Evidence for pressure-induced unconventional quantum criticality in the coupled spin-ladder antiferromagnet C9H18N2CuBr4

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Quantum phase transitions in quantum matter occur at zero temperature between distinct ground states by tuning a nonthermal control parameter. In most cases, these transitions can be accurately described within the Landau theory of phase transitions, similar to conventional thermal phase transitions. However, this picture can break down under certain unusual circumstances. Here, we present a comprehensive study of the effect of hydrostatic pressure on the magnetic structure and the spin dynamics of the spin-1/2 ladder compound C9H18N2CuBr4. Single-crystal heat capacity and neutron diffraction measurements reveal that the Néel ordered phase breaks down at and beyond a critical pressure of Pc~1.0 GPa through a continuous quantum phase transition. Estimates of the critical exponents suggest that this transition may fall beyond the traditional Landau paradigm. The inelastic neutron scattering spectra at 1.3 GPa are characterized by two well-separated gapped modes, including one continuum-like and another resolution-limited excitation in distinct scattering channels, which further indicates an exotic quantum-disordered phase above Pc [1].

Reference:

[1] T. Hong et al., arXiv:cond-mat/2011.04477.

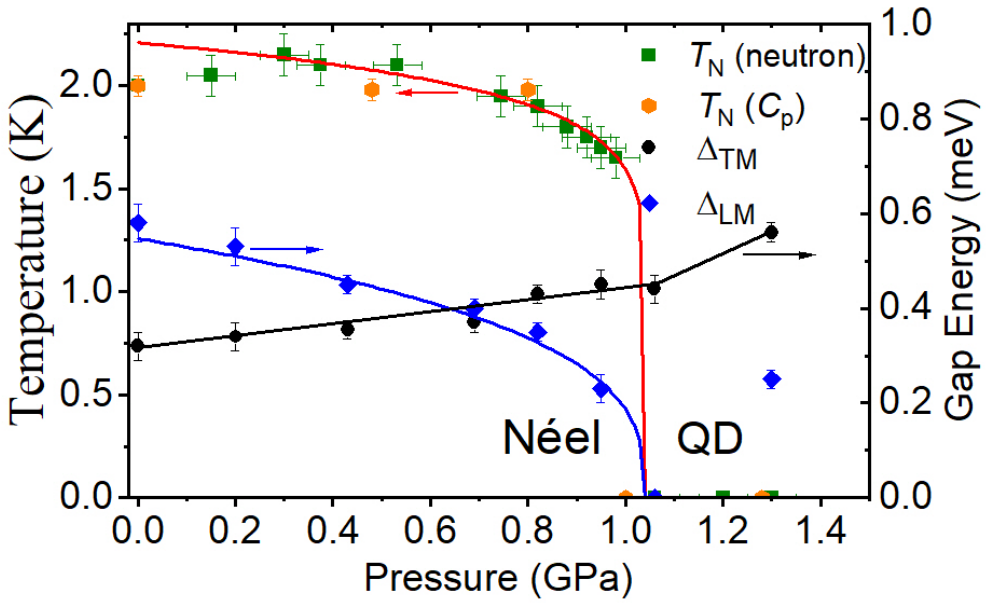

Figure 1