Comment on "Strain-Induced Nonanalytic Short-Range Order in the Spin Glass $Cu_{83}Mn_{17}$"

On the basis of x-ray scattering experiments Reichert *et al.* have recently reported [1] experimental evidence of a nonanalyticity of the diffuse scattering intensity $I_D(\mathbf{q})$ at $\mathbf{q} = 0$ in the reciprocal space of the $Cu_{83}Mn_{17}$ alloy. However, the point $\mathbf{q} = 0$ itself as well as the comparatively large vicinity of this point ($|\mathbf{q}| < 0.45$ r.l.u.) were not studied *experimentally* at all in [1] because of the method limitation (see caption to Fig. 4 therein). The evidence was based just on the fact of the identical behavior of both the experimentally observed and theoretically calculated $I_D(\mathbf{q})$ at $|\mathbf{q}| \geq 0.45$ r.l.u. The theoretical data contain the nonanalyticity [2] due to taking into account for lattice distortions within the lattice-statics method.

To check the validity of the above-mentioned evidence presented in [1] we studied as an example the Fourier transform (FT) $\alpha_{\mathbf{q}}$ of the short-range order parameters $\alpha_{\mathbf{R}}$ ($\mathbf{R}$ is the radius vector of the lattice site) obtained in the same case as the $Cu_{83}Mn_{17}$ alloy in [3]. From the comparison of our results presented in Figs. 1 and 2 with those calculated by Reichert *et al.* and shown in Figs. 3 and 5 in [1], it follows that at $|\mathbf{q}| \geq 0.45$ r.l.u. the behavior of $\alpha_{\mathbf{q}}$ is identical to the behavior of $I_D(\mathbf{q})$ theoretically calculated in [1]. Nevertheless, $\alpha_{\mathbf{q}}$ is an analytical function in contrast to $I_D(\mathbf{q})$ at $\mathbf{q} = 0$ because we calculated $\alpha_{\mathbf{q}} = \sum_{\mathbf{R}}[\alpha_{\mathbf{R}} \exp(i\mathbf{qR})]$ by the direct FT of the *limited* number of parameters $\alpha_{\mathbf{R}}$. Therefore, it is not correct to conclude about the nonanalyticity at point $\mathbf{q} = 0$ not studying that point and its immediate vicinity [4].

Thus, the experimental evidence presented in [1] about the presence of nonanalyticity of $I_D(\mathbf{q})$ at $\mathbf{q} = 0$ in the $Cu_{83}Mn_{17}$ alloy is incorrect. Taking also into account the technique limitation of x-ray measurements within the nearest vicinity of the point $\mathbf{q} = 0$ [5], the experimental study performed in [1] seems not to be adequate for a solution of the problem set forth in the title.

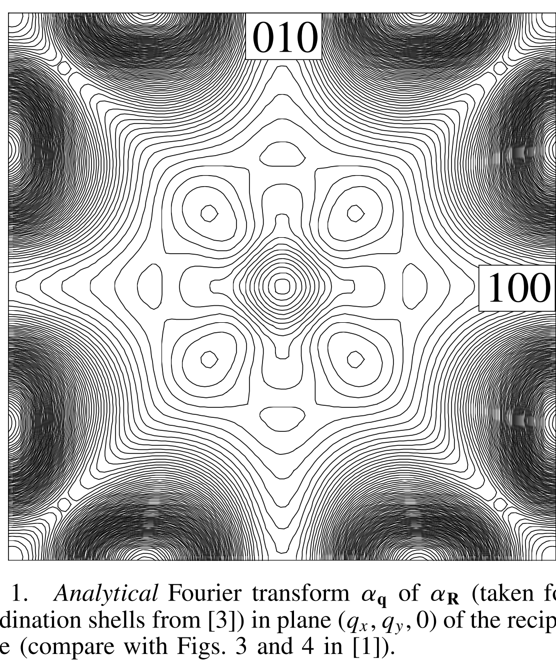

FIG. 1. *Analytical* Fourier transform $\alpha_{\mathbf{q}}$ of $\alpha_{\mathbf{R}}$ (taken for 30 coordination shells from [3]) in plane $(q_x, q_y, 0)$ of the reciprocal space (compare with Figs. 3 and 4 in [1]).

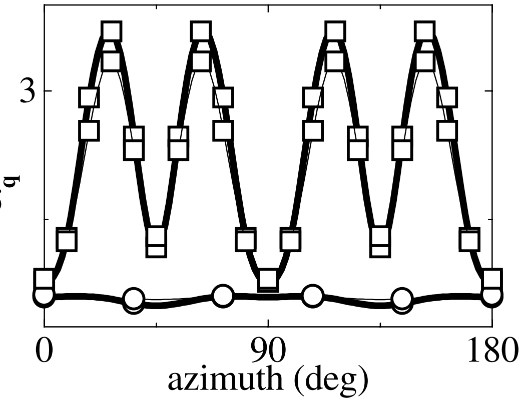

FIG. 2. Azimuthal dependence of *analytical* $\alpha_{\mathbf{q}}$ calculated, taking into account $\alpha_{\mathbf{R}}$ [3] for 9 (thin line) and 30 (bold line) coordination shells, at $|\mathbf{q}| = 0.45$ r.l.u. (circles) and $|\mathbf{q}| = 1.1$ r.l.u. (squares) (compare with Fig. 5 in [1]).

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[1] H. Reichert *et al.,* Phys. Rev. Lett. **87**, 236105 (2001).
[2] Such a nonanalyticity means that $\lim_{\mathbf{q}\to 0, \mathbf{q}/|\mathbf{q}|=\mathbf{n}} I_D(\mathbf{q}) \equiv I(\mathbf{n}) \neq I_D(\mathbf{q} = \mathbf{0})$. The value $I_D(\mathbf{q} = 0)$ [as well as $V(\mathbf{q} = 0)$, where $V(\mathbf{q})$ is the FT of the strain-induced part of the interaction potential] can be determined [e.g., A. G. Khachaturyan, *Theory of Structural Transformations in Solids* (Wiley, New York, 1983)]. But surprisingly this crucial fact is not noted in [1] and the value $V(\mathbf{q} = 0)$ is not shown in Fig. 2 therein.
[3] H. Roelofs *et al.,* Phys. Status Solidi (b) **187**, 31 (1995).
[4] The choice of the function $\alpha_{\mathbf{q}}$ at issue as an example is not crucial. To prove our statement it would be sufficient to find *any analytical* at $\mathbf{q} = 0$ function that at $|\mathbf{q}| \geq 0.45$ r.l.u. behaves correspondingly to the *nonanalytical* $I_D(\mathbf{q})$ theoretically calculated in [1].
[5] Moreover, from the unclear description of the fitting procedure in [1], it seems to follow that Reichert *et al.* had to already use the other experimental results obtained from the *neutron* scattering data in [3].

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