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Inelastic electron and light scattering from the elementary electronic excitations in quantum wells M.S. KUSHWAHA, Rice University — The most fundamental approach to an understanding of electronic, optical, and transport phenomena which the condensed matter physics offers is generally founded on two experiments: the inelastic electron scattering and the inelastic light scattering. This work embarks on providing a systematic framework for the theory of inelastic electron scattering and of inelastic light scattering from the electronic excitations in quantum wells. To this end, we start with the Kubo's correlation function to derive the generalized dielectric function, the inverse dielectric function, and the Dyson equation for the screened potential within the framework of Bohm-Pines' random-phase approximation. This is followed by a thorough development of the theory of inelastic electron scattering and of inelastic light scattering. After trying and testing the eigenfunctions, we compute the density of states, the Fermi energy, the full excitation spectrum made up of single-particle and collective (plasmon) excitations, the loss functions for the inelastic electron scattering, and the Raman intensity for the inelastic light scattering. It is found that HREELS can be a potential alternative of the overused Raman scattering for investigating collective excitations in such nanostructures.

Manvir Kushwaha
Rice University

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