

FUNDAMENTALS OF NANO ELECTRONICS

B. Quantum Transport

1. Schrodinger Equation
2. Contact-ing Schrodinger

More Examples



4. Spin Transport

3.1. Introduction

3.2. Quantum Point Contact

3.3. Self-Energy

3.4. Surface Green's Function

3.5. Graphene

3.6. Magnetic Field

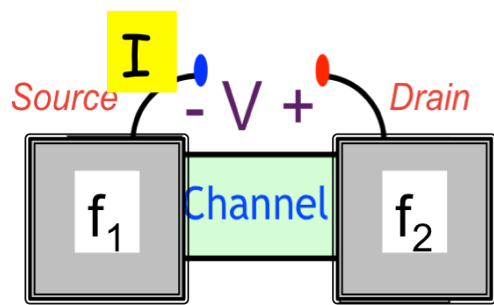
3.7. Golden Rule

3.8. Inelastic Scattering

3.9. Can NEGF Include Everything?

3.10. Summing up ..

3.1a Introduction



$$\Sigma = \Sigma_1 + \Sigma_2 + \Sigma_0$$

$$\Sigma^{in} = \Sigma_1^{in} + \Sigma_2^{in} + \Sigma_0^{in}$$

$$\Gamma \equiv i(\Sigma - \Sigma^+)$$

$$\begin{matrix} \Sigma_0, \Sigma_0^{in} \\ \Sigma_1^{in} & \begin{matrix} \text{---} H \text{---} \end{matrix} & \Sigma_2^{in} \\ \Sigma_1 & & \Sigma_2 \end{matrix}$$

UNIT 3
More
examples

$$G^R = [EI - H - \Sigma]^{-1}$$

$$G^n = G^R \Sigma^{in} G^A$$

$$A = i[G^R - G^A]$$

$$I_1 = \frac{q}{h} \text{Trace} [\Sigma_1^{in} A - \Gamma_1 G^n]$$

Coherent Transport $\rightarrow \frac{q}{h} \text{Trace} [\Gamma_1 G^R \Gamma_2 G^A] (f_1 - f_2)$

2.1. Introduction

2.2. Semiclassical Model

2.3. Quantum Model

2.4. NEGF Equations

2.5. Current Operator

2.6. Scattering Theory

2.7. Tr

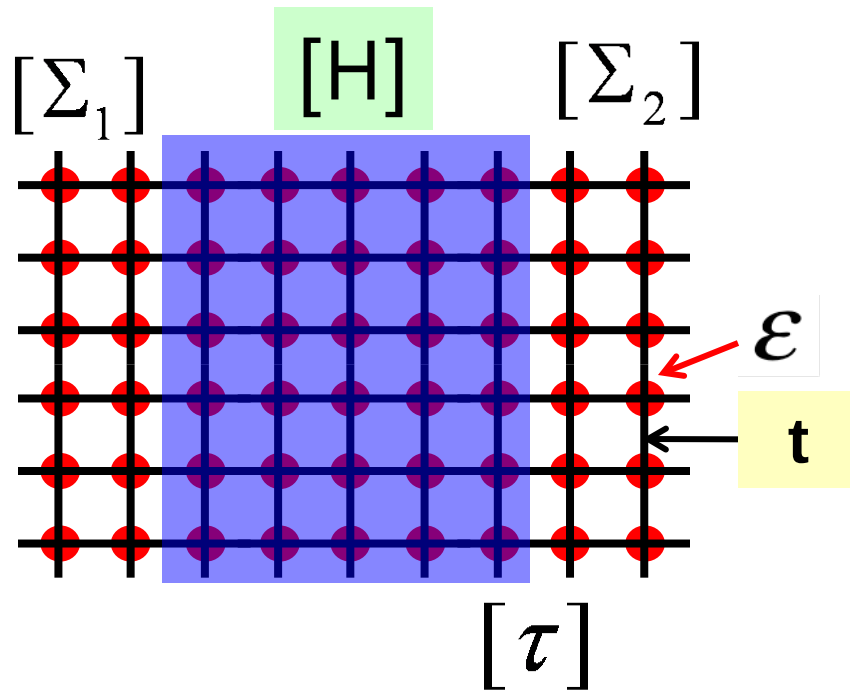
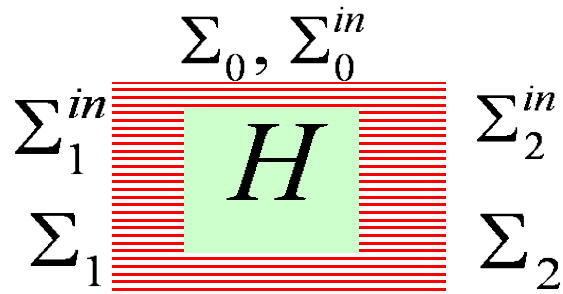
1D Examples

