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Spin polarization and alignments from color fields in the glasma

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We establish the theoretical formalism to study how the color fields in the glasma state dynamically generate spin polarization of quarks and the spin correlation of a quark and an antiquark in high-energy nuclear collisions. By utilizing the perturbative solution of the quantum kinetic theory for spin transport of massive quarks under classical color fields with dynamics following linearized Yang-Mills equations, we derive the spectra of spin polarization and correlation of quarks at small momentum and central rapidity in the integral form of gluon-field correlators. Applying the Golec-Biernat Wusthoff dipole distribution, it is found that the effect on spin polarization vanishes. In contrast, we find the non- vanishing out-of-plane spin correlation and make a qualitative estimation based on the dimensional analysis. This glasma-induced spin correlation pertinent to spin alignment of vector mesons could be prominently enhanced at weak coupling and large collision energy.

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