Hill *et al.* Reply: In Ref. [1] and Ref. [2] we reported that the sublattice magnetizations in both $Mn_{0.75}Zn_{0.5}F_2$ and $Fe_{0.5}Zn_{0.5}F_2$ after zero field cooling (ZFC) and subsequent hearing in a field go to zero continuously in a fashion which simulates a rounded power law. Further, in both systems the rounding scales like H^2. This enabled us to construct the universal scaling plots shown in Fig. 1. The solid lines are the results of fits of all of the data to a phenomenological rounded power law form

$$I(T,H) = \frac{A}{\sqrt{\pi}\sigma(H)} \int f(T,t_c) \times \exp\left[-\left\{\frac{t_c - T_c(H)}{\sigma_{\mathrm{ZFC}}(H)}\right\}^2\right] dt_c\,, \qquad (1)$$

where $f(T,t_c) = (1 - T/t_c)^{2\beta_{\mathrm{ZFC}}}$ and $\sigma_{\mathrm{ZFC}}(H) = BH^2$.

We find $\beta = 0.2 \pm 0.05$ and 0.13 ± 0.05 for $Mn_{0.75}Zn_{0.25}F_2$ and $Fe_{0.5}Zn_{0.5}F_2$, respectively. This decay of the order parameter is accompanied by critical fluctuations whose length scale saturates at the field cooled (FC) value at $T_c(H)$. This was labeled "*trompe l'oeil*" critical behavior. The *trompe l'oeil* model also enables one to reconcile scattering and thermodynamic measurements [2].

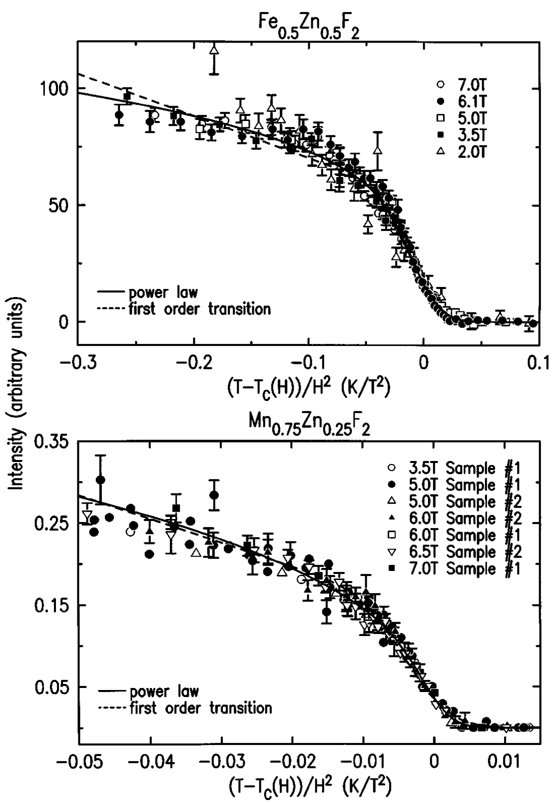

FIG. 1. Scaled magnetic Bragg intensity plotted as a function of $[T - T_c(H)]/H^2$ in $Fe_{0.5}Zn_{0.5}F_2$ and $Mn_{0.75}Zn_{0.25}F_2$. The solid and dashed lines are the results of leasts squares fits to Eq. (1) with $f(T,t_c) = (1 - T/t_c)^{2\beta_{\mathrm{ZFC}}}$ and $f(T,t_c) = [1 - T/t^*(H)]$ for $t < t_c$ and $f(T,t_c) = 0$ for $t \geq t_c$, respectively.

Wong [3], utilizing an argument based on Fisher renormalization, argues that the underlying transition should be first order. This argument, as well as the cluster spin flip mechanism of Ref. [4], is specific to diluted antiferromagnets in a uniform field. However, one might expect a discontinuous jump in the sublattice magnetization on quite general grounds for random field systems, especially in the ZFC superheated regime. In its simplest form, a first order transition is realized by the above power law form with $\beta_{\mathrm{ZFC}} \to 0$. However, fits to Eq. (1) for $\beta_{\mathrm{ZFC}} = 0.05$ or less are entirely unsatisfactory. If, as suggested by Wong, one adds a linear term to the intensity, that is, one writes, $f(T,t_c) = [1 - T/t^*(H)]$ for $T < t_c$, 0 for $T \geq t_c$, then the fits are much improved. The results so-obtained are shown as the dashed lines in Fig. 1. While the goodness of fits for the first order form are slightly larger than those for the power law, the data do not distinguish between the models. However, there are two possible caveats to the rounded first order model. First, in $Fe_{0.5}Zn_{0.5}F_2$ values of $t^*(H) > T_N(0) = 36.7$ K are required to obtain satisfactory fits, and this seems unphysical. Second, in the rounded power law model, critical fluctuations whose length scale saturates at the FC value occur naturally. In a first order model even allowing for cluster spin flips, it seems to us that these specific characteristics must be imposed artificially.

We must, nevertheless, stress that both the trompe l'oeil model and the rounded first order model describe the ZFC data in the transition region well. Both have plausible heuristic physical bases. Further experiments and theory will be necessary to choose between these two models or for that matter, some third, as yet unknown, model.

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