HADRONIC MATRIX ELEMENTS OF GLUON OPERATORS IN THE INSTANTON VACUUM

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We propose a method to evaluate hadronic matrix elements of QCD gluon operators in the instanton vacuum. We construct the ground state of the interacting instanton ensemble for non-zero ϑ–angle using a variational principle. A method to study the ϑ–dependence of observables on the lattice is suggested. We then derive the effective fermion action, which allows to calculate hadronic correlation functions in a $1/N_c$–expansion (Nambu–Jona-Lasinio type effective fermion theory). Gluon operators are systematically represented as effective fermion operators. Physical matrix elements are obtained after integrating the correlation functions over fluctuations of the numbers of instantons. The influence of the fermion determinant on the topological susceptibility is taken into account. Our effective description gives matrix elements fully consistent with the trace and $U(1)_A$ anomalies. The approach allows to consistently evaluate the nucleon matrix elements of various gluon and mixed quark–gluon operators in a chiral soliton picture of the nucleon.

REFERENCE

Diakonov D.I., Polykov M.V., Weiss C. Preprints PNPI-TH-2076-1995. 41 p. and RUB-TPII-27/95 to appear in Nucl.Phys.B.

NUCLEON TENSOR CHARGES IN SU(2) CHIRAL QUARK–SOLITON MODEL

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We investigate the singlet $g_T^{(0)}$ and isovector $g_T^{(3)}$ tensor charges of the nucleon, which are deeply related to the first moment of the leading twist transversity quark distribution $h_1(x)$ at a low normalization point, in the chiral quark-soliton model. With rotational $O(1/N_c)$ corrections taken into account, we obtain $g_T^{(0)} = 0.69$ and $g_T^{(3)} = 1.45$. Within the same approximation and parameters the model yields $g_A^{(0)} = 0.36$, $g_A^{(3)} = 1.21$ for axial charges and correct octet–decuplet mass splitting. We show how the chiral quark-soliton model interpolates between the nonrelativistic quark model and the Skyrme model.

REFERENCE

Kim H.-C., Polyakov M.V., Goeke K. Preprint RUB-TPII-6/95 to appear in Nucl.Phys.A Preprint RUB-TPII-26/95 to appear in Phys.Rev.D.