ECE 495N

Fundamentals of Nanoelectronics

Fall 2008

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Lecture: 12
Title: Single Electron Charging
Date: September 22, 2008

Video Lectures posted at:
https://www.nanohub.org/resources/5346/

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Single-electron Charging

Lecture 12

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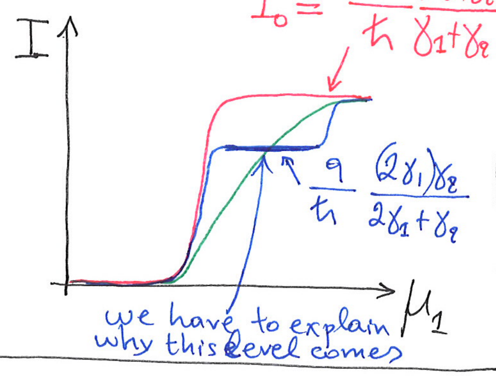
$$E\Phi(\vec{r}) = \left(-\frac{\hbar^2}{2m}\nabla^2 + \underbrace{U_N(r)}_{-\frac{q^2}{4\pi\epsilon_0 r}} + U_{ee}(r)\right)\Phi(\vec{r})$$

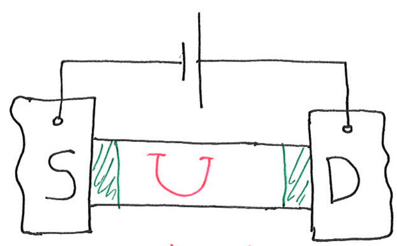
For $He \xrightarrow{\sim 25\,eV} He^{+} \xrightarrow{-53\,eV} He^{++}$

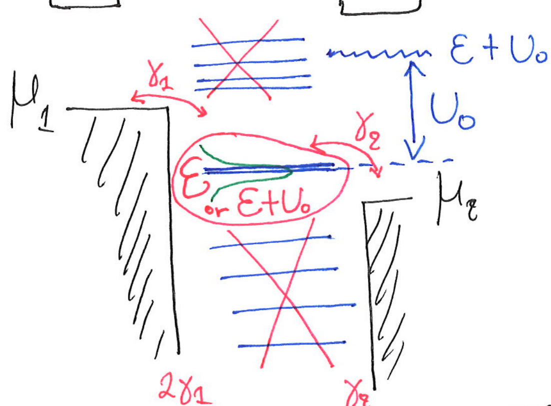
$\frac{-13.6eV}{4}$ ═══

$-13.6eV$ ═══

$$I_0 \equiv \frac{q}{\hbar}\frac{2\gamma_1\gamma_2}{\gamma_1+\gamma_2}$$







$$I = \frac{q}{\hbar}\frac{2\gamma_1\gamma_2}{\gamma_1+\gamma_2}\left(\overset{1}{f_1} - \overset{0}{f_2}\right)$$

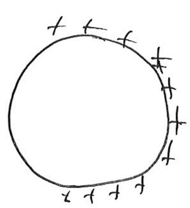
$$N = \frac{2\gamma_1 f_1 + \gamma_2 f_2}{\gamma_2 + \gamma_2}$$

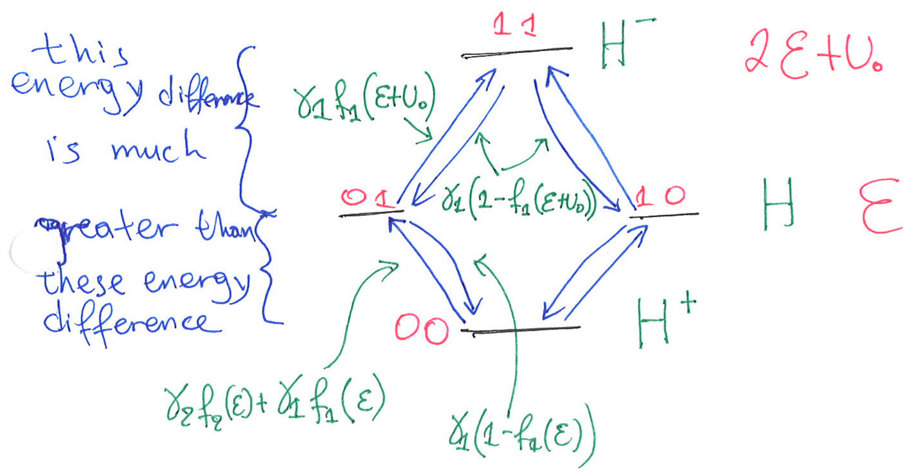
$$U = U_L + U_0\Delta N$$

NOTE

Charging energy

$$\frac{q^2}{4\pi\epsilon R}$$





So from this diagram we will come out to the result for current.