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Dispersion relations near quantum criticality in the quasi one-dimensional Ising chain $CoNb_2O_6$ in transverse magnetic field IVELISSE CABRERA, JORDAN THOMPSON, RADU COLDEA, Clarendon Laboratory, Department of Physics, University of Oxford, Oxford OX1 3PU, United Kingdom, NEIL ROBINSON, FABIAN ESSLER, The Rudolf Peierls Centre for Theoretical Physics, Oxford University, Oxford OX1 3NP, United Kingdom, DHARMALINGAM PRABHAKARAN, Clarendon Laboratory, Department of Physics, University of Oxford, Oxford OX1 3PU, United Kingdom, ROBERT BEWLEY, TATIANA GUIDI, ISIS Facility, Rutherford Appleton Laboratory, Chilton, Didcot, Oxon OX11 0QX, United Kingdom — The Ising chain in a transverse magnetic field is one of the canonical examples of a quantum phase transition. We have recently realized this model experimentally in the quasi-one-dimensional (1D) Ising-like ferromagnet $CoNb_2O_6$ [1]. Here, we present single-crystal inelastic neutron scattering measurements of the magnetic dispersion relations in the full three-dimensional (3D) Brillouin zone for magnetic fields near the critical point and in the high field paramagnetic phase. We explore the gap dependence as a function of field and quantify the cross-over to 3D physics at the lowest energies due to the finite interchain couplings. We parametrize the dispersion relations in the high-field paramagnetic phase to a spin wave model to quantify the sub-leading terms in the spin Hamiltonian beyond the dominant 1D Ising exchange. [1] R. Coldea, D.A. Tennant, E.M. Wheeler et al, Science 327 177-180 (2010).

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