

Investigations in Non-perturbative QCD

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Abstract

In this thesis we review two methods for studying the non-perturbative region of QCD: the effective field theory, chiral perturbation theory (χ PT), and the cloudy bag model, a successful chiral quark model of hadron structure. We use information from both of these sources to construct a simple extrapolation formula in the pion mass, m_π , for the nucleon electromagnetic form factors, which combines the correct non-analytic chiral behaviour predicted by χ PT with the correct large m_π behaviour. This formula is applied to recent quenched lattice QCD results to extrapolate to the physical regime. Given the simple nature of the extrapolation scheme, our results compare surprisingly well with experiment. We also employ a simple chiral quark model (the hedgehog) to examine the volume and pion mass dependence of the axial coupling constant, g_A , along with the hedgehog baryon mass. Our results for g_A reveal large volume dependence at low pion masses.

Statement of Originality

This work contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text.

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