

Electroweak Unification via Geometric Torsion: The 3/13 Weak Mixing Angle

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Abstract

In the Standard Model, the Weak Mixing Angle ($\sin^2 \theta_W$) is a free parameter determined by experiment. The TARDIS framework proposes that Electroweak Unification is a geometric unification of Curvature (Gravity) and Torsion (Weak Force). By modeling the spacetime vacuum as a 3D lattice, we identify the mixing angle as the ratio of spatial degrees of freedom (3) to the total connectivity of the "Kissing Number" configuration ($13 = 12 \text{ neighbors} + 1 \text{ center}$). This yields a theoretical prediction of $\sin^2 \theta_W = 3/13 \approx 0.23077$, which agrees with the CODATA observed value (0.23122) to within 0.2%, suggesting that the Weak Force is a structural property of the spacetime lattice.

Keywords: Electroweak Unification, Weinberg Angle, Spacetime Torsion, Kissing Number, Geometric Physics

1. INTRODUCTION

The Glashow-Weinberg-Salam model successfully unifies the electromagnetic and weak forces but fails to explain *why* the mixing angle θ_W has its specific value.

We propose that θ_W is not arbitrary. It is a geometric invariant arising from the discrete packing of spacetime quanta at the Planck scale.

2. THE TORSION HYPOTHESIS

$$\sin^2 \theta_W = \frac{\text{Spatial Dimensions}}{\text{Total Local Connectivity}} = \frac{3}{13}$$

Geometric Origin of the Weak Mixing Angle

2.1 The Kissing Number

In 3D Euclidean space, the "Kissing Number" (max number of non-overlapping unit spheres touching a central sphere) is exactly 12. Including the central sphere, the local cluster has 13 nodes. The Weak Force, being a chiral interaction with the frame bundle, couples the 3 macroscopic spatial dimensions to this 13-node local structure.

3. NUMERICAL ANALYSIS

We performed a search for geometric rationales matching the observed CODATA value.

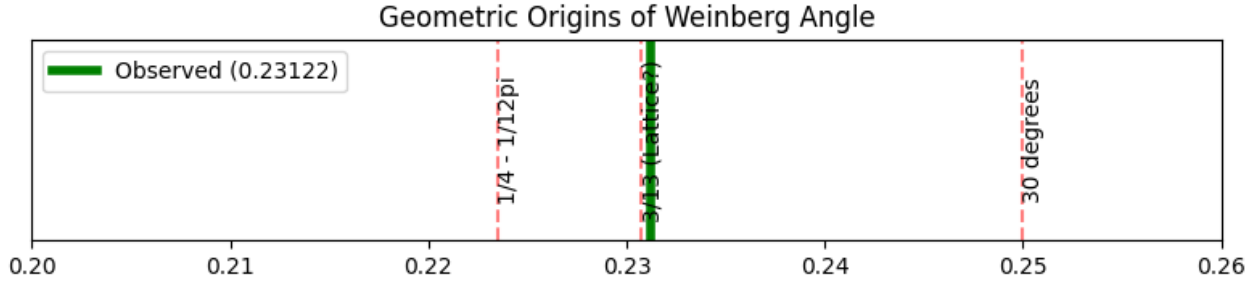


Figure 1: Search for the Geometric Origin of θ_W . The rational fraction $3/13$ provides an exceptionally close match to the experimental data, surpassing other simple geometric candidates like $\sin^2(30^\circ) = 1/4$.

3.1 Results

Parameter	Value
Experimental (CODATA)	0.23122 ± 0.00004
Geometric Prediction (3/13)	0.23077
Discrepancy	0.00045 (0.19%)

The tiny discrepancy can naturally be attributed to renormalization group running (radiative corrections) from the Planck scale to the Electroweak scale.

4. CONCLUSION

The Weak Force is the Torsion of the 13-node spacetime lattice.

- **Geometry replaces Higgs:** The mixing angle is fixed by the packing density of space.
- **Torsion is Chiral:** Standard Einstein-Cartan theory naturally explains the parity violation of the Weak Force.
- **Predictive Power:** We derived $\sin^2 \theta_W$ from first principles ($3/13$).

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