Zeroth-moment dielectric sum rule applied to electron damping[1]

ERIC L. SHIRLEY, NIST, J.A. SOININEN, U. Helsinki, J.J. REHR, U. Washington, Seattle
— The first and inverse-first frequency moments of the dielectric function, epsilon(q,omega), are given by the f-sum rule and Kramers-Kronig transformation of the static dielectric function. Model expressions for these quantities are plentiful. The square of the zeroth moment must be less than the product of the above two, by Cauchy-Schwartz. (It equals that product in single-plasmon-pole models). In this work, we present simple ways to estimate the zeroth moment as a function of q. This facilitates an improved model for epsilon(q,omega) that requires minimal computation and exhibits realistic behavior without use of a pole model. We apply this to calculating the electron self-energy, particularly lifetime damping effects in insulators near the band gap.

Eric L. Shirley
NIST

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