The unimpressive origin of the apparent fragile-strong transition

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Supercooled water is suspected to undergo a fragile-strong transition (FST). Theoretical interest has been fostered by a possible connection with a Widom line emanating from the phase boundary between low and high density amorphous ice. Experimental support for the FST has mostly come from high-resolution neutron spectroscopy. The FST appears as a kink in the temperature dependence of a mean relaxation time $\langle\tau\rangle$. This interpretation depends critically on the assumption that the experiment sees one and the same relaxation process above and below the kink. Based on new backscattering spectra of water in carbon nanohorns we show that the contrary is the case.

Formally, our fit function is the same as regularly used in support of a FST: a sum of a delta line, accounting for elastic scattering by the matrix, and a Kohlrausch spectrum. This model suffers from parameter degeneracies. Occam's razor tells us to maximize constraints under minimal physical assumptions. We use harmonic extrapolations of the T dependent scattering intensity to fix the amplitudes in our delta-plus-Kohlrausch fits. We then identify two q,T regions that admit particularly stringent constraints, and a crossover regime in between. In this way, we find that quasielastic scattering reveals different physics in different q,T regimes: At low T, it is dominated by localized motion; at high T by relaxation-coupled diffusion.