

Electromagnetic Structure of Octet Baryons

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Abstract: The electromagnetic properties of the baryon octet are calculated in quenched QCD on a $20^3 \times 40$ lattice with a lattice spacing of 0.128 fm using the fat-link irrelevant clover (FLIC) fermion action. FLIC fermions enable simulations to be performed efficiently at quark masses as low as 300 MeV. By combining FLIC fermions with an improved-conserved vector current, we ensure that discretisation errors occur only at $\mathcal{O}(a^2)$ while maintaining current conservation. Magnetic moments and electric and magnetic radii are extracted from the electric and magnetic form factors for each individual quark sector. From these, the corresponding baryon properties are constructed. Our results are compared extensively with the predictions of quenched chiral perturbation theory. We detect substantial curvature and environment sensitivity of the quark contributions to electric charge radii and magnetic moments in the low quark mass region. Furthermore, our quenched QCD simulation results are in accord with the leading non-analytic behavior of quenched chiral perturbation theory, suggesting that the sum of higher order terms makes only a small contribution to the chiral expansion.