Stress correlations and vibrational dynamics of glasses

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Recent theoretical models [1, 2] supported by numerical simulations [3] suggest the presence of long-ranged stress correlations in glasses. They appear as a signature of the disordered structure and consequently should be ubiquitous in glasses. However, the experimental proof of the existence of such long ranged correlations is particularly challenging. Experimental verification of this prediction is essential to construct and validate a theory of amorphous solids.

One way to test these models is by measuring the attenuation of sound over a wide frequency window, spanning the region from a few tens of GHz to the THz regime. The power law decay of the stress correlations should affect in a peculiar way the sound attenuation, producing an excess of attenuation compared to the Rayleigh prediction.

Access to the relevant frequency range is at present impossible on bulk samples. Our proposal is to use the 50 micro-eV energy resolution setup of the NRS beamline to get hints on the anomalous elasticity of glasses by probing the low frequency side of the density of vibrational states. We will discuss in some details the challenges and opportunities of the new technique and present preliminary results obtained on the prototypical glass of silica.

References

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