Klein, Holczer, and Grüner Reply: In a recent Letter [1] we have suggested that a peak in the conductivity σ_1, observed at frequencies well below the gap frequency and just below T_c in $Bi_2Sr_2CaCu_2O_8$, may arise as the consequence of conductivity coherence factors. Such an effect has recently been observed by us also in conventional superconductors [2] such as Pb.

Two recent Comments offer [3,4] alternative explanations and suggest that the increase of σ_1 is due to effects which modify the conductivity above T_c, and consequently is not a signature of the superconducting state which develops below T_c. The Comment by Horbach, van Saarloos, and Huse [3] suggests that fluctuation effects are important. We fully agree with this interpretation, and we also have suggested [1] that the rise of σ_1 *above* T_c is due to fluctuation effects. Although we maintain that the peak in σ_1 occurs below T_c, while fluctuation effects lead to a peak strictly at T_c, as a result of the small difference between T_c and the temperature when the peak in σ_1 occurs, $T(\sigma_{1\,\max})$, the interpretation as offered by Horbach, van Saarloos, and Huse [3] remains a possibility. A similar temperature dependence for σ_1 was derived by Olsson and Koch [4] by assuming a broadened transition and a two-fluid model, and in their model $\sigma_1(T)$ also strongly increases above T_c with a peak at T_c. Their experiments on $YBa_2Cu_3O_7$ also show a strong increase of σ_1 above T_c.

In order to clarify the issue we have conducted experiments on $YBa_2Cu_3O_7$, where fluctuation effects are significantly smaller, and the results are shown in Fig. 1. (For the experimental technique and analysis see Ref. [1].) We also recover a peak for σ_1 with two important differences with respect to $Bi_2Sr_2CaCu_2O_8$. First, the peak occurs well below T_c. This is most clearly seen by the fact that the measured R_s is already decreased at $T(\sigma_{1\,\max})$ by nearly 1 order of magnitude from its normal-state value. Second, the conductivity has only a modest increase above T_c in clear contrast to the prediction of both models, and the increase of σ_1 is dominantly due to the development of the superconducting state below T_c. Similar results have also been obtained by others on $YBa_2Cu_3O_7$ by using different methods [5,6]. In the figure we also display a calculation [7] of σ_1 with a large gap (but strong coupling effects neglected).

Whether the observation of increased conductivity below T_c in high-temperature oxides is due to conductivity coherence factors or due to the change of the relaxation rate [8] remains to be seen, and further experiments, in particular at different frequencies, are required to clarify this point.

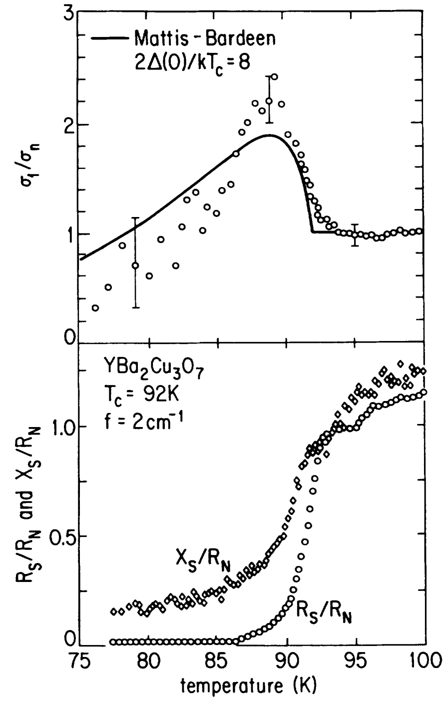

FIG. 1. Conductivity σ_1 and components of the surface impedance $Z_s = R_s + iX_s$ measured on $YBa_2Cu_3O_7$. Both R_s and X_s are normalized just above T_c.

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[1] K. Holczer *et al.*, Phys. Rev. Lett. **67**, 152 (1991).
[2] K. Holczer, O. Klein, and G. Grüner, Solid State Commun. **78**, 875 (1991).
[3] M. L. Horbach, W. van Saarloos, and D. A. Huse, Phys. Rev. Lett. **67**, 3464 (1991).
[4] H. K. Olsson and R. H. Koch, preceding Comment, Phys. Rev. Lett. **68**, 2406 (1992).
[5] H. M. Cheah, A. Porch, and J. R. Waldram, Physica (Amsterdam) **165B**, 1195 (1990).
[6] P. H. Kobrin *et al.*, Physica (Amsterdam) **176C**, 121 (1991).
[7] D. C. Mattis and J. Bardeen, Phys. Rev. **111**, 412 (1958); J. J. Chang and D. J. Scalapino, Phys. Rev. B **40**, 4299 (1989).
[8] M. C. Nuss *et al.*, Phys. Rev. Lett. **66**, 3305 (1991); P. Littlewood and C. Varma (unpublished).