Abstract Submitted
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Derivation of anomalous hydrodynamics from quantum field theory[1] MASARU HONGO, TOMOYA HAYATA, Department of Physics, The University of Tokyo, YOSHIMASA HIDAKA, Theoretical Research Division, Nishina Center, RIKEN, YUKI MINAMI, Theoretical Biology Laboratory, RIKEN, TOSHIFUMI NOUMI, Theoretical Research Division, Nishina Center, RIKEN — Hydrodynamics is a low-energy effective theory which describes a long-distance and long-time behavior of many-body systems. It has been recently pointed out that triangle anomalies affect macroscopic transport properties and generate anomaly-induced transports. These transport phenomena have a common feature that they are dissipationless, or in other words, they don't cause the entropy production. One example is the chiral magnetic effect, which represents the existence of a dissipationless vector current along the magnetic field and is expected to occur in ultra-relativistic heavy ion collisions. In this study, we derive anomalous hydrodynamic equations from the point of view of quantum field theory. Assuming the local Gibbs distribution at initial time, we derive a thermodynamic potential for relativistic hydrodynamics. This action has a form in the curved space-time whose metric is determined by the thermodynamic variables such as the temperature. We show that anomaly-induced transports manifest from this thermodynamic potential if systems do not have the parity symmetry, and, therefore, are dissipationless. We also discuss a relation between our work and other recent approaches that aim at deriving hydrodynamic equations for the parity-violating systems.

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