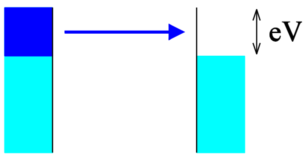
VII. Transport cohérent

VII.1 Quantification de la conductance dans une dimension

Conductance



- current = electron charge × electron density × electron velocity

  = total density of states at the Fermi level × (μ_L-μ_R)

$$I = e \times 2\nu \times eV \times v_F$$

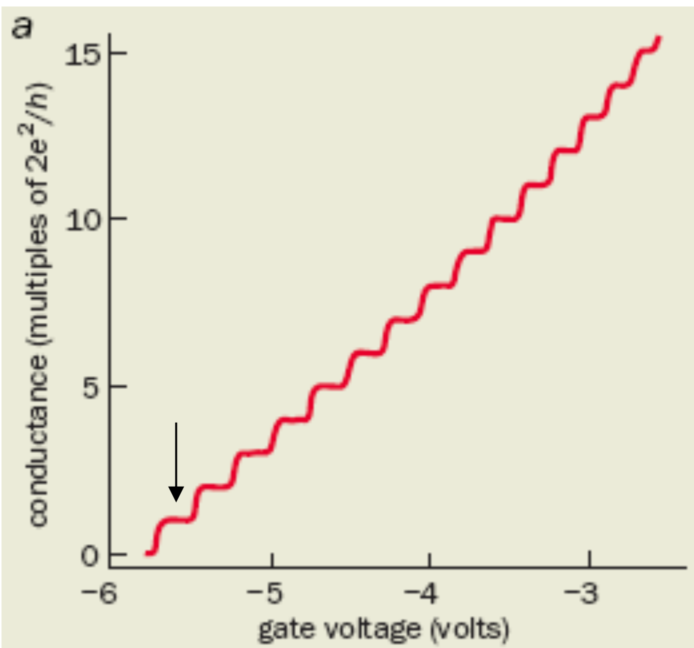
$$= e \times 2\frac{1}{2\pi\hbar v_F} \times eV \times v_F = 2\frac{e^2}{h}V$$

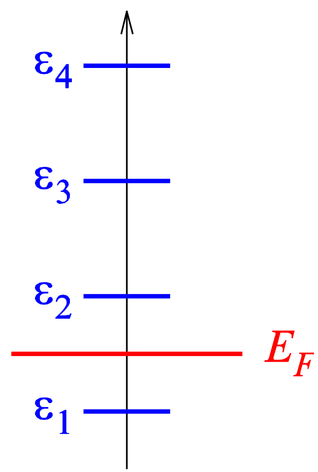
- conductance: $G = \partial I / \partial V = 2\ e^2/h = 2\ G_0$

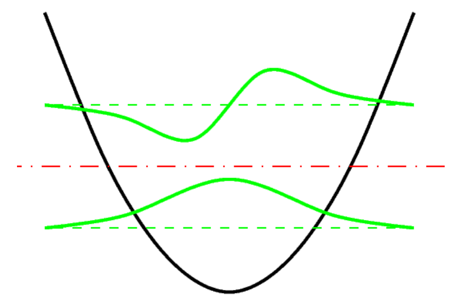
  avec $G_0 = e^2/h$ conductance quantum

Conductance

- Experiment I: van Wees *et al*. (1988), Wharam *et al*. (1988)





