

Geometric conservation in curved spacetime and entropy

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We provide an improved definition of new conserved quantities derived from the energy-momentum tensor in curved spacetime by introducing an additional scalar function. We find that the conserved current and the associated conserved charge become geometric under a certain initial condition of the scalar function, and show that such a conserved geometric current generally exists in curved spacetime. Furthermore, we demonstrate that the geometric conserved current agrees with the entropy current for the perfect fluid, thus the conserved charge is the total entropy of the system. While the geometric charge can be regarded as the entropy for non-dissipative fluid, its physical meaning should be investigated for more general cases.

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