2nd Exercise 12.6.2015

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Thermoelectric effect

We have discussed the current that flows when a voltage is applied between the two contacts,

$$I = \frac{e}{\hbar}\frac{\gamma_D \gamma_S}{\gamma_S + \gamma_D}\int D(E-\mu)[f_S(E) - f_D(E)]dE \quad (1)$$

It does not matter whether the equilibrium Fermi energy μ lies on the lower end or the upper end of the DOS.

- Visualize this situation, by assuming very small bias voltage V. Use $\gamma_D = \gamma_S$ =0.005 eV and create a python module named tools.py to contain the Lorentzian.

We can produce a current also without applying a bias voltage if we simply heat up one contact relative to the other, such that $T_S > T_D$.

- Plot Fermi functions for T =300, 310 K (k_B=8.6174e-05 eV/K) and their difference. Add the Fermi function to tools.py.
- Plot the corresponding current as a function of -0.25 eV $< \mu <$ 0.25 eV. Use another python module constants.py to store the necessary constants k_B, e=1.602 10^{-19} As, $\hbar$ =1.055 10^{-34} Js, 1eV=1.602 10^{-19} J.