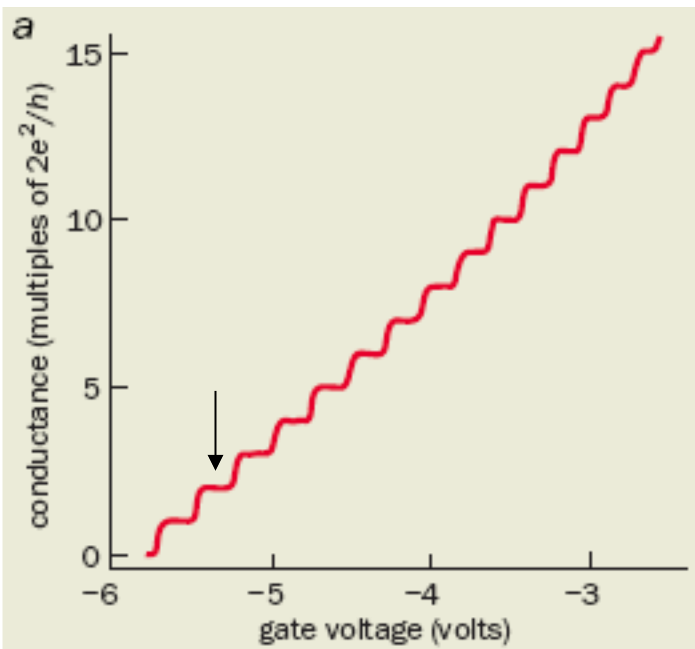


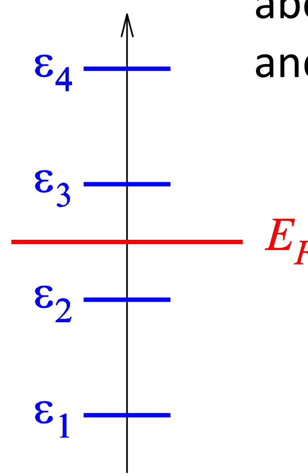
$$G = 2\frac{e^2}{h}$$

Berggren & Pepper, Physics World 2002

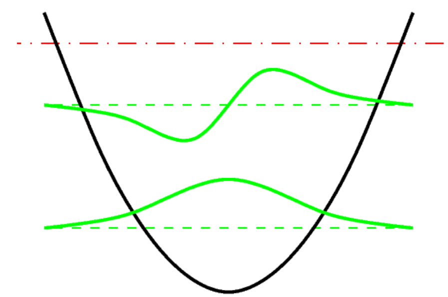
Conductance

- Experiment I: van Wees *et al*. (1988), Wharam *et al*. (1988)





as the electron density is raised,
the chemical potential moves
above the second level
and the system becomes quasi-1D

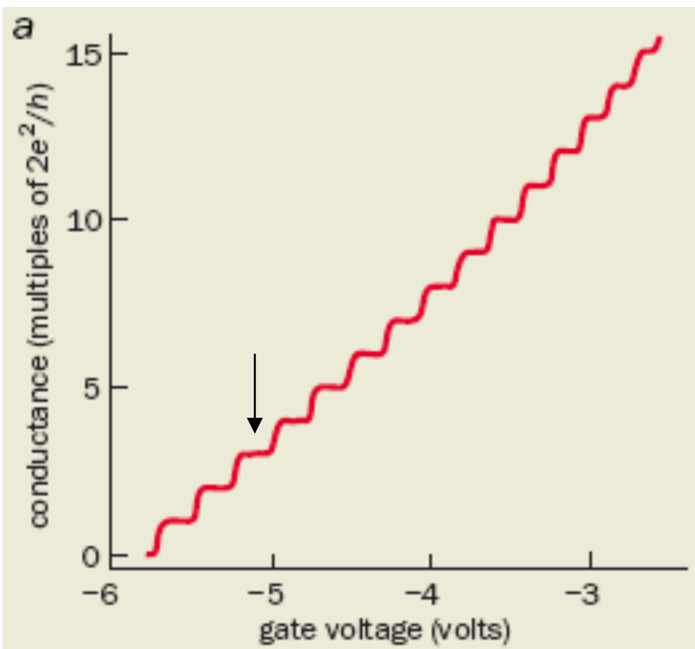


$$G = 2 \times 2\frac{e^2}{h}$$

Berggren & Pepper, Physics World 2002

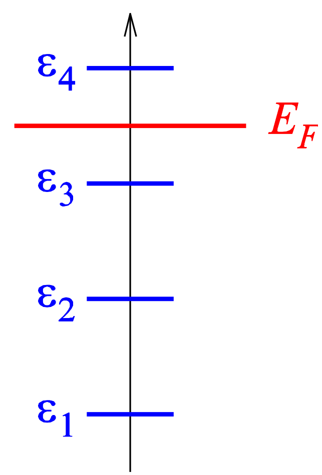
Conductance

- Experiment I: van Wees *et al*. (1988), Wharam *et al*. (1988)



Berggren & Pepper, Physics World 2002

general case: $$G = N \times 2\frac{e^2}{h}$$



$$G = 3 \times 2\frac{e^2}{h}$$

Conductance

- Experiment II: Thomas *et al.* (1996)

magnetic field:

Zeeman splitting
of energy levels

conductance steps
at $G = k \times e^2/h$