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An improved formula for spin polarization at local thermodynamic equilibrium

We present an upgraded formula for Wigner function and spin polarization of fermions emitted by a relativistic fluid at local thermodynamic equilibrium at the freeze-out which improves the one obtained in literatures and used in numerical simulations of relativistic nuclear collisions. By using a
new expansion method applicable to freeze-out hypersurfaces with arbitrary geometry, we reproduce the known term proportional to thermal vorticity and obtain a better approximation for the spin-shear term. The new method captures the long-distance interference along the particle ' s trajectory, which was missed in previous approaches. It also naturally excludes contributions from space-time gradients in the normal direction of the hypersurface, providing a theoretical justification for the isothermal condition previously imposed a priori. This framework can be extended to particles with arbitrary spin.

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