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Anomalous transport, massive gravity theories and holographic momentum relaxation

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Quantum anomalies give rise to new transport phenomena. In particular a magnetic field can induce an anomalous current via the chiral magnetic effect [1] and a vortex in the relativistic fluid can also induce a current via the chiral vortical effect [2]. The related transport coefficients can be calculated via Kubo formulae [3,4,5]. These effects can be studied in holographic models with Chern-Simons couplings dual to anomalies in field theory.

We study a holographic model with translation symmetry breaking based on linear massless scalar field backgrounds. We compute the electric DC conductivity and find that it can vanish for certain values of the translation symmetry breaking couplings. Then we compute the chiral magnetic and chiral vortical conductivities. They are completely independent of the holographic disorder couplings and take the usual values in terms of chemical potential and temperature. To arrive at this result we suggest a new definition of energy-momentum tensor in presence of the gravitational Chern-Simons coupling.

Some related works are [6,7]. This work is based on [8].

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