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# CP-violating gluon operators and neutron EDM from the QCD instanton vacuum

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Experimental studies of hadronic CP-violation rely on theoretical calculations of the hadronic matrix elements of higher-dimensional QCD operators representing the effects of the CP-violating short-distance dynamics at the hadronic scale. We report about a recent calculation of the spin-dependent nucleon matrix element of Weinberg's dimension-6 CP-odd gluon operator $f^{abc}(\tilde{F}_{\mu\nu})^a(F^{\mu\rho})^b(F^{\nu}{}_{\rho})^c$ using the instanton picture of the QCD vacuum [1]. In leading order of the instanton packing fraction, the dimension-6 operator is effectively proportional to the topological charge density $(\tilde{F}_{\mu\nu})^a(F^{\mu\nu})^a$, whose nucleon matrix element is given by the flavor-singlet axial charge and constrained by the $U(1)_A$ anomaly. The nucleon matrix element of the dimension-6 operator is obtained substantially larger than in other estimates, because of the strong localization of the nonperturbative gluon fields in the instanton vacuum. We comment on the neutron EDM induced by the dimension-6 gluon operator. We discuss the connection of the CP-violating operators with other operators describing nucleon spin structure in deep-inelastic processes.

[1] C. Weiss, Phys. Lett. B 819 (2021) 136447

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