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Critical Properties of the Unconventional Spin-Peierls System TiOBr J.P. CLANCY, B.D. GAULIN, Department of Physics and Astronomy, McMaster University, F.C. CHOU, Center for Condensed Matter Sciences, National Taiwan University — TiOBr is one of only three inorganic compounds which have been shown to undergo a spin-Peierls (SP) transition, developing a dimerized singlet ground state at low temperatures. However, unlike conventional SP systems, TiOBr exhibits not one, but two successive phase transitions: a continuous transition to an incommensurate SP state at T_{c2}∼48K, followed by a discontinuous transition to a commensurate SP state at T_{c1}∼27K. We have performed x-ray diffraction measurements on single crystal TiOBr, and carried out a detailed analysis of the critical exponent β near T_{c2}. Our results yield a transition temperature of T_{c2}=47.85(5)K and an exponent of β=0.30(3). This value is consistent with conventional 3D Ising-like behavior (β=0.326), and closely compares to the exponent reported for $CuGeO_3$ (β=0.36(3)) [1], the canonical inorganic SP system. In contrast with measurements performed on isostructural TiOCl [2], we observe no evidence of commensurate dimerization fluctuations in either the incommensurate SP phase ($T_{c1}<T<T_{c2}$) or the so-called pseudogap phase ($T_{c2}<T<T^*$∼100-150K). Furthermore, the incommensurate scattering between T_{c1} and T_{c2} appears to be shifted in Q-space relative to the commensurate scattering below T_{c1}. [1] M.D. Lumsden et al., PRL **76**, 4919 (1996). [2] J.P. Clancy et al., PRB **75**, 100401(R) (2007).

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