Fundamentals of Nanoelectronics

ECE495 - Session 13, Sept 23, 2009

Single vs. Multi Electron Picture II

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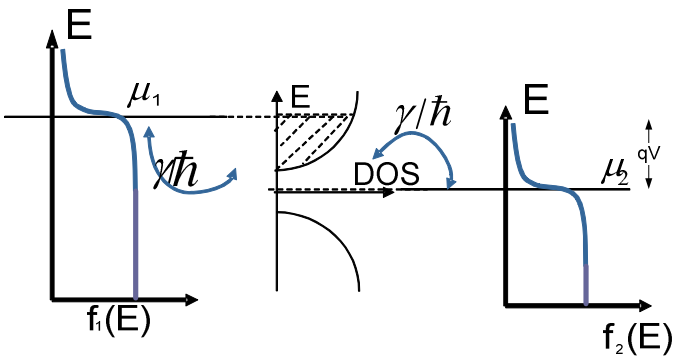
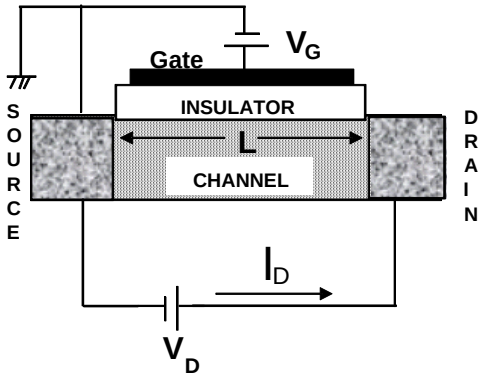
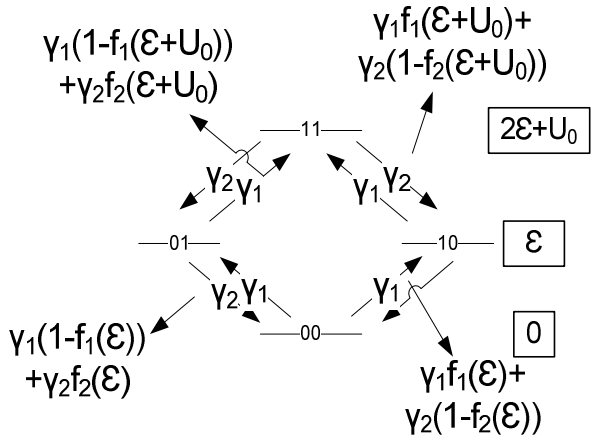
Review

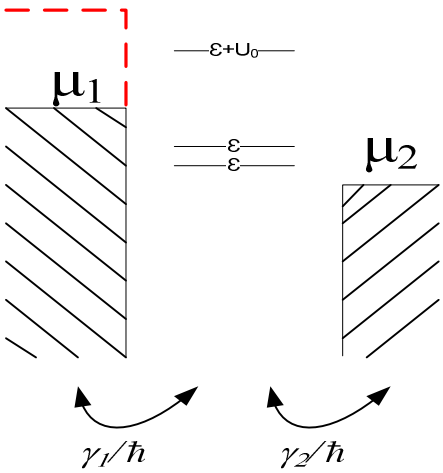


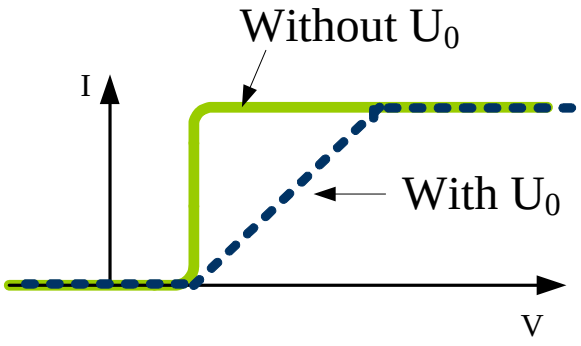


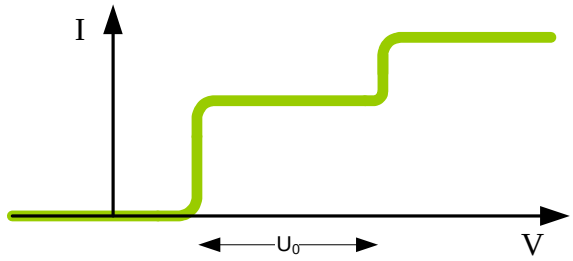
Multi-electron picture



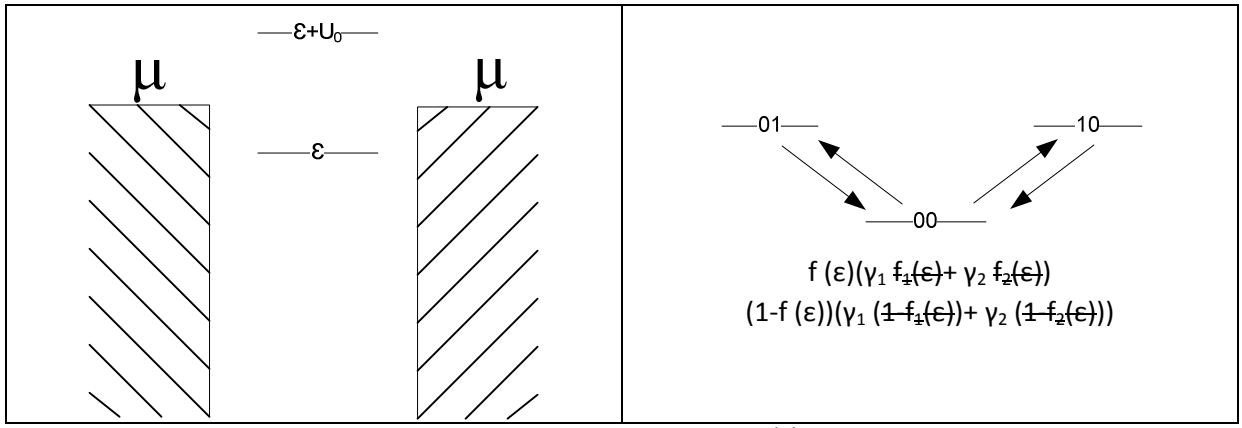
One-electron picture







Equilibrium condition: if both contacts have the same Fermi function, that's we call it equilibrium condition. Non-equilibrium means two different electrochemical potentials, two different Fermi functions or two different temperatures in the two contacts.



$$P_{01}.\big(1-f(\varepsilon)\big)(\gamma_1+\gamma_2)=P_{00}.f(\varepsilon)(\gamma_1+\gamma_2)\Rightarrow\frac{P_{00}}{P_{01}}=\frac{1-f(\varepsilon)}{f(\varepsilon)}=\frac{1}{f(\varepsilon)}-1$$

$$f(\varepsilon)=\frac{1}{1+e^{(\varepsilon-\mu)/k_BT}}\ Fermi\ Function$$

$$\Rightarrow\frac{P_{00}}{P_{01}}=e^{(\varepsilon-\mu)/k_BT}$$

$$P_\alpha=\frac{1}{Z}e^{-(E_\alpha-\mu N_\alpha)/k_BT}$$

Where α is state number (0,1, and 2 for two levels) in multi-electron picture , $\boldsymbol{N_\alpha}$ shows the number of electron in the state and $\boldsymbol{E_\alpha}$ is energy of the state. $\boldsymbol{Z}$ is constant number called the *partition function* is determined so as to ensure that the probabilities given by the equation for all states α add up to one.