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Finite Conductivity without Momentum Relaxation and Violation of Charge Diffusion Bounds in Lifshitz Holography[1] BRANDON LANGLEY, PHILIP PHILLIPS, University of Illiniois at Urbana-Champaign — We compute and analyze the optical conductivity at finite chemical potential in a holographic Lifshitz geometry using the Einstein-Dilaton-Maxwell action. From the exact expression for the DC conductivity, we find that for a dynamical exponent $z \neq 1$, the conductivity is finite, despite the system exhibiting translational invariance. This indicates that interactions alone are sufficient for generating finite conductivities even in systems without momentum relaxation. We confirm our result by computing the conductivity numerically and find it does not take a Drude form, indiciating our model represents an incoherent metal. Our exact computation of the charge diffusivity reveals it is possible to violate the Hartnoll diffusivity bound, where we use the butterfly velocity as the proposed characteristic velocity in our model.

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