Hackathon 3

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Consider an n-type semiconductor bar with the length of 200 nm in thermal equilibrium. Doping on the n-side $N_D = 1E23\ m^{-3}, N_A = 0$. Assume that Maxwell-Boltzmann statistics (i.e. $n = N_C exp\left(\frac{E_C - E_F}{k_B T}\right)$ and $p = N_V exp\left(\frac{E_F - E_V}{k_B T}\right)$) is valid. In this system solve the Poisson's equation

$$\frac{d^2V}{dx^2} = -\frac{q}{\varepsilon}\left(N_D + p - n\right) \tag{1}$$

Ensure that the value of h (spacing between two mesh nodes) is not very small (because that would result long computation time) and not very large. Assume that zero bias is applied across the semiconductor Given parameters: $\varepsilon = 11.9 \times 8.854 \times 10^{-12}$ $q = 1.6 \times 10^{-19} C$ $k_B T = 26\ meV$ $N_C = 3E15 m^{-3}$ For the reference, you may consider $E_F = 0$

You can use any method of your choice to solve the system of equations. Based on your solution, print out $E_C - E_F$ at x = 100 nm in eV