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Spin Hydrodynamics in Belinfante form and local polarization from hydrodynamic model

We discuss a puzzle in relativistic spin hydrodynamics; in the previous formulation the spin source from the antisymmetric part of the canonical energy-momentum tensor (EMT) is crucial. The Belinfante improved EMT is pseudo-gauge transformed from the canonical EMT and is usually a physically sensible choice especially when gauge fields are coupled as in magnetohydrodynamics, but the Belinfante EMT has no antisymmetric part. We find that pseudo-transformed entropy currents are physically inequivalent in nonequilibrium situations. We also identify a current induced by the spin vorticity read from the Belinfante symmetric EMT.

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