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# Covariant Spin Statistical Mechanics with Torsion and Its Applications on Spin Hydrodynamics and Chiral Transports

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We derive semiclassical spin statistical mechanics in Riemann geometry with an external torsion field and use it to investigate spin hydrodynamics and chiral effects. We derive spin hydrodynamics with torsion at the first order of gradients in local equilibrium state. We show torsion plays a similar role as vorticity in spin hydrodynamics and induces spin polarization in equilibrium state. In the presence of the chiral electromagnetic and Nieh-Yan anomalies, we derive the chiral magnetic, vortical and torsional effects from the anomalous thermal potential current. We prove the chiral torsional effect is definitely the result of Nieh-Yan anomaly and discuss the related Chern-Simons-like term to it.

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