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Electrical Analogues of Optical & EELS Spectra: Silicon[1] DAVID Y. SMITH, University of Vermont and Argonne National Laboratory, WILLIAM KARSTENS, Saint Michael's College — We have explored an analogy between optical and electrical-circuit resonances that yields insight into single-particle and collective excitations. The analogy rests on the similarity of the differential equations for the Drude-Lorentz model of optics and the impedance of ac circuits. A parallel combination of capacitive (C) and inductive-capacitive (L-C) branches is a suitable circuit model. The L-C branches correspond to single-particle excitations. The C branch accounts for the electric-field term in the displacement, or equivalently the free-space susceptibility. Collective excitations represent combination resonances of the L-C and C branches. These excitations involve only *internal* mesh currents that can flow in the absence of an *external* (input) current. In this case, the admittance of the circuit is zero corresponding to the vanishing of the dielectric function at the plasmon resonance in optics (absent resistive losses). Circuit impedance corresponds to charged-particle energy loss. In contrast, circuit admittance (inverse impedance) corresponds to optical measurements. The interference of mesh currents in the circuit model plays the role of Coulomb screening in energy-loss spectra.

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