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Relativistic distribution function for particles with spin at local thermodynamical equilibrium

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We present an extension of relativistic single-particle distribution function for weakly interacting particles at local thermodynamical equilibrium including spin degrees of freedom, for massive spin 1/2 particles. We infer, on the basis of the global equilibrium case, that at local thermodynamical equilibrium particles acquire a net polarization proportional to the vorticity of the inverse temperature four-vector field. The obtained formula for polarization also implies that a steady gradient of temperature entails a polarization orthogonal to particle momentum. The single-particle distribution function in momentum space extends the so-called Cooper-Frye formula to particles with spin 1/2 and allows to predict their polarization, and particularly of Lambda hyperons, in relativistic heavy ion collisions at the freeze-out.

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