Is the Drude weight a thermodynamic quantity?[1] MARCOS RIGOL, B. SRIRAM SHASTRY, University of California, Santa Cruz — Transport properties distinguish metals from insulators, and superconductors from ideal metals. In one dimension, they can help differentiate integrable from nonintegrable systems. The Drude weight (or charge stiffness) is found to be nonzero in integrable metals, even at very large temperature, whereas it vanishes for generic (nonintegrable) systems. In systems with periodic boundary conditions, the Drude weight can be identified as the coefficient accompanying the zero-frequency delta peak in the real part of the electrical conductivity. Paradoxically on the other hand, for systems with open boundary conditions, it can be shown that this coefficient is identically zero for any finite system, regardless of its integrability. For the Drude weight to be a thermodynamically meaningful quantity, both kinds of boundary conditions should produce the same answer in the thermodynamic limit. We resolve this paradox using analytical and numerical methods.

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