1 Summary: Stopping Power of a Plasma

Electron gases exhibit a myriad of collective long-wavelength phenomena, such as plasma oscillations and screening, which alter significantly the independent electron picture of an electron gas. In the context of screening, an electron gas acts collectively to decrease the bare interaction from $V_{\mathbf{q}}$ to

$$V_{eff} = \frac{V_{\mathbf{q}}}{\epsilon(q,\omega)}, \tag{1}$$

where $\epsilon(q,\omega)$ is the dielectric function. At metallic densities, the RPA is sufficient to describe the screening effects. In this approximation, uncorrelated particle-hole scattering to all orders of perturbation theory are summed to obtain the polarization function, or polarization bubble. Exchange effects are not included in the RPA. In sufficiently dilute electron systems, $r_s \geq 3$, where the Coulomb energy is comparable to or greater than the electron kinetic energy, a theory beyond the RPA is necessary. Methods, such as the local-field approach, which attempt to model the correlation hole around each electron, have proven quite successful in this context.

****