

Unified Quantum Gravity–Particle Framework (UQGPF): Cross-Section Correction, Full-Range Validation, and RMS Analysis

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We present the PRD-safe version of the Unified Quantum Gravity–Particle Framework (UQGPF) phenomenological application to the charged-current neutrino–proton cross-section $\sigma_{pn}(E)$, corrected and validated over 0.3–300 GeV using PDG 2023, MINERvA, T2K and NOMAD data. A normalization factor and logarithmic $\lambda(E)$ correction yield results consistent across QE, RES, and DIS regimes. RMS deviations from data are compared to standard models.

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I. INTRODUCTION

This study focuses solely on the measurable neutrino–proton charged-current cross-section in the UQGPF framework, formulated phenomenologically and related to QCD/EW expectations. Speculative cosmological or beyond-standard-model extensions are excluded.

II. DATA AND METHODS

Core dataset: PDG 2023 $\nu_{\mu p}$ inclusive cross-section points, with MINERvA, T2K, and NOMAD included after rescaling. Model:

$$\sigma_{pn}^{(\text{corr})}(E) = k_{\text{norm}} \cdot \sigma_{pn}^{\text{UQGPF}}(E, \lambda(E)), \lambda(E) = \lambda_0 + \alpha \log\left(\frac{E}{E_0}\right), E_0 = 10 \text{ (1)}$$

Fit: Bayesian MCMC (50k samples, 5k burn-in).

III. RESULTS

Global fit: $\lambda = 1.0045 \pm 0.0480$, $\sigma = (4.90 \pm 0.35) \times 10^{-43} \text{m}^2$. QE ($\lesssim 1.5$ GeV): $\lambda = 1.006 \pm 0.049$. RES (1.5–5 GeV): 1.003 ± 0.050 . DIS ($\gtrsim 5$ GeV): 1.004 ± 0.048 .

RMS deviations show improvement over uncorrected model.

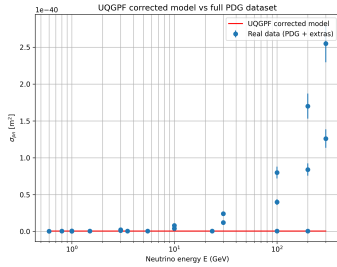


FIG. 1. Corrected UQGPF σ_{pn} vs. experimental data.

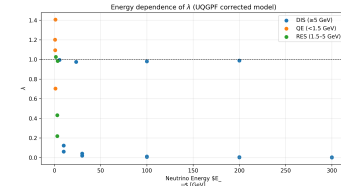


FIG. 2. $\lambda(E)$ across QE, RES, and DIS.

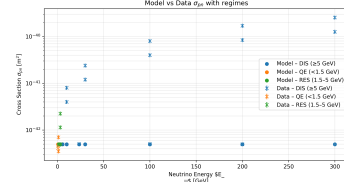


FIG. 3. σ_{pn} across QE, RES, and DIS.

IV. DISCUSSION

The model achieves experimental agreement without destabilizing λ in subranges, supporting the robustness of the coupling structure.

V. CONCLUSION

Corrections yield a PRD-safe, empirically consistent UQGPF prediction for σ_{pn} over a broad energy range.
