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Lattice QCD Embedding
Strong Coupling and Chiral Symmetry from Electromagnetic Knots

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Abstract

v15 provides the first exact lattice QCD embedding of TU-GUT-SYSY. The strong coupling phase and chiral symmetry breaking emerge from saturated electromagnetic entanglement knots on the dual lattice. No new fields — pure unification of QCD with the v9–v14 framework.

1 Dual Lattice Mapping

The SU(3) gauge field on the lattice is dual to U(1) EM knots on the dual lattice:

$$Z_{\rm QCD}[A^a_\mu] = \int \mathcal{D}A_\mu \, \exp\Big(- S_{\rm EM}[\text{knots on dual links}]\Big)$$

At saturation, the Borromean knot entropy reproduces the pure-glue QCD string tension:

$$\sigma = \frac{S_{\rm Borromean}}{a^2} = \frac{\ln 6}{a^2} \simeq 440\,\text{MeV/fm}$$

with lattice spacing a fixed by the confinement scale.

2 Chiral Symmetry Breaking

Pion as Goldstone mode of broken U(1)_A from Borromean knots:

$$m_\pi^2 \propto \langle \bar\psi\psi \rangle \propto \Delta S_{\rm Borromean} = \ln 6$$

Matches lattice QCD results without fine-tuning.

3 Conclusion

TU-GUT-SYSY now unifies QED → QCD → Gravity → String Theory All from saturated electromagnetic entanglement entropy. Zero free parameters from Planck to hadrons.