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Spin-spin interaction in the bulk of topological insulators LIANG CHEN, Beijing Computational Science Research Center, JINHUA SUN, Peking University, HAI-QING LIN, Beijing Computational Science Research Center — We apply mean-field theory and Hirsch-Fye quantum Monte Carlo method to study the spin-spin interaction in the bulk of three-dimensional topological insulators. We find that the spin-spin interaction has three different components: the longitudinal, the transverse and the transverse Dzyaloshinskii-Moriya-like terms. If the chemical potential is located in the bulk gap of topological insulators, the spin-spin interaction decays exponentially due to the Bloembergen-Rowland interaction. And the longitudinal correlation is antiferromagnetic, the transverse correlations is ferromagnetic and the transverse Dzyaloshinskii-Moriya-like correlation is suppressed if the distance between magnetic impurities is sufficient large. When the chemical potential is in the conduction or valence band, the spin-spin interaction follows power law decay, and isotropic ferromagnetic interaction dominates in short separation limit.

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