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**Field induced linear magneto-elastic coupling in multiferroic $TbMnO_3$** NADIR ALIOUANE, DIMITRI ARGYRIOU, Hahn-Meitner-Institut, Glienicker Str. 100, Berlin D-14109, J. STREMPFER, I. ZEGKINOGLOU, Max-Planck-Institut fur Festkorperforschung,Heisenbergstrasse 1, 70569 Stuttgart, Germany, M. V. ZIMMERMAN, HASYLAB at Deutsches Elektronen-Synchrotron DESY, Notkestr. 85, 22603 Hamburg, Germany — We have used in-field neutron and X-ray single crystal diffraction to measure the incommensurability $\delta$ of the crystal and magnetic structure of multiferroic $TbMnO_3$. We show that the flop in the electric polarization at the critical field $H_C$, for field $H$ along the $a-$ and $b-$axis coincides with a 1st order transition to a commensurate phase with propagation vector $