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The Baryon Resonance Spectrum and the $1/N_c$ Expansion[1]

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Why do baryon resonance multiplets exist, and what controls their formation and decays? It is natural to consider them as merely excited states of some three-quark or meson-nucleon potential. But these are just simplistic quantum-mechanical pictures that recognize neither the full field-theoretical complexities of QCD nor the extremely brief lifetimes of resonances due to quark pair production. Both of these issues are addressed by the $1/N_c$ expansion of QCD, where N_c is the number of color charges. Constraints arising at large N_c on meson-baryon scattering amplitudes not only create linear relationships between them, thus linking distinct partial waves and their embedded resonances, but also restrict the possible resonant decay channels. I present strong experimental evidence in favor of this approach, describe the multiplet structure that it predicts, and show how to perform the analysis beyond the strict large N_c limit by incorporating $1/N_c$-suppressed effects.

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