Transport in Mesoscopic Structures: A Basic Introduction to the Theory

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1. **Introduction and organization.**
2. **Reminder of solid state physics.**
   - **2.1.** Electronic states and their occupation.
   - **2.2.** Reduced dimensions.
3. **Coherent transport in mesoscopic structures: The scattering approach.**
   - **3.1.** From macroscopic wires to atomic-scale junctions.
   - **3.2.** Heuristic derivation of the Landauer formula.
   - **3.3.** Penetration of a potential barrier: Tunnel effect.
   - **3.4.** The scattering matrix in quantum mechanics.
   - **3.5.** Resonant tunneling.
   - **3.6.** Multichannel Landauer formula.
   - **3.7.** Heat transport and thermoelectricity.
4. **Coherent transport in molecular junctions: A case study.**
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   - **5.3.** Three-terminal devices.
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   - **6.1.** Signatures of the hopping transport regime.
   - **6.2.** Hopping transport in molecular junctions: Experimental examples.
   - **6.3.** DNA-based molecular junctions.

7. **Beyond electrical conductance.**

   7.1. Non-equilibrium current fluctuations: shot noise.

   7.2. Thermopower or Seebeck coefficient.

   7.3. Heat dissipation in ballistic nanostructures.

Bibliography

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