Hidden dynamical symmetry in the ageing of disordered Ising models

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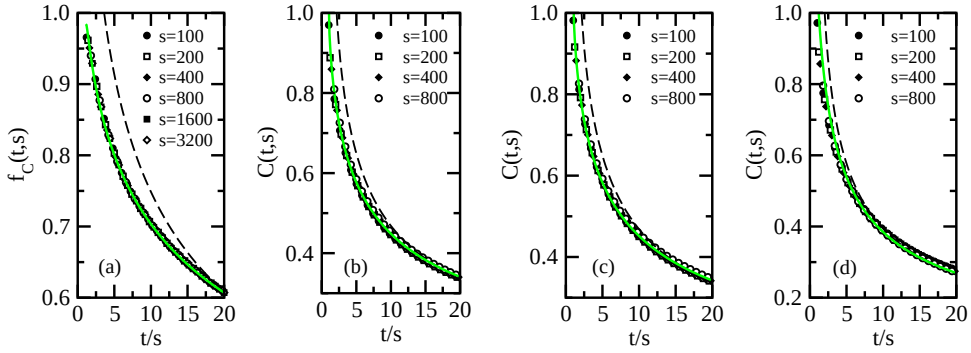
Statistical systems brought out of equilibrium by a rapid change ('quench') in a thermodynamic control parameter may undergo physical ageing, which is characterized by (i) a slow, non-exponential dynamics (even in the ordered phases far below the critical point), (ii) breaking of time-translation-invariance and (iii) dynamical scaling. We have proposed that dynamical scaling might be generalised towards some larger, local form of scale-invariance. Recently, we have shown how to extend such an approach, beyond the known case where the dynamical exponent $z = 2$ [1], towards arbitrary values of z [2]. A key ingredient is the assumption of Galilei-invariance (generalised to $z \neq 2$) which allows to derive so-called Bargman superselection rules. These in turn hint towards a *integrable* structure underlying ageing and also imply that local scale-invariances should be seen as *hidden* symmetries of the Langevin equations used for the description of ageing – in the sense that they are true symmetries of the *deterministic part* of these equations. In this way, the coupling of the system to a heat bath can be exactly taken into account [1,2].

We shall compare the resulting predictions for two-time responses and correlators $C(t,s)$ to numerical data in the $2D$ Ising model with bond disorder quenched to $T < T_c$ [3], where z varies continuously with the model's parameters. The figure illustrates this for $C(t,s) = f_C(t/s)$ in several cases with a dynamical exponent going from $z = 4$ to $z = 2.5$.



[1] F. Baumann and M. Henkel, J. Stat. Mech. P07015 (2007).
[2] F. Baumann and M. Henkel, `to be published (2008)`.
[3] M. Henkel and M. Pleimling, Europhys. Lett. **76**, 561 (2006);
F. Baumann, M. Henkel and M. Pleimling, `arXiv:0709.3288`.