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Mean-Field Critical Behavior in the $Sr_{1-x}(Ca_{0.5}Ba_{0.5})_xRuO_3$ (0 $\leq$ x $\leq$ 0.35) JINGUANG CHENG, JIANSHI ZHOU, JOHN GOODENOUGH, TMI, University of Texas at Austin — Orthorhombic $SrRuO_3$ is a metallic ferromagnet with $T_c \approx 160$ K where mean-field (MF) critical behavior has been observed. [1] Recently, we have shown that cubic $BaRuO_3$ belongs to the 3D Heisenberg universality class with short-range exchange interactions. [2] The partial chemical substitution by either smaller Ca^{2+} or larger Ba^{2+} in $Sr_{1-x}A_xRuO_3$ which changes the bond angle <Ru-O-Ru> and introduces an A-cation size variance $\sigma^2 \equiv <r_A^2> - <r_A>^2$, causes a clear deviation from the MF behavior. In order to distinguish effects of <Ru-O-Ru> versus σ^2, we have synthesized $Sr_{1-x}(Ca_{0.5}Ba_{0.5})_xRuO_3(0 \leq x \leq 0.35)$ under 1000 $^\circ$C and 10 GPa in a Walker-type multianvil; these samples have the same average <Ru-O-Ru> as that of $SrRuO_3$, but a different σ^2. All samples exhibit perfect MF critical behaviors, which indicates that the peculiar bond angle <Ru-O-Ru> $\approx 163^\circ$ plays an essential role in determining the MF critical behavior of $SrRuO_3$.
[1] D. Kim, *et al.*, Phys. Rev. B **67**, 100406 (2003).
[2] J.-S. Zhou, *et al.*, Phys. Rev. Lett. **101**, 077206 (2008).

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