Mapping the lattice dynamical anomaly of the order parameters across the Verwey transition in magnetite

Supplementary Figures

**Supplementary Figure 1.** Energy (a) and width (b) of the $X_3$ mode as a function of temperature across the Verwey transition. Left and right horizontal arrows are associated with datapoints at 2 K and 293 K, respectively. The hatched area represents the resolution limit. A vertical dashed line denotes $T_V$. 
Supplementary Figure 2. Temperature dependence across the Verwey transition of inelastic neutron scattering (INS) spectra at the X-point, in the energy range of the transverse-acoustic (TA)-X$_4$, lowest-energy transverse-optical (TO)-X$_3$ and TO-X$_2$ modes. In Suppl. Fig. 2–4, a linear baseline is subtracted from the data, and continuous lines represent multi-Gaussian fits to the data, to single out distinct phonon modes from the background intensity.
Supplementary Figure 3. Temperature dependence across the Verwey transition of INS spectra at the ∆-point, in the energy range of the TA-Δ$_5$ mode.
**Supplementary Figure 4.** INS spectra along the [001] direction around the (4,0,0) Brillouin zone above (a) and below $T_V$ (b), and at our 2 K base temperature (c).