

Spin-dependent distribution functions for relativistic hydrodynamics of spin-1/2 particles

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We study properties of the spin density matrices used in recent formulations of relativistic hydrodynamics of particles with spin 1/2. We show that it is possible to reduce the spin density matrices to the forms linear in the Dirac spin operator. This allows for a natural determination of the spin polarization vectors of particles and antiparticles by the trace of products of the spin density matrices and the Pauli matrices. We demonstrate that the total spin polarization vector obtained in this way agrees with the Pauli-Lubanski four-vector, constructed from an appropriately chosen spin tensor and boosted to the particle rest frame. We further show that several forms of the spin tensor used in the literature give the same Pauli-Lubanski four-vector.

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