Dessau, Shen, and Marshall Reply: In our Letter, we reported on high energy-resolution angle-resolved photoemission (ARPES) data taken from three Bi2212 samples [1]. All of these samples showed a gap anisotropy in the a-b plane which is very much larger than in conventional superconductors. This was the main point of our paper, and precluded the possibility of the isotropic s-wave gap $\Delta_s=\Delta_{s0}$. We further compared our data to the **k**-space dependences that one would expect from other more complicated forms of the order parameter, including a simple form for the extended s-wave gap $\Delta_{s\text{ex}} \sim [\cos(k_x a)+\cos(k_y a)]$ and the $d_{x^2-y^2}$ wave gap $\Delta_d \sim [\cos(k_x a)-\cos(k_y a)]$, as well as other suggestions in the literature such as the mixed symmetry order parameter $s+id$. The direction of the gap anisotropy that our measurement displayed—maximum near the $\overline{M}$ point $(\pi,0)$ and minimum near the Γ-$X(Y)$ zone diagonal—was consistent with the $d_{x^2-y^2}$ and $s+id$ gaps, but was inconsistent with the simplest extended s-wave gap (e.g., it has a line of zeros connecting the $\overline{M}$ points). This led us to state "Our data are qualitatively incompatible with the extended s-wave scenario, having the gap proportional to $|\cos(k_x a)+\cos(k_y a)|$." The first half of the sentence is challenged in the preceding Comment [2]. We did not conclude that our data were incompatible with a more general form of an anisotropic s-wave gap, as evidenced by our discussion centering around Refs. [23–25] of our Letter.

The expansion of the s-wave gap that Mahan used is equivalent to our expansion, but does have an advantage in that the second term, $\Delta_1\cos4\phi$, more closely resembles the angular dependence of the data for *appropriate* choices of Δ_0 and Δ_1 [3]. The angular dependence of the $d_{x^2-y^2}$ gap matches most of the data with only one adjustable parameter. Two of the samples, 1 and 3, had a gap minimum of a few meV or less, suggestive of good compatibility with the d-wave gap function $|\cos(k_x a)-\cos(k_y a)|$. Another sample, 2, had a much larger minimum gap of ~ 8 meV (this is the sample that Mahan highlighted in his Comment). Because of a less flat surface (as confirmed by a laser reflection), we felt that this sample was probably not as representative as the others, and that the larger gap along Γ-$X(Y)$ could be understood by much greater effective angular averaging. Since we have published our Letter, we have taken data on eleven other samples, the results of which are briefly summarized in Fig. 1 (samples 1, 2, and 3 are the same as the original samples 1, 2, and 3, with the exception that only the freshest data points were included). We have taken great care to ensure that all additional samples were as flat as possible, and only data which are not severely affected by aging are shown. The figure shows that the minimum gap is always along Γ-$X(Y)$, and is $\frac{1}{4}$ of the maximum gap or less, with the one exception sample 2 from our earlier paper. This confirms our earlier statement that sample 2 should be considered anomalous.

The most significant question that remains is whether the gap is in fact d wave, or whether it is simply a more complicated form of an s-wave gap, such as has been proposed by Mahan [2] or by Chakravarty *et al.* [4]. In fact, many of the arguments that are claimed to favor a d-wave gap could also be explained within the context of a very general and anisotropic s-wave gap. Certainly the trend towards smaller and smaller gaps along Γ-$X(Y)$ are more and more suggestive of a node in the order parameter, but this does not rule out the anisotropic s-wave gap. Likewise, a comparison of a least-squares fit to the data such as carried out by Mahan is not reliable, as the s-wave fit has two free parameters [3] while the d-wave fit has only one. Our best bet for resolving this crucial issue is to perform studies which are sensitive to the phase of the order parameter.

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[1] Z.-X. Shen *et al.*, Phys. Rev. Lett. **70**, 1553 (1993).
[2] G. D. Mahan, preceding Comment, Phys. Rev. Lett. **71**, 4277 (1993).
[3] The general form of the s-wave expansion does not constrain the sign of Δ_1, which determines whether the maximum gap is along Γ-$X(Y)$ or along Γ-$\overline{M}$. Therefore, the anisotropic s-wave fit may be considered to have three adjustable parameters.
[4] S. Chakravarty *et al.*, Science **261**, 337 (1993).

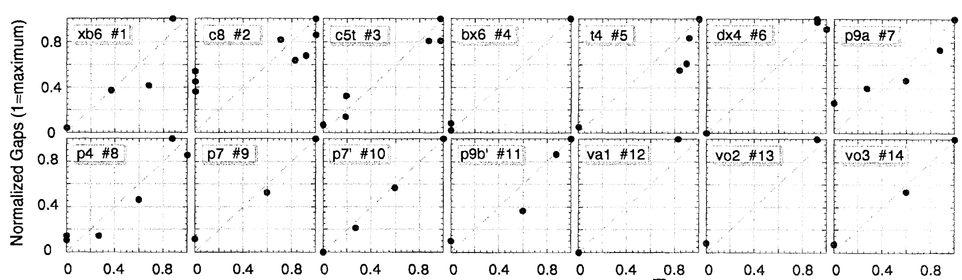

FIG. 1. Normalized energy gap vs $|\cos(k_x a)-\cos(k_y a)|$ for fourteen Bi2212 samples. The maximum gap is typically near 20 meV. Samples 1, 2, and 3 are from our original paper (Ref. [1]) while samples 4–11 are new data. On this plot a $d_{x^2-y^2}$ symmetry gap would be linear and equal to 0 at $|\cos(k_x a)-\cos(k_y a)|=0$.

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