Kim and Park Reply: Both of the previous comments by Smith and Lobb [1] and Samoilov [2] point out that there is no significant change in the Hall conductivity σ_{xy} even after the heavy-ion irradiation compared to the change in the Hall and longitudinal resistivity, ρ_{xy} and ρ_{xx}, respectively, in a certain temperature range where both ρ_{xy} and ρ_{xx} change substantially, for instance, $0.95 < T/T_c < 0.97$ for $H = 2$ T (see Figs. 1, 2, and 4 in Ref. [3]). They further assert that the data of Kang *et al.* [3] actually support the model by Vinokur *et al.* [4] which predicts the Hall conductivity $\sigma_{xy}(\approx \rho_{xy}/\rho_{xx}^2)$ to be independent of pinning, contrary to the conclusion drawn by Kang *et al.* [3].

As pointed out in [1], the model by Wang, Dong, and Ting (WDT) [5] may not be a perfect and quantitative description of our data. However, the WDT model is the only available theory that considers the role of pinning on the Hall behavior. The second point raised in [1] is that $\Gamma(v_L) \sim v_L^{-1/2}$ is derived in the nonohmic regime of the vortex glass state [6]. According to WDT, $\Gamma(v_L) \sim v_L^{-1/2}$ is applicable close to the vortex-glass transition temperature where the pinning effect is significant.

Samoilov [2] claimed that the accuracy in σ_{xy} is not larger than the difference in the Hall conductivity before and after irradiation. A careful investigation of the data in Fig. 4 in [1] reveals that the curvatures between two σ_{xy} curves, unirradiated and irradiated, even above $T/T_c \sim 0.924$, where the scattering of data is negligible, are different. The increasing $|\Delta\sigma_{xy}|$ with T decreasing can be expected from such a difference in the curvatures. Indeed the data (Fig. 3 in [7]) of Samoilov *et al.* also show a similar difference in the curvatures agreeing well with our data of Fig. 4 in [3]. The only difference is that our data are plotted in the reduced temperature scale in order to correct the T_c change after irradiation, hence the difference in σ_{xy} after irradiation is clearly visible, whereas the actual sample temperature was used in the plot in [7] in spite of T_c reduction. Moreover, the scatter of σ_{xy} in Fig. 4 is much smaller than 1500 $(\Omega\,\mathrm{cm})^{-1}$, an estimation made by Samoilov.

Both Comments listed numerous experimental findings of pinning independence of the Hall behavior. Most of the works are made on the samples without columnar pins or on very anisotropic systems. The most related work is the one by Samoilov *et al.* [7] and we interpret that their results are in favor of the pinning dependence of σ_{xy}, contrary to the authors' assertion, as discussed above as well as in [3]. We also observed a similar pinning dependence of σ_{xy} in ion-irradiated YBCO films [8]. A further detailed study of the angular dependence of σ_{xy} has revealed a clear pinning dependence [9] again. A recent study [10] on YBCO/PBCO superlattices shows another evidence of the pinning dependence of the Hall properties.

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[1] A. W. Smith and C. J. Lobb, preceding Comment, Phys. Rev. Lett. **79**, 4044 (1997).
[2] A. V. Samoilov, preceding Comment, Phys. Rev. Lett. **79**, 4045 (1997).
[3] W. N. Kang *et al.*, Phys. Rev. Lett. **76**, 2993 (1996).
[4] V. M. Vinokur *et al.*, Phys. Rev. Lett. **71**, 1242 (1993).
[5] Z. D. Wang, J. Dong, and C. S. Ting, Phys. Rev. Lett. **72**, 3875 (1994).
[6] V. M. Vinokur *et al.*, Phys. Rev. Lett. **65**, 259 (1990).
[7] A. V. Samoilov *et al.*, Phys. Rev. Lett. **74**, 2351 (1995).
[8] D. H. Kim *et al.*, IEEE Trans. Appl. Supercond. **7**, 1997 (1997).
[9] J. H. Park *et al.*, (private communication).
[10] L. M. Wang, H. C. Yang, and H. E. Hornig, Phys. Rev. Lett. **78**, 527 (1997).

 0031-9007/97/79(20)/4046(1)$10.00