Erratum: Thermal transport in the Falicov-Kimball model [Phys. Rev. B 64, 245118 (2002)]

J. K. Freericks and V. Zlatić

(Received 11 September 2002; published 13 December 2002)

Two errors were discovered in our manuscript. Our chemical potential was shifted by $0.02t^*$ for the half-filled case, resulting in a nonzero thermopower, when it must vanish by symmetry. Also, our formula for the electronic thermal conductivity was missing a factor of T^2 in the denominator.

DOI: 10.1103/PhysRevB.66.249901 PACS number(s): 72.15.Jf, 72.20.Pa, 71.30.+h, 71.10.Fd, 99.10.+g

The formula [Eq. (11)] for the electronic thermal conductivity was missing a factor of T^2 in the denominator. It should read

$$\kappa = \frac{k_B^2}{T^2}\left[L_{22} - \frac{L_{12}L_{21}}{L_{11}}\right]. \tag{1}$$

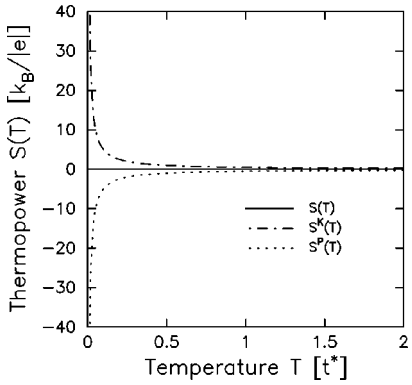

FIG. 2. Corrected plot of the thermopower for the case $U=1$, $w_1=0.5$, and $\rho_d=1$. The total thermopower vanishes, although the individual pieces can become quite large.

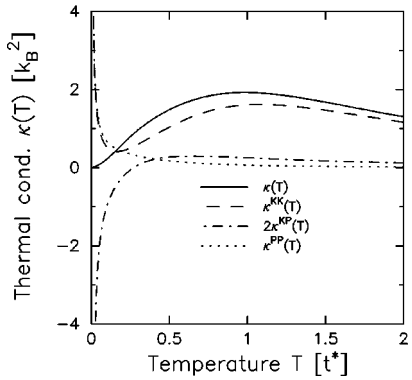

FIG. 3. Corrected plot of the thermal conductivity for the case $U=1$, $w_1=0.5$, and $\rho_d=1$. The plot shows the different contributions from the kinetic and potential energy pieces of the heat current. Note how there is a dramatic cancellation between the sum of the kinetic and potential pieces and the kinetic-potential piece of the thermal conductivity to produce a nearly linear dependence at low T as expected for a metal (the nonlinearity arises from small violations of the Wiedemann-Franz relation). At high T, the thermal conductivity is described well by the kinetic-energy only piece.

There was an error in the chemical potential ($\mu=U/2+0.02t^*$ instead of $\mu=U/2$) for the half-filled case. This resulted in a nonzero thermopower, even though the thermopower must vanish at half filling due to particle-hole symmetry. Because the kinetic and potential energy contributions to the thermopower are large, the erroneous shift in the chemical potential caused the net thermopower to be nonzero. Also, the thermal conductivity curves plotted in our results need to have the factor of $1/T^2$ included.

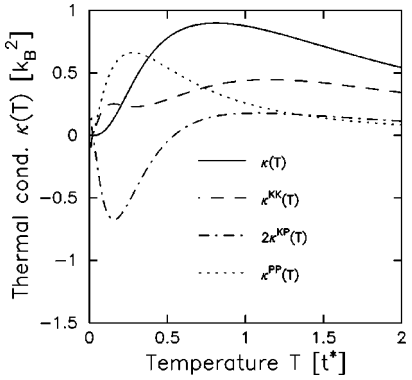

FIG. 5. Corrected plot of the thermal conductivity for the case $U=2$, $w_1=0.5$, and $\rho_d=1$. The plot shows the different contributions from the kinetic and potential energy pieces of the heat current. Note how the potential energy terms become increasingly important, and how the thermal conductivity goes to zero faster than linearly because of the insulating behavior at low T.

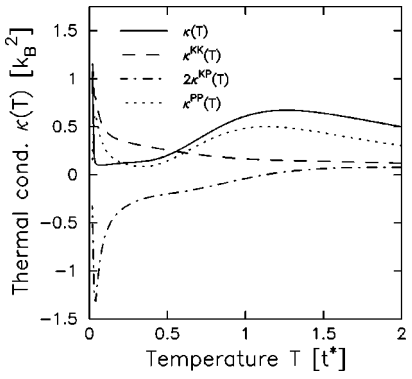

FIG. 7. Corrected plot of the thermal conductivity for the case $U=4$, $w_1+\rho_d=1.5$, and $E_F=-0.7$. The plot shows the different contributions from the kinetic and potential energy pieces of the heat current. Note how κ tracks well with the potential energy pieces of the heat current.

The corrected figures are as follows (Figs. 2, 3, 5, and 7). First, in Fig. 2, we show the case where the filling of the localized electrons is a constant $\langle w \rangle = 1/2$ and half filling $\rho_e = 1$ for the electrons.

As we increase the correlation strength so that the interacting density of states has a gap and the system is a correlated insulator the behavior of the thermal transport changes. The corrected thermopower curves are qualitatively similar to those of Fig. 2 and will not be repeated here (note that the total thermopower vanishes as it must due to symmetry).

In Figs. 3 and 5, we plot the thermal conductivity for $U = 1$ and $U = 2$ at half filling. We no longer have computational problems at low temperature. Note how the thermal conductivity has increasingly more important contributions from the potential-energy pieces at higher T here.

Finally, In Fig. 7, we present results for the case where the total filling $\rho_e + \langle w \rangle = 1.5$ is a constant but the electrons can change from localized to itinerant ($E_f = -0.7$ and $U = 4$). The corrected thermopower curve is essentially the same and is not repeated, but the corrected thermal conductivity differs and is shown in Fig. 7. The main point to note is that at the lowest temperatures κ increases, because the scattering due to f-electrons drops as the f-electron concentration vanishes.

ACKNOWLEDGMENT

This work was supported by the National Science Foundation under Grant No. DMR-9973225.