Comment on "Thermal Transport in a Charged Bose Gas and in High-T_c Oxides"

In a recent Letter [1], a theory was developed for transport phenomena in a charged Bose gas. It was found that, for a special relation between two different scattering mechanisms, the momentum relaxation rate would show a maximum below the transition temperature. The conclusions were supported by reference to thermal conductivity enhancement below T_c in $YBa_2Cu_3O_{7-x}$ (YBCO) [2]. However, the basic assumption that the thermal conductivity maximum results from the relaxation time temperature dependence is incorrect. It follows from direct *diffusivity* measurements using photothermal techniques [3] that, in pure YBCO single crystals, the relaxation time for the particles transferring heat increases monotonically below T_c (Fig. 1, curve 1). It will be seen that, below T_c, the diffusivity rises over 2 orders of magnitude. The maximum in thermal conductivity κ is naturally explained by the simultaneous increase of diffusivity D and decrease of heat capacity c ($\kappa \sim cD$). Curve 2 in the inset of Fig. 1 shows the thermal conductivity calculated from diffusivity data (curve 1) and heat capacity measured elsewhere [4]. The measured data are extremely sensitive to the sample homogeneity. If the measurement is carried across a single twin boundary, the thermal conductivity maximum becomes much weaker (curve 3 in the inset). The maximum of curve 2 is sharper than that reported in [2] (dashed curve 4 in the inset) because in our experiments the spatial resolution was higher, and the measurements could be taken inside a single YBCO domain $\sim 10\ \mu m$ in extent.

Though limitation of the relaxation time mechanism discussed by Alexandrov and Mott may, in general, be related to the heat transfer in high-T_c materials, it may happen only below ~ 30 K. At higher temperatures, the maximum of thermal conductivity is more naturally explained within the traditional model of photon transport [5].

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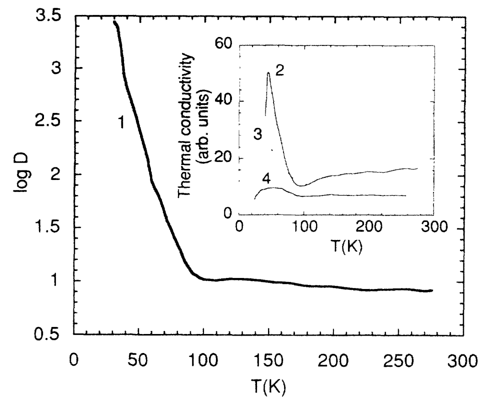

FIG. 1. Thermal diffusivity and thermal conductivity in the *a-b* plane of YBCO as a function of temperature (see details in text).

I. M. Fishman and G. S. Kino
E. L. Ginzton Laboratory
Stanford University
Stanford, California 94305-4085

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