2.8. Tunneling

2.9. Dephasing

2.10. Summing up ..

3.1b Introduction



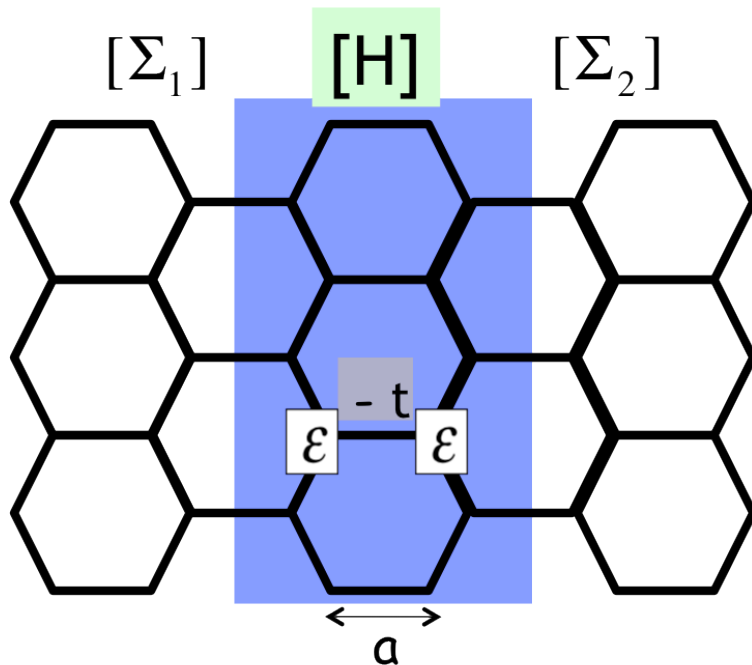
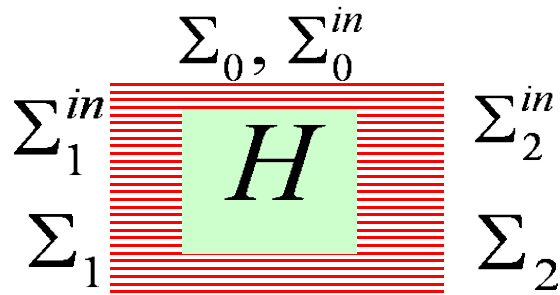
General Expression
For Self-Energy

$$\Sigma = \tau g \tau^+$$

3.1. Introduction

3.10. Summing up ..

3.1c Introduction



General Expression
For Self-Energy

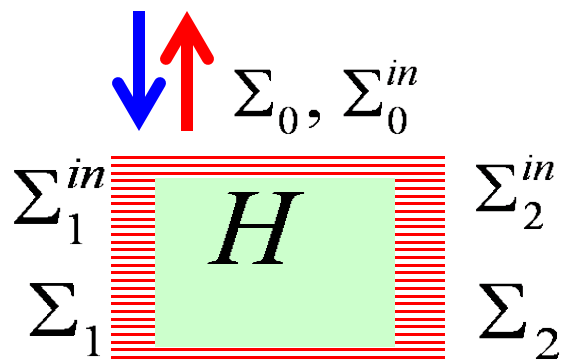
$$\Sigma = \tau g \tau^+$$

- 3.1. Introduction
- 3.2. Quantum Point Contact
- 3.3. Self-Energy
- 3.4. Surface Green's Function

Everything?

