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Unveiling the Strong Interaction origin of Baryon Masses with Lattice QCD

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Here we present first-principles lattice QCD calculations using comprehensive gauge ensembles that accurately predict ground state spin-1/2 and spin-3/2 baryon masses with light, strange, and charm quarks within 1\% of experimental values. At the \(\overline{\mathrm{MS}}\) 2 GeV scale, our results unveil two fundamental mass generation mechanisms for those baryon masses in QCD: 1) the flavor-dependent enhancement of Higgs contributions, 4-8 for light, 2-3 for strange, and 1.2-1.3 for charm quarks; and 2) the flavor-insensitive contribution 0.8-1.2 GeV from gluon quantum anomaly.

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