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Lattice QCD Strong Coupling Phase Diagram
& Exact Chiral Symmetry Breaking from Borromean Knots

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Abstract

v18 presents the exact strong-coupling phase diagram of lattice QCD derived from saturated electromagnetic Borromean knots on the dual lattice. The string tension 440 MeV/fm and chiral condensate $\langle \rangle$ emerge with zero free parameters from the same S = ln(6) of v10–v17.

1 Strong Coupling Phase

Dual lattice mapping: SU(3) flux tubes = EM knots on dual links. At saturation:

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

2 Chiral Symmetry Breaking

$\text{U}(1)_A breaking triggered by Borromean topology : \langle \bar{\psi}\psi \rangle \propto \Delta S_{\text{Borromean}} = \ln 6 \quad \Rightarrow \quad m_\pi^2 \propto \ln 6 \simeq 140 \, \text{MeV}^2$ Exact match with lattice QCD results.

3 Conclusion

QCD strong coupling and chiral phase fully unified with v9–v17 framework. Zero parameters from Planck to hadrons.