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Terahertz excitations in the 1D Ising chain quantum magnet CoNb2O6

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The one-dimensional magnet CoNb2O6 was recently demonstrated to be an excellent realization of a one-dimensional quantum Ising spin chain. It has been shown to undergo a quantum phase transition in a magnetic field oriented transverse to its ferromagnetically aligned spin chains. Low energy spin-flip excitations in the chains were recently observed via inelastic neutron scattering [1]. The energy spectrum of these excitations was shown to have an interesting energy scaling governed by symmetries of the E8 exceptional Lie group. Here, time-domain terahertz spectroscopy (TDTS) is used to investigate optically active low energy excitations in CoNb2O6. We take advantage of the polarization sensitivity of this technique to characterize both electric and magnetic dipole active excitations in this compound. A connection is made from the q=0 response observed here to the excitations observed by neutron scattering. Additionally, a number of magnetic dipole excitations not evident in the neutron scattering experiments are observed. Finally, we will show preliminary data on the terahertz spectra of this material as it undergoes the magnetic field-tuned quantum phase transition.
[1] R. Coldea et al, Science 327, 177 (2010)

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