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Extreme conditions magnetostriction study of the Shastry-Sutherland sample SCBO[1] AUDREY GROCKOWIAK, National High Magnetic Field Laboratory, BJRN WEHINGER, University of Geneva, WILLIAM CONIGLIO, National High Magnetic Field Laboratory, CHISTIAN RUEGG, Paul Scherrer Institute, STANLEY TOZER, National High Magnetic Field Laboratory, NATIONAL HIGH MAGNETIC FIELD LABORATORY TEAM, PAUL SCHERRER INSTITUTE COLLABORATION — The Shasty–Sutherland model, which consists of a set of spin 1/2 dimers on a 2D square lattice, is simple and soluble but captures a central theme of condensed matter physics by sitting precariously on the quantum edge between isolated, gapped excitations and collective, ordered ground states. This model is realized in SrCu2(BO3)2. Recent x-ray diffraction data revealed a direct correlation of the lattice with magnetic susceptibility measurements at low temperatures [1]. The variation of the lattice parameters with temperature is thus directly linked to the spin response of the system. Indeed, scattering intensities from the spin waves, measured by inelastic neutron scattering experiments, decay accordingly [2]. The magnetic correlations can thus be monitored by the lattice parameters and are thus sensitive to magnetostriction. Ambient pressure magnetostriction up to 100.7 T [5, 6] show clear signatures related to the magnetization plateaus at 30, 40 and 80T. Together with total energy calculations these studies revealed a strong magneto elastic coupling driven by the super exchange angle CuOCu. Applying hydrostatic external pressure results in continuous and discontinuous quantum phase transitions [1,3]. Zero field high pressure neutron spectroscopy measurements have revealed so far three phases : spin dimer from 0 to 2GPa, antiferromagnetic from 4 to 6 GPa, and a 4-spin plaquette singlet state was recently identified in the 2 to 4GPa region [4]. We report here on high pressure (up to 2GPa), high magnetic field (up to 65T) and 3He temperature magnetostriction experiments, using FBGs. Fiber Bragg Grating (FBG) Dilatometry [6] permits to measure the magnetostriction of a sample in function of the response of an optical fiber to applied strain. Audrey Grockowiak
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[1]Continuous and discontinuous quantum phase transitions in a model two-dimensional magnet Haravifarda S, et al., PNAS, Feb. 14, 2012 vol. 109 no. 7 2286–2289 [2] High-Resolution Study of Spin Excitations in the Singlet Ground State of SrCu2(BO3)2, B. Gaulin, et al., Phys.Rev. Lett. 93, 267202 (2004) [3]Quantum phase transitions in the orthogonal dimer system SrCu2.BO3.2 Hiroshi Kageyama H, et al. Physica B 329–333 (2003) 1020–1023 [4]Observation of a 4-spin Plaquette Singlet State in the Shastry–Sutherland compound SrCu2 (BO3)2Zayed M.E., et al. arXiv: 1603.02039v [5]Magnetostriction and magnetic texture to 100.75 Tesla in frustrated SrCu2(BO3)2. Proc Natl Acad Jaime M, et al. Sci US109(31)12404–12407. (2012)

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