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Title: The structure and terahertz dynamics of water confined in nanoscale pools in salt solutions
Author: Turton, DA Corsaro, C Candelaresi, M Brownlie, A Seddon, KR Mallamace, F Wynne, K
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Abstract: The behaviour of liquid water below its melting point is of great interest as it may hold clues to the properties of normal liquid water and of water in and on the surfaces of biomolecules. A second critical point, giving rise to a polyamorphic transition between high and low density water, may be hidden in the supercooled region but cannot be observed directly. Here it is shown that water can be locked up in nano-pools or worm-like structures using aqueous LiCl salt solutions and can be studied with terahertz spectroscopies. Very high dynamic range ultrafast femtosecond optical Kerr effect (OKE) spectroscopy is used to study the temperature-dependent behaviour of water in these nano-pools on timescales from 10 fs to 4 ns. These experiments are complemented by temperature-dependent nuclear magnetic resonance (NMR) diffusion measurements, concentration-dependent Fourier-transform infrared (FTIR) measurements, and temperature-dependent rheology. It is found that liquid water in the nanoscale pools undergoes a fragile-to-strong transition at about 220 K associated with a sharp increase in the inhomogeneity of translational dynamics.