Stretched Exponential Relaxation of Glasses at Low Temperature

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While it is indeed commonly believed that, as frozen supercooled liquids, glasses should continue to flow over the years (e.g., in the case of the stained-glass windows of medieval cathedrals), the dramatic increase of their viscosity below the glass transition temperature T_g suggests, on the contrary, that their relaxation time is on the order of 10^{32} years at room temperature. However, a recent study conducted by Mauro et al. reported the intriguing dynamics of the relaxation of a commercial Corning® Gorilla Glass® at room temperature, over 1.5 years. Here, we report a novel atomistic simulation method allowing us to directly access the long-term (years) dynamics of glass relaxation at room temperature [1]. We find that the potential energy relaxation follows a stretched exponential decay, with a stretching exponent $\beta = 3/5$, as predicted by Phillips's diffusion-trap model. Interestingly, volume relaxation is also found. However, it is not correlated to the energy relaxation, but it is rather a manifestation of the mixed alkali effect. Beyond glasses, being able to predict and tune the relaxation and aging of materials could improve the understanding of memory encoded materials or protein folding.

[1] Bauchy *et al.*, Phys. Rev. Lett. 115, 165901 (2015)