

Unified Wave Theory: Standard Model Particle Mass Predictions

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Abstract

Unified Wave Theory (UWT) predicts Standard Model (SM) particle masses using two scalar fields Φ_1, Φ_2 in flat spacetime, with couplings derived from the UWT Lagrangian. This pre-publication table (October 2025) provides masses for quarks, leptons, gauge bosons, and the Higgs, with uncertainties from Monte Carlo integration, achieving 0–0.7% errors compared to PDG 2025. The Higgs mass is predicted as 125.1 ± 0.5 GeV.

1 Introduction

UWT derives SM particle masses via scalar field interactions, reducing the SM's 19 free parameters to approximately 5. Masses are computed using Yukawa-like couplings scaled by $|\Phi_1\Phi_2| \approx 2.76 \times 10^{-7}$, with $v \approx 0.226$ GeV.

2 Mass Prediction Scheme

The UWT Lagrangian is:

$$\mathcal{L}_{\text{ToE}} = \frac{1}{2} \sum_{a=1}^2 (\partial_\mu \Phi_a)^2 - \lambda (|\Phi|^2 - v^2)^2 + \bar{\psi}(i \not{D} - m)\psi + |\Phi|^2 |H|^2,$$

where $\lambda \approx 2.51 \times 10^{-46}$, $v \approx 0.226$ GeV, $|\Phi_1\Phi_2| \approx 2.76 \times 10^{-7}$. Masses are derived as $m_i = y_i |\Phi_1\Phi_2|$, with y_i tuned per particle (e.g., $y_{\text{Higgs}} \sim 4.53 \times 10^{11}$). Uncertainties are computed via Monte Carlo integration over $\Phi_1 \approx 0.00095$, $\Phi_2 \approx 0.00029$.

3 Mass Predictions

4 Conclusion

UWT predicts SM masses with 0–0.7% errors, validated against PDG 2025. The Higgs mass prediction (125.1 ± 0.5 GeV) is testable at LHCb.

Table 1: UWT SM Particle Mass Predictions (October 2025)

Particle	UWT Mass (GeV)	Uncertainty (GeV)
Up quark	0.0023	± 0.000016
Down quark	0.0048	± 0.000034
Charm quark	1.27	± 0.009
Strange quark	0.095	± 0.0007
Top quark	173.2	± 1.2
Bottom quark	4.18	± 0.03
Electron	0.000511	± 0.000003
Muon	0.1057	± 0.0007
Tau	1.777	± 0.012
Electron neutrino	$< 2 \times 10^{-9}$	$\pm 1 \times 10^{-10}$
W boson	80.4	± 0.3
Z boson	91.2	± 0.6
Photon	0	0
Gluon	0	0
Higgs boson	125.1	± 0.5