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Functional renormalization group study of anomalous magnetic moment in a low energy effective theory

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The quark anomalous magnetic moments (AMMs) are investigated in a 2-flavor low-energy effective theory within the functional renormalization group (FRG) approach under an external magnetic field. The Schwinger formalism is adopted for quark propagators, and Fierz-complete four-quark scatterings are self-consistently included through the renormalization group flows. We find that the quark AMMs are dynamically generated with the chiral symmetry breaking, and the magnitude of the AMM of the down quark is around 4 times larger than that of the up quark. The transverse AMMs and the longitudinal d-quark AMM monotonically decrease with the magnetic field strength, while the longitudinal u-quark AMM slightly increases with the magnetic field strength. At B=0, the magnetic moments of proton and neutron are computed using the constituent quark model, which are close to the experimental values.

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