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COMMENT

Comment on 'Transverse fluctuations in the driven lattice gas'

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Abstract
Extensive simulation results of the transverse fluctuations in two driven lattice gases, the classical one with current and a modified version without current, are in agreement with the field theory proposed by Garrido *et al* (GSM). Based on the facts that results from both models are indistinguishable and they obey excellent scaling only by using GSM exponents, I concluded that the conclusions of the recent letter by Caracciolo *et al* are flawed.

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Caracciolo *et al* (CGGP) [1] have addressed the controversial issue of the universality class of the Katz–Lebowitz–Sphon (KLS) model [2], which is an interacting lattice gas driven by a uniform field E [1–4]. Janssen *et al* (JSLC) [5] earlier proposed a Langevin equation for the KLS model, where the main nonlinearity is a current term. This Langevin equation has been questioned by Garrido *et al* (GSM) [6] arguing that the current vanishes for $E \to \infty$, the anisotropy being the relevant ingredient. So, the universality classes predicted by these competing Langevin representations are different. Also, a modification of the KLS model, such that the direction of the field changes at random, has been proposed [2]. For this RKLS model the current vanishes and the Langevin representation matches the GSM equation.

In these comments it is shown that CGGP's conclusions, which have been claimed to agree with the JSLC equation [1], are flawed and have to be disregarded. In order to support this statement, extensive calculations of the transverse fluctuations $G_\perp(q_\parallel = 0, q_\perp = q) \equiv G(q)$, covering the same temperatures as in CGGP's letter but using much larger lattices, have been performed.

According to scaling arguments, it is convenient to plot $Y = G(q)(T - T_c)^\gamma$ versus $X = q(T - T_c)^{-\nu_\perp}$ (figure 1(*a*)), where γ and $\nu_\perp$ are the susceptibility and correlation length critical exponents, respectively. Also, figure 1(*b*) shows $1/G(q)$ versus q^2 plots, as obtained for both the maximum and the minimum temperatures used in figure 2 of [1]. Note that data collapse is obtained using arbitrary lattice shapes, in contrast to CGGP's scaling assumptions and their biased selection of a shape consistent with the JSLC equation (see figure 2 in [1]).

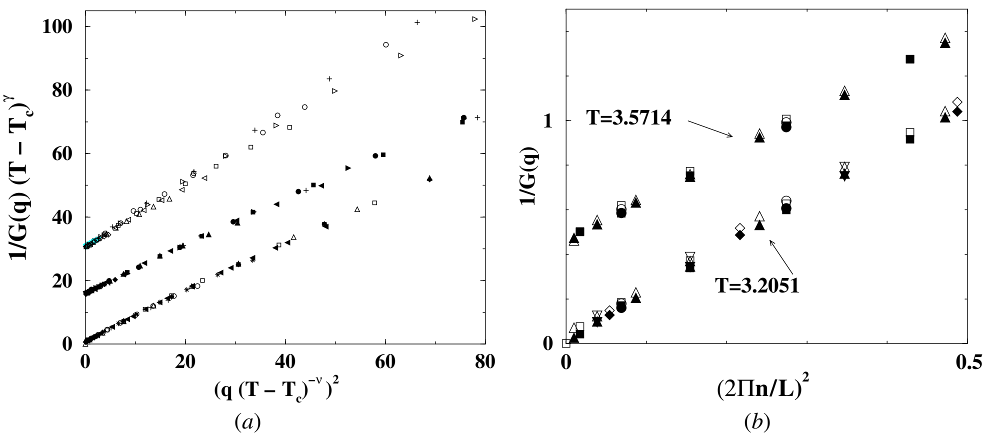

Figure 1. (*a*) $1/Y$ versus X^2 plots obtained for 8 different temperatures ($3.205 \leqslant T \leqslant 3.5714$) and 12 different lattice sizes ($110 \leqslant L_{\parallel} \leqslant 2098$ and $24 \leqslant L \leqslant 256$). The lower (medium) curve corresponds to the RKLS (KLS) model with GSM's exponents $\gamma = 1.17$ and $\nu_{\perp} = 0.63$ [4]. Upper curve: KLS model with JSLS's exponents $\gamma = 1$ and $\nu_{\perp} = 1/2$. The vertical axis of the curves is shifted for the sake of clarity. (*b*) $1/G(q)$ versus q^2 plots for the KLS (full symbols) and the RKLS (open symbols) models, obtained by using the same lattice sizes as in (*a*).

On the basis of my results, I can state: (i) for $T > T_c$, the Orstein–Zernike (OZ) approach given by equation (6) of [1], reflecting the Gaussian behaviour of $G(q)$, also *holds for the RKLS model in spite of the lack of theoretical predictions on that issue*. Therefore, checking scaling functions, obtained based on the Gaussian behaviour of $G(q)$ at T_c by performing measurements above T_c, as in figure 2 of [1], is not an irrefutable test of the JSLC theory. (ii) Data corresponding to both the KLS and the RKLS models are indistinguishable (figure 1(*b*)[1]) and both models obey OZ (figures 1(*a*) and (*b*)). So, it follows that any further treatment of the raw numerical data of $G(q)$, as performed by CGGP, *will not allow distinguishing between the universality classes of both models*. Since the RKLS model is described by a Langevin equation without a current term, the conclusion that both models belong to the same universality class (for $E \to \infty$), ruled by the GSM equation, emerges as the only valid choice, in agreement with *the results of figure 1(a) showing that data collapse is only obtained by taking GSM's exponents,* and recent numerical results [3, 4], in contrast to CGGP's conclusions.

Finally, I stress that the systematic shift of the numerical data from the exact scaling function in figure 2 of CGGP's letter remains unexplained and much larger lattices are clearly needed to obtain a solid conclusion.

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