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The Nucleon Axial Coupling from Quantum Chromodynamics

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The *axial coupling of the nucleon*, g_A, is the strength of its coupling to the *weak* axial current of the Standard Model, much as the electric charge is the strength of the coupling to the electromagnetic current. This axial coupling dictates, for example, the rate of β-decay of neutrons to protons and the strength of the attractive long-range force between nucleons. Precision tests of the Standard Model in nuclear environments require a quantitative understanding of nuclear physics rooted in Quantum Chromodynamics, a pillar of this theory. The prominence of g_A makes it a benchmark quantity to determine theoretically, a difficult task as the theory is non-perturbative. Lattice QCD provides a rigorous, non-perturbative definition of the theory which can be numerically implemented. In order to determine g_A, the lattice QCD community has identified two challenges which must be overcome to achieve a 2% precision by 2020: the excited state contamination must be controlled and the statistical precision must be markedly improved. Here we report a calculation of $g_A^{\rm QCD} = 1.271 \pm 0.013$ using an unconventional method that overcomes these challenges.

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