

## The First Observation of Boson Peak from Water Vapour Deposited Amorphous Ice

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Boson peak in the vibrational spectra of amorphous materials (*e.g.* silica) is a subject attracted considerable scientific attention in recent years. The excess of low-energy vibrational modes (the so-called Boson peak) coexisting with the sound waves from crystalline spectrum is still unresolved mystery. Understanding the physical mechanism of the source of the low-energy excitations is fundamentally important for us to understand the structure and dynamics of the amorphous materials. In this paper, we report the first observation of the Boson peak in the inelastic incoherent neutron scattering (IINS) spectrum from a low-density amorphous (LDA) form of ice obtained by vapour deposition on a cooled substrate (at 20 K) with low flow-rate ( $\sim 14$  mg/h). The IINS spectrum of vapour deposited amorphous (VDA) ice clearly shows the low-energy excess excitations centred at 4 meV, while there was no excess scattering from other LDA ices studied before, which were obtained either by annealing the high-density amorphous ice or by hyper-quenching of water droplets of  $\mu\text{m}$ -size. In addition, the integrated intensity of the acoustical peak in the IINS spectrum for VDA ice (1-15 meV) is also noticeably larger compared to that for ice-Ih (by about 5%). The observation indicates that the Boson peak in VDA ice spectrum is more likely due to the broken hydrogen bonds in the glass material.