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Collective excitations and low temperature transport properties of bismuth[1] PIOTR CHUDZINSKI, THIERRY GIAMARCHI, DPMC, University of Geneva, 24 Quai Ernest-Ansermet, CH-1211 Geneva 4, Switzerland — We examine the influence of collective excitations on the transport properties (resistivity and magneto-optical conductivity) for semimetals, focusing on the case of bismuth. We show, using a random-phase approximation (RPA), that the properties of the system are drastically affected by the presence of an acoustic-plasmon mode, which is a consequence of the presence of two types of carriers (electrons and holes) in this system. We find a crossover temperature T^* separating two different regimes of transport. At high temperatures where $T > T^*$, the Baber scattering explains quantitatively the dc resistivity experiments, while at low temperatures where $T < T^*$, the interactions of the carriers with this collective mode lead to a T^5 behavior of the resistivity. We examine other consequences of the presence of this mode. In particular a two-plasmon edge feature in the magneto-optical conductivity is predicted. We compare our results with the experimental findings on bismuth. We discuss the limitations and extensions of our results beyond the RPA, and examine the case of other semimetals such as $1T - TiSe_2$.

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