Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.
This journal is © the Owner Societies 2015

Supplementary Information

Without loss of generality, the general expressions for the charge and heat currents can be written when the external field E and temperature gradient ∇T are directed along $\hat{x}$ according to Fig. 1 When the fluctuation-induced field points to the right, the Fermi levels of the left and right reservoirs are respectively $\mu_L = \mu - ew(E_T + E)$ and $\mu_R = \mu$. Assuming $E_T > E$, when the fluctuation-induced field points to the left, the Fermi levels of the left and right reservoirs are respectively $\mu_L = \mu$ and $\mu_R = \mu - ew(E_T - E)$.

After making the observation that both types of orientations are equally probable, the respective currents are expressed as

$$j = \int_{-\infty}^{\infty} dE\big[f(E,T+\Delta T) - f\big(E + ew(E_T+E),T\big)\big]M(E_T+E,E) + \int_{-\infty}^{\infty} dE\big[f\big(E + ew(E_T+E),T+\Delta T\big) - f(E,T \tag{A.1}$$

$$j_L^q = \frac{1}{e}\int_{-\infty}^{\infty} dE\big[f(E,T+\Delta T) - f\big(E + ew(E_T+E),T\big)\big]\big[E - \mu + \tag{A.2}$$

$$j_R^q = \frac{1}{e}\int_{-\infty}^{\infty} dE\big[f(E,T+\Delta T) - f\big(E + ew(E_T+E),T\big)\big][E-\mu]M \tag{A.3}$$

where $M(E_T \pm E,E)$ is given in Eq. 6. The heat current traveling through the junction is $j^q = (j_L^q + j_R^q)/2$. Applying linear response theory on the charge and heat current, one finds

$$j = L_{11}E + L_{12}\nabla T \tag{A.4}$$

$$j^q = L_{21}E + L_{22}\nabla T \tag{A.5}$$

where

$$L_{11} = \frac{\partial}{\partial E}\big(L_1(E_T+E,T) - L_1(E_T-E,T)\big)_{E=0}, \quad L_{12} = w\frac{\partial L_2(E_T,T)}{\partial T} \tag{A.6}$$

$$L_{21} = \frac{\partial}{\partial E}\big(L_1^q(E_T+E,T) - L_1^q(E_T-E,T)\big)_{E=0}, \quad L_{22} = w\frac{\partial L_2^q(E_T,T)}{\partial T} \tag{A.7}$$

$$L_1(E_T,T) = \int_{-\infty}^{\infty} dE\left(f\left(E - \frac{ewE_T}{2},T\right) - f\left(E + \frac{ewE_T}{2},T\right)\right)M(E_T,E) \tag{A.8}$$

$$L_2(E_T,T) = \int_{-\infty}^{\infty} dE\left(f\left(E - \frac{ewE_T}{2},T\right) + f\left(E + \frac{ewE_T}{2},T\right)\right)M(E_T,E) \tag{A.9}$$

$$L_1^q(E_T,T) = \frac{1}{e}\int_{-\infty}^{\infty} dE\left(f\left(E - \frac{ewE_T}{2},T\right) - f\left(E + \frac{ewE_T}{2},T\right)\right)[E-\mu]M(E_T,E) \tag{A.10}$$

$$L_2^q(E_T,T) = \frac{1}{e}\int_{-\infty}^{\infty} dE\left(f\left(E - \frac{ewE_T}{2},T\right) + f\left(E + \frac{ewE_T}{2},T\right)\right)[E-\mu]M(E_T,E) \tag{A.11}$$

It is noted that the Eqs. (A.6, A.7) can be recast in the following equivalent form used to obtain the analytical expressions in Table I:

$$L_{11} = 2\frac{\partial L_1}{\partial E_T}, \quad L_{12} = w\frac{\partial L_2}{\partial T}, \quad L_{21} = 2\frac{\partial L_1^q}{\partial E_T}, \quad L_{22} = w\frac{\partial L_2^q}{\partial T} \tag{A.12}$$