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Nota di contenuto	Electron Transport in Nanostructures and Mesoscopic Devices; Table of Contents; Chapter 1. Introduction; 1.1. Introduction and preliminary warning; 1.2. Bibliography; Chapter 2. Some Useful Concepts and Reminders; 2.1. Quantum mechanics and the Schrodinger equation; 2.1.1. A more than brief introduction; 2.1.2. The postulates of quantum mechanics; 2.1.3. Essential properties of observables; 2.1.4. Momentum operator; 2.1.5. Stationary states; 2.1.6. Probability current; 2.1.7. Electrons in vacuum and group velocity; 2.2. Energy band structure in a periodic lattice 2.3. Semi-classical approximation 2.4. Electrons and holes; 2.5. Semiconductor heterostructure; 2.6. Quantum well; 2.6.1. 1D case; 2.6.2. Coupled quantum wells; 2.6.3. Quantum-confined Stark effect; 2.7. Tight-binding approximation; 2.8. Effective mass approximation; 2.8.1. Wannier functions; 2.8.2. Effective mass Schrodinger equation; 2.9. How good is the effective mass approximation in a confined

structure?; 2.10. Density of states; 2.10.1. 3D case; 2.10.2. 2D case; 2.10.3. 1D case; 2.10.4. Summary; 2.11. Fermi-Dirac statistics; 2.12. Examples of 2D systems

2.13. Characteristic lengths and mesoscopic nature of electron transport

2.14. Mobility: Drude model; 2.15. Conduction in degenerate materials; 2.16. Einstein relationship; 2.17. Low magnetic field transport; 2.18. High magnetic field transport; 2.18.1. Introduction; 2.18.2. Some reminders about the particle Hamiltonian in the presence of an electromagnetic field; 2.18.3. Action of a magnetic field (classical); 2.18.4. High magnetic field transport; 2.19. Exercises; 2.19.1. Exercise; 2.19.2. Exercise; 2.19.3. Exercise; 2.19.4. Exercise; 2.20. Bibliography

Chapter 3. Ballistic Transport and Transmission Conductance

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3.11.1. Buttiker's formula

3.11.2. Three-terminal device; 3.11.3. Four-terminal device; 3.12. Non-zero temperature; 3.12.1. Large applied bias $\mu_1 - \mu_2 \gg 0$; 3.12.2. Incoherent states; 3.12.3. Coherent states; 3.12.4. Physical parameters included in the transmission probability; 3.12.5. Linear response ($\mu_1 - \mu_2 < k_B T$ or $T(E) = C \text{st}$); 3.13. The integer quantum Hall effect; 3.13.1. The experiment; 3.13.2. The explanation; 3.14. Exercises; 3.14.1. Exercise; 3.14.2. Exercise; 3.14.3. Exercise; 3.14.4. Exercise; 3.14.5. Exercise; 3.15. Bibliography; Chapter 4. S-matrix Formalism

4.1. Scattering matrix or S-matrix

Sommario/riassunto

This book introduces researchers and students to the physical principles which govern the operation of solid-state devices whose overall length is smaller than the electron mean free path. In quantum systems such as these, electron wave behavior prevails, and transport properties must be assessed by calculating transmission amplitudes rather than microscopic conductivity. Emphasis is placed on detailing the physical laws that apply under these circumstances, and on giving a clear account of the most important phenomena. The coverage is comprehensive, with mathematics and theoretical material s