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Relativistic hydrodynamics with spin

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A new framework for relativistic hydrodynamics with spin is proposed. It is based on the conservation laws for charge, energy, momentum, and angular momentum. The conservation laws lead to hydrodynamic equations for the charge density, local temperature, and fluid velocity, as well as for the spin polarization tensor. The resulting set of differential equations extends the standard picture of perfect-fluid hydrodynamics, with a conserved entropy current, in a minimal way.

In addition, the properties of the relativistic spin density matrices for spin-1/2 particles, which have been used recently in works on the polarization of Lambda hyperons, are discussed. Their relations to the Pauli-Lubański four-vector and different forms of the spin tensor are elucidated.

The proposed framework forms a basis for hydrodynamic interpretation of polarization measurements in heavy-ion collisions.

Based on the recent work by WF, B. Friman, A. Jaiswal, and E. Speranza, "Relativistic fluid dynamics with spin", arXiv:1705.00587.

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