Dynamics of Glassy Materials by High Resolution Inelastic X-ray Scattering

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The nature of short wavelength excitations in glassy materials is highly debated in the physics of disordered materials. What is the length scale beyond which the continuous homogeneous medium approximation breaks down in glasses? What is the microscopic origin of sound attenuation in strong and in fragile glasses? Is there any relationship between propagating acoustic modes and the boson peak?

The development of high resolution inelastic x-ray scattering technique allowed us to experimentally address these problems by measuring the dynamical structure factor $S(Q,E)$ of glassy materials in the mesoscopic region between 1 and some tens nm^{-1}, both varying the energy (E) at fixed exchanged wave vector (Q) and varying Q at fixed E [1]. A review is here reported, together with a comparison with results obtained by complementary techniques like Brillouin light scattering [2] and inelastic ultra-violet scattering [3].

[1] Sette F., Krisch M.H., Masciovecchio C., Ruocco G., Monaco G., *Science*, 1998, **280**, 1550. [2] Fioretto D., Mattarelli M., Masciovecchio C., Monaco G., Ruocco G., Sette F., *Phys. Rev. B*, 2002, **65**, 224205. [3] Masciovecchio C., Gessini A., Di Fonzo S., Comez L., Santucci S.C., Fioretto D., *Phys. Rev. Lett.,* 2004, **92**, 247401.

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