3.10. Summing up ..

3.1d Introduction



Part B, 2.9

*Elastic
Processes*

$$[\Sigma_0]_{ij} = D_{ij} [G^R]_{ij}$$

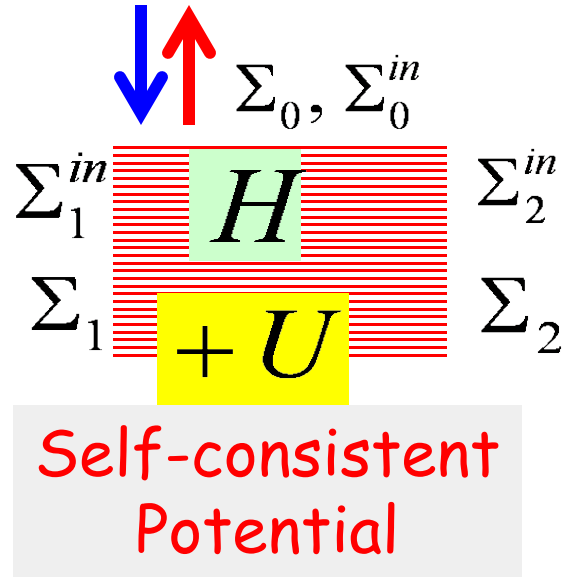
$$[\Sigma_0^{in}]_{ij} = D_{ij} [G^n]_{ij}$$

$$\Sigma = \Sigma_1 + \Sigma_2 + \Sigma_0 + (\Sigma_0)_{diss}$$

$$\Sigma^{in} = \Sigma_1^{in} + \Sigma_2^{in} + \Sigma_0^{in} + (\Sigma_0^{in})_{diss}$$

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- 3.10. Summing up ..

3.1e Introduction

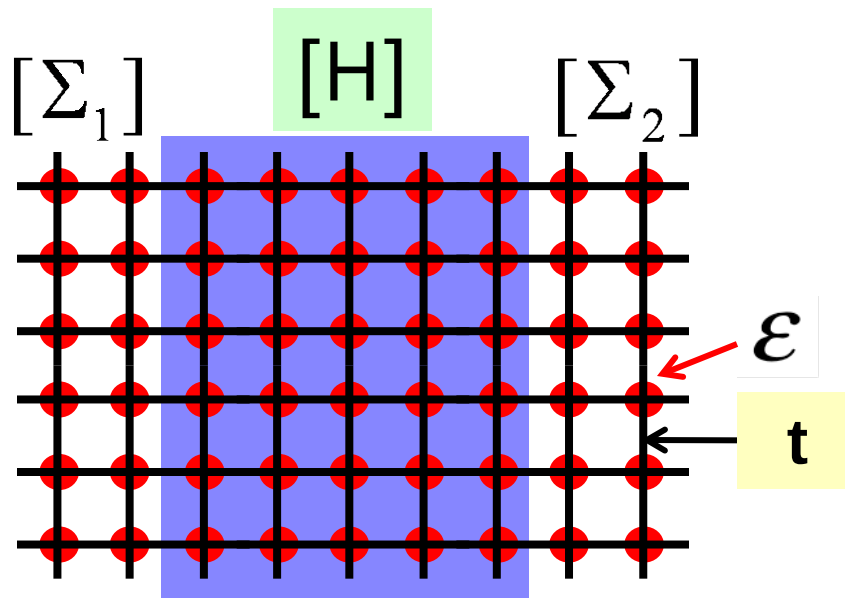
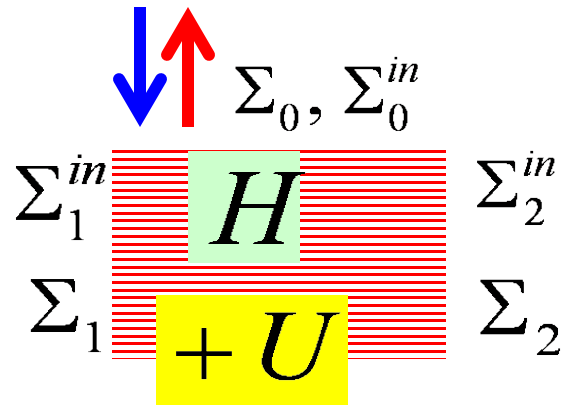


$$\Sigma = \Sigma_1 + \Sigma_2 + \Sigma_0 + (\Sigma_0)_{diss}$$

$$\Sigma^{in} = \Sigma_1^{in} + \Sigma_2^{in} + \Sigma_0^{in} + (\Sigma_0^{in})_{diss}$$

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Coming up next ..



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