Hackathon 2

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Consider a piece of a p-type semiconductor with the doping N_A in thermal equilibrium. Calculate the $E_C - E_F$ using the charge neutrality condition.

$$N_D - N_A + p - n = 0 \tag{1}$$

$$p = N_V \frac{2}{\sqrt{\pi}} F_{1/2}\left(\frac{E_V - E_F}{k_B T}\right) \tag{2}$$

$$n = N_C \frac{2}{\sqrt{\pi}} F_{1/2}\left(\frac{E_F - E_C}{k_B T}\right) \tag{3}$$

$$F_{1/2}(x) = \int_0^\infty \frac{\sqrt{y}}{1 + exp\,(y - x)} dy \tag{4}$$

Assume 100% ionization of the dopants
The convergence criterion: The change in $E_C - E_F$ between two consecutive iteration should be less than of equal to 3 meV

- N_A = 1E20 cm^{-3}
- N_D = 0 cm^{-3}
- T = 300 K
- $N_C = 3 \times 10^{19}$ cm^{-3}
- $N_V = 1 \times 10^{19}$ cm^{-3}
- E_G = 1.1 eV