where $\lambda_h \sim 10^{-3}$ and $|\Phi|^2 \approx 0.0511\,\text{GeV}^2$, induce a coherent background that stabilizes Cooper pairs.

The Cooper pair wavefunction is modified by the UWT scalar fields:

$$\psi_{\text{pair}} \propto e^{i\theta} \left[ 1 + \lambda_h \frac{|\Phi_1 \Phi_2|}{m_h^2} \cos(k_{\text{wave}} |\vec{r}| + \epsilon_{\text{CP}} \pi) \right], \tag{3}$$

where $m_h \approx 125\,\text{GeV}$, $\epsilon_{\text{CP}} \approx 2.58 \times 10^{-41}$, and $|\Phi_1 \Phi_2| \approx 4.75 \times 10^{-4}$. The oscillatory term $\cos(k_{\text{wave}} |\vec{r}| + \epsilon_{\text{CP}} \pi)$ enhances the pairing amplitude, increasing the critical temperature ($T_c$) by reducing thermal disruptions.

This coherence is amplified by Scalar-Boosted Gravity (SBG), with $g_{\text{wave}} \approx 19.5$, which aligns the $\Phi_1, \Phi_2$ phases to minimize entropy:

$$S \propto -|\Phi_1 \Phi_2| \ln(|\Phi_1 \Phi_2|). \tag{4}$$

The resulting entangled state:

$$|\Psi\rangle = \frac{1}{\sqrt{2}}(|\Phi_1\rangle|\Phi_2\rangle + |\Phi_2\rangle|\Phi_1\rangle), \tag{5}$$

sustains long-range order in the superconductor, potentially enabling room-temperature superconductivity.

### 1.1 Experimental Implications

The $\Phi_1, \Phi_2$ oscillations ($k_{\mathrm{wave}} \approx 0.0047$) can be probed via:

- **SQUID-BEC Experiments (2027)**: Detect $\Phi_1, \Phi_2$ coherence at $f \approx 1.12 \times 10^5$ Hz, correlating with Higgs decay rate deviations ($\Gamma_{UWT} \approx 9.28\,\mathrm{keV} \times 1.00000654$).
- **ATLAS/CMS (2025–2026)**: Measure Higgs coupling deviations at $4\sigma$, validating the $\lambda_h|\Phi|^2|h|^2$ term.
- **HL-LHC (2029)**: Confirm UWT's predictions at $5\sigma$, potentially detecting enhanced $T_c$ in UWT-inspired materials.

## 2 Conclusion

The $\Phi_1, \Phi_2$ oscillations in UWT enhance Cooper pair coherence by stabilizing electron pairing through Higgs field interactions and SBG. This mechanism supports high-temperature superconductivity, offering a pathway to room-temperature applications, with testable predictions for upcoming experiments.