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High-Pressure Susceptibility, Magnetostriction and Ultrasound Measurements on SCBO

Grockowiak, A., Coniglio, W.A. (NHMFL, Florida), Wehinger, B., Rüegg, C. (U. of Geneva and Paul Scherrer Institute, Switzerland), Suslov, A., Tozer, S.W. (NHMFL, Florida)

Introduction

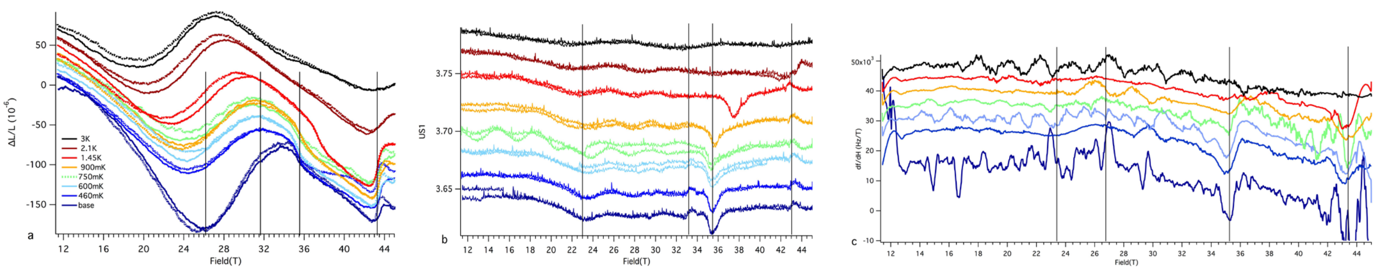
The Shastry–Sutherland model for frustrated magnets, which consists of a set of spin 1/2 dimers on a 2D square lattice, is realized in $SrCu_2(BO_3)_2$. Its magnetization shows plateaus at fractional values of the full magnetization, which are in particular well pronounced for 1/3 and 1/2 magnetization with onset fields of 40.2 T and 84 T [1-3]. Applying hydrostatic external pressure results in continuous and discontinuous quantum phase transitions with increasing ratio of inter- to intradimer coupling [4,5].

Experimental

We have pursued our simultaneous measurement of magnetostriction (MS) and susceptibility measurement under pressure, and have added ultrasound (US). Susceptibility was measured via the tunnel diode oscillator (TDO) technique, MS with an optical Fiber Bragg Grating (FBG) ([6]), and two transducers to measure the US signal, inside a piston cylinder cell up to 45 T and at ^{3}He temperatures. This enables us to get a comprehensive set of data collected in the same experimental conditions of temperature, field and pressure on the same sample.

Results and Discussion

We have performed the three simultaneous experiments from 0 to 10kbar, up to 45T. Figures a, b and c show respectively the temperature dependence of the MS (a), US (b), and the derivative of the TDO signal (c).
All observed magnetization plateaux shows a decreasing amplitude with increasing temperature, except from the 1/4 plateau observed at about 36T, which interestingly shifts to higher fields with higher temperatures and is yet to be understood..



Conclusions

Further experimental work is required to access the next pressure range of 10-25kbar, and additional theoretical work is in progress to disentangle the contributions from the lattice and the spins.

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