

Abstract Submitted  
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**Magnetic phase diagram and multiferroicity of  $\text{Ba}_3\text{MnNb}_2\text{O}_9$ : A spin- $\frac{5}{2}$  triangular lattice antiferromagnet with weak easy-axis anisotropy<sup>1</sup>**

M. LEE, E.S. CHOI, Natl High Magnetic Field Lab, X. HUANG, Southeast University, Nanjin, China, J. MA, C.R. DELA CRUZ, M. MATSUDA, W. TIAN, Oak Ridge Natl Lab, TN, USA, Z.L. DUN, University of Tennessee, TN, USA, S. DONG, Southeast University, Nanjin, China, H.D. ZHOU, University of Tennessee, TN, USA — We have performed magnetic, electric, thermal, and neutron powder diffraction (NPD) experiments as well as density functional theory (DFT) calculations on  $\text{Ba}_3\text{MnNb}_2\text{O}_9$ . All results suggest that  $\text{Ba}_3\text{MnNb}_2\text{O}_9$  is a spin- $\frac{5}{2}$  triangular lattice antiferromagnet (TLAF) with weak easy-axis anisotropy. At zero field, we observed a narrow two-step transition at  $T_{N1} = 3.4$  K and  $T_{N2} = 3.0$  K. The neutron diffraction measurement and the DFT calculation indicate a  $120^\circ$  spin structure in the  $ab$  plane with out-of-plane canting at low temperatures. With increasing magnetic field, the  $120^\circ$  spin structure evolves into up-up-down ( $uud$ ) and oblique phase showing successive magnetic phase transitions, which fits well to the theoretical prediction for the 2D Heisenberg TLAF with classical spins. Multiferroicity is observed when the spins are not collinear but suppressed in the  $uud$  and the oblique phase. We discuss the results in comparison with our previous works on its sister compounds with small spins,  $\text{Ba}_3\text{NiNb}_2\text{O}_9$  ( $S = 1$ ) (J. Hwang *et al.*, Phys. Rev. Lett. **109**, 257205 (2012) and  $\text{Ba}_3\text{CoNb}_2\text{O}_9$  ( $S = \frac{1}{2}$ ) (M. Lee *et al.*, Phys. Rev. B **89**, 104420 (2014)).

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