Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

A new magnetic phase diagram for the quasi-one-dimensional (1D) spin chain compound $Ca_3Co_2O_6$[1] HARI SRIKANTH, P. LAMPEN, Univ of South Florida, N.S. BINGHAM, Paul Scherrer Institut, Switzerland, M.H. PHAN, Univ of South Florida, H.T. YI, S.W. CHEONG, Rutgers University — The spin chain cobaltite system $Ca_3Co_2O_6$ combines geometric frustration with intrinsic low-dimensionality, giving rise to complex physical phenomena that continue to attract a great deal of interest. A long-wavelength spin-density wave (SDW) has recently been observed in $Ca_3Co_2O_6$ at zero field, stabilized by a helical exchange pathway among neighboring chains. We establish a new and more comprehensive phase diagram for this exotic system through the evolution of the magnetic entropy change ΔS_M (T,H) associated with the magnetocaloric effect. ΔS_M measurements in a single crystal of $Ca_3Co_2O_6$ prepared by the flux method demonstrate the suppression of the SDW modulation by small applied magnetic fields (<1T). Metamagnetic transitions to a ferrimagnetic up-up-down spin chain arrangement and full ferromagnetic alignment are observed below 25 K. Short-range ordered (SRO) correlations with an antiferromagnetic character grow in volume as the temperature is lowered below 15 K, resulting in a crossover from ΔS_M (H) <0 to ΔS_M (H) >0 at 12 K. Our entropy–based analysis reflects current understanding of the role of SDW and SRO phases in $Ca_3Co_2O_6$, resolves new sub-features of the ferrimagnetic phase, and extends previous results below the onset of slow dynamics ($\sim$ 10 K).

[1]USF authors acknowledge DoE BES under Award # DE-FG02-07ER46438 (magnetic measurements and analysis).

Hariharan Srikanth
Univ of South Florida

Date submitted: 12 Nov 2014 Electronic form version 1.4