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Magnetic Texture & Frustration in Quantum Magnets via Strain Measurements to 100 Tesla

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Strong geometrical frustration in magnets leads to exotic states, such as spin liquids, spin supersolids, magnetic solitons, and complex magnetic textures. $SrCu_2(BO_3)_2$, a spin-1/2 Heisenberg antiferromagnet in the archetypical Shastry-Sutherland lattice, exhibits a rich spectrum of magnetization plateaus and stripe-like magnetic textures in applied fields. We observed new magnetic textures via optical FBG magnetostriction and magnetocaloric measurements in fields up to 100.75 Tesla at 73.6 T and at 82 T [1] which we attribute, using a controlled density matrix renormalization group approach, to a 2/5 plateau and to the long-predicted 1/2-saturation plateau. The plateau predicted at 2/5 saturation is particularly interesting since strain appears to be the only experimental probe with enough sensitivity to reveal it as magnetization probes see a much more gradual change in the same field range [2,3]. $BiCu_2PO_6$ is a frustrated two-leg spin ladder compound with a spin gap that can be closed with a magnetic field of approximately 20T to induce a soliton lattice [4,5]. Time permitting, I will also discuss magnetization, magnetostriction and specific heat vs magnetic fields to 65 T used to obtain the anisotropic (H,T) phase diagram in $BiCu_2PO_6$ single crystal samples. Work at the NHMFL was supported by the National Science Foundation, the US Department of Energy Office of Basic Energy Science through the project "Science at 100 Tesla," and the State of Florida.

[1] M. Jaime, et al. *Proc. Natl. Acad. Sci.* **109**, 12407 (2012).
[2] S.E. Sebastian, et al., *Proc. Natl. Acad.* Sci. **105**, 20157 (2009).
[3] Y.H. Matsuda, et al., *Phys. Rev. Lett.* **111**, 137204 (2013).
[4] Y. Kohama, et al., Phys. Rev. Lett. **109**, 167204 (2012).
[5] F. Cassola, et al., Phys. Rev. Lett. **110**, 187201 (2013).