

Torsion in the Raychaudhuri equations and in spacetime thermodynamics

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Abstract

We study null geodesic congruences (NGCs) in the presence of spacetime torsion, recovering and extending results in the literature. Only the highest spin irreducible component of torsion gives a proper acceleration with respect to metric NGCs, but at the same time obstructs abreastness of the geodesics. This means that it is necessary to follow the evolution of the drift term in the optical equations, and not just shear, twist and expansion. We show how the optical equations depend on the non-Riemannian components of the curvature, and how they reduce to the metric ones when the highest spin component of torsion vanishes. We then comment on a generalization of Jacobson spacetime thermodynamics in the presence of torsion. We show that the presence of torsion per se does not need to alter the equilibrium picture, if due care is taken in dealing with the Noether currents and energy-momentum conservation in Einstein-Cartan theory.