and this Correspondence highlight the importance of: (1) establishing a connection between nonlinear response and dynamics in an unperturbed bulk fluid; (2) determining which length scale is the most relevant one for the understanding of glassy dynamics in the bulk; and (3) extending simulations beyond the mode-coupling crossover. ❐

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Kob *et al.* reply — In their Correspondence, Flenner and Szamel[1] compare the temperature dependence of an alternative dynamic length scale, ξ_4, with that of ξ^{dyn}, which we studied[2]. Using computer simulations of the same system, they conclude that these two length scales have a different temperature dependence. In particular, ξ_4 does not follow the striking non-monotonic temperature dependence we reported for ξ^{dyn}. Although both types of measurements aim at quantifying the spatial extent of dynamic correlations in supercooled liquids, the two procedures differ on essential points, which we now discuss.

Whereas we measured up to the distance at which the value of the relaxation time is affected by the presence of an amorphous wall[2], Flenner and Szamel quantify instead the spatial extent of spontaneous dynamic fluctuations at low wavevectors for a fixed timescale (the bulk relaxation time). These two measurements need not be directly related, although they seem to coincide at moderate temperatures (Fig. 1a of ref. 1). Although four-point functions as measured by Flenner and Szamel have played a pivotal role in previous analysis of dynamic heterogeneity, theoretical work has also revealed a number of shortcomings. Most notably, four-point functions display a strong dependence on the statistical ensemble chosen to perform measurements. As a result, they receive distinct contributions from density and energy fluctuations and show, even in idealized cases, complex scaling properties[3], which complicates the direct extraction of a correlation length. A second difficulty lies in the fact that these various contributions have different temperature dependences, with a crossover taking place very close to the mode-coupling temperature where the subtle effects we reported[2] occur. We remark that this corresponds to the temperature scale where ξ_4 and ξ^{dyn} start to differ. These known weaknesses of four-point functions had in fact motivated our study of an alternative correlation length scale that is free of such ambiguities.

Given these important differences, it is not clear how a non-monotonic temperature evolution of dynamic correlations will manifest itself in the numerical data of Flenner and Szamel. Although the authors argue that the evolution of ξ_4 with the relaxation time shows a crossover (Fig.1c in ref. 1), we point out that the presented data does not clearly show such a change in behaviour. Another possibility, not explored by Flenner and Szamel, could be that the functional form of the four-point correlation function $S_4(q,t)$ as investigated by these authors changes with temperature, in agreement with the idea that the geometry of the relaxing entities changes with temperature, as we argued[2]. As the reported effect is small (Fig. 2b in ref. 2), one would presumably need a relative accuracy of $S_4(q,t)$ of better than 1% at low wavevectors. The data shown by Flenner and Szamel demonstrate that at present this remains technically difficult.

Finally, the crossover we report also coincides with the emergence of non-trivial static correlations in the system, a result that cannot be obtained using purely dynamic correlations. Overall, this suggests that the approach of pinning particles, for which no *a priori* knowledge of the nature of the relaxing entities is needed, is extremely helpful for studying small but important effects in the relaxation properties of glass-forming systems that cannot be drawn from the measurements of Flenner and Szamel. We point out that since our results[2] were published, we have independently confirmed the qualitative change of transport properties in our system near the mode-coupling crossover by analysing the temperature evolution of dynamical finite size effects[4]. ❐

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Origin of the Au/Ge(001) metallic state

To the Editor — The physical realization of two-dimensional electron systems, such as semiconductor heterostructures, graphene and topological insulators, has revealed a cornucopia of new and exciting physics. It has been predicted that one-dimensional electron systems will also open up a new realm of physical phenomena, driven by the appearance of spin and charge collective modes and non-Fermi-liquid behaviour[1]. The exploration of this new field has barely begun, its promises have not yet materialized, and the extent of its potential for new physics and devices remains largely untapped. However, a great leap forward has been made recently by Blumenstein and colleagues[2]. In their