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**Magnetic neutron diffraction study of  $\text{BaFe}_{2(1-x)}\text{Co}_{2x}\text{As}_2$  critical exponents through the tricritical doping** D.M. PAJEROWSKI, National Institute of Standards and Technology Center for Neutron Research, C.R. ROTUNDU, Materials Science Division, Lawrence Berkeley National Laboratory, J.W. LYNN, National Institute of Standards and Technology Center for Neutron Research, R.J. BIRGENEAU, Department of Physics, Department of Materials Science and Engineering, University of California, Berkeley — We present temperature dependent magnetic neutron diffraction measurements of  $\text{BaFe}_{2(1-x)}\text{Co}_{2x}\text{As}_2$  for  $x = 0.039$ ,  $0.022$ , and  $0.021$  as-grown single crystals. We are motivated to investigate the magnetic tricritical point in the  $(x,T)$  plane near  $x_{tr}^m \approx 0.022$ , [1] as well as to systematically probe the character of the magnetic phase transition across a range of dopings. All samples show long range antiferromagnetic order that may be described near the transition by  $I \propto (1 - T/T_N)^{2\beta}$  with  $\beta = 0.291$  for  $x = 0.039$ ,  $\beta = 0.208$  for  $x = 0.022$ , and  $\beta = 0.198$  for  $x = 0.021$ , showing a monotonic increase from the parent  $\text{BaFe}_2\text{As}_2$  compound,  $\beta = 0.103$ . [2] We will discuss the results based on theoretical predictions for the behavior of the order parameter in the vicinity of a tricritical point.

[1] M.G. Kim, R.M. Fernandes, A. Kreyssig, J.W. Kim, A. Thaler, S.L. Bud'ko, P.C. Canfield, R.J. McQueeney, J. Schmalian, and A.I. Goldman, Phys. Rev. B 83, 134522 (2011).

[2] S.D. Wilson, Z. Yamani, C.R. Rotundu, B. Freelon, E. Bourret-Courchesne, and R.J. Birgeneau, Phys. Rev. B 79, 184519 (2009).

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