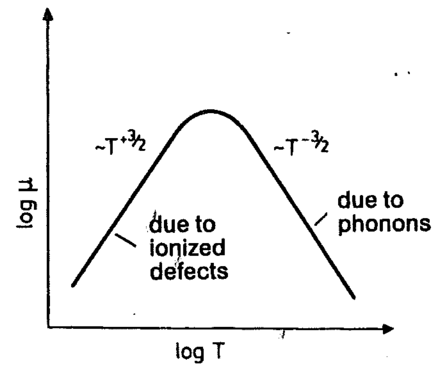


Fig. 12.12. Schematic temperature dependence of the mobility μ for a semiconductor in which scattering from phonons and charged impurities occurs

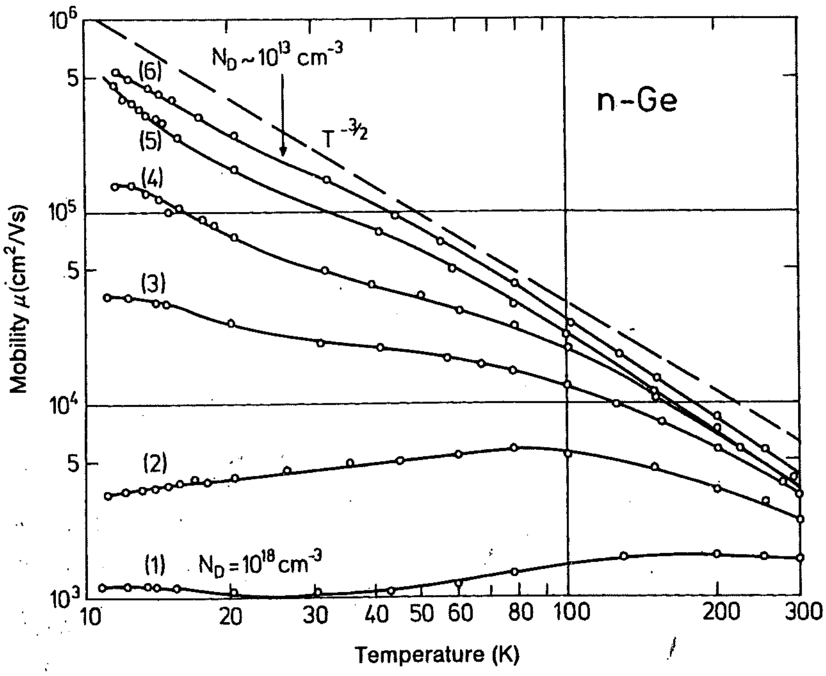
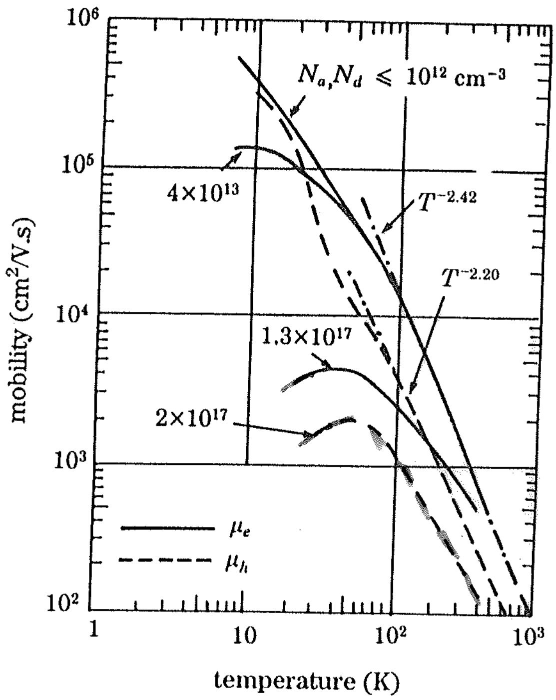


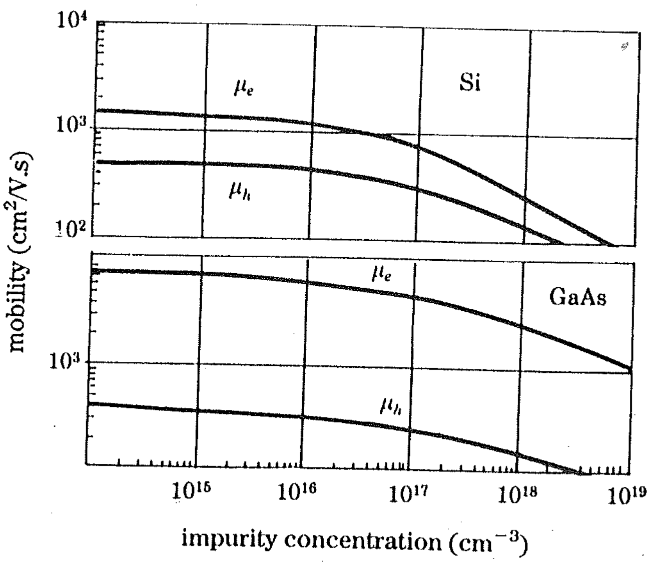
Fig. 12.13. Experimentally determined temperature dependence of the mobility μ of free electrons. For the samples (*1*) to (*6*), the donor concentration N_D varies between 10^{18} and $10^{13}\,cm^{-3}$. The samples are the same as those used for the measurements in Fig. 12.11. (After [12.3])



IMPUREZZE $\sim T^{3/2}$

RETICOLO $\sim T^{-3/2}$

Fig. 5.4. Temperature dependence of the electron and hole mobilities μ_e, μ_h for silicon samples with different doping levels. The electron mobility is shown as continuous curves and the hole mobility as dashed. The dash–dot curves are the best fits to the experimental results.



T= 300 K.

Fig. 5.5. Electron and hole mobility in silicon and gallium arsenide at room temperature, as a function of the impurity concentration.

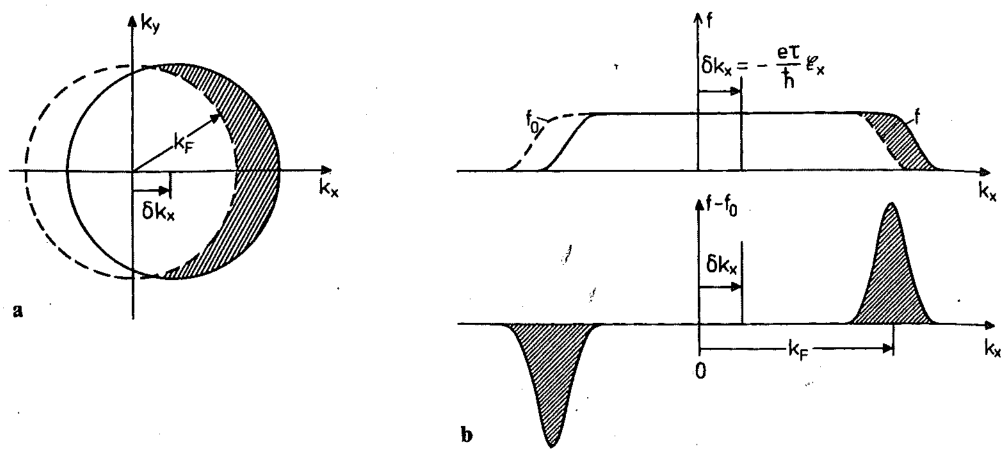


Fig. 9.4. The effect of a constant electric field $\mathscr{E}_x$ on the k-space distribution of quasi-free electrons: **a** The Fermi sphere of the equilibrium distribution [– – –, centered at (0,0,0)] is displaced in the stationary state by an amount $\delta k_x = -e\tau\mathscr{E}_x/\hbar$. **b** The new Fermi distribution $f(E(k))$ only differs significantly from the equilibrium distribution f_0 (– – –) in the vicinity of the Fermi energy (Fermi radius)

resented by a Fermi distribution shifted by $e\tau\mathscr{E}/\hbar$ from the equilibrium position, as shown in Fig. 9.4.

It is interesting to consider the effect of elastic and inelastic scattering on the approach to equilibrium in k-space. The stationary state of the distribution is represented as a displaced Fermi sphere in Fig. 9.5 (full line). If the external field is switched off, the displaced

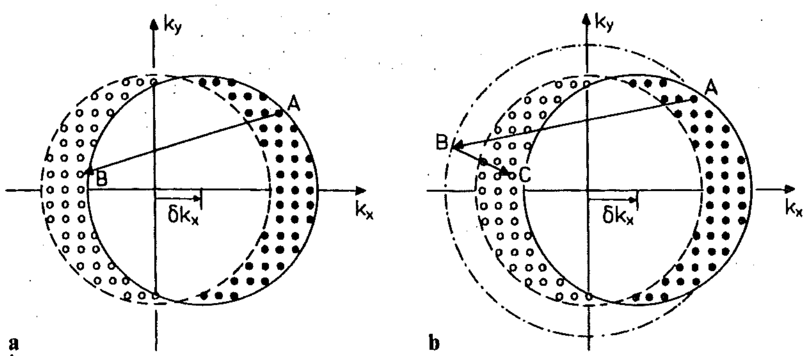


Fig. 9.5 a, b. Electron scattering processes in k-space. The dashed circle represents the Fermi surface in thermodynamic equilibrium ($\mathscr{E} = 0$). Under the influence of an electric field $\mathscr{E}_x$ and for a constant current, the Fermi surface is displaced as shown by the full circle. **a** When the electric field is switched off, the displaced Fermi surface relaxes back to the equilibrium distribution by means of electron scattering from occupied states (●) to unoccupied states (○). Since the states A and B are at different distances from the k-space origin (i.e., have different energies), the relaxation back to equilibrium must involve inelastic scattering events (e.g., phonon scattering). **b** For purely elastic scattering (from states A to B), the Fermi sphere would simply expand. When the field is switched off, equilibrium can only be achieved by inelastic scattering into states C within the dashed (equilibrium) Fermi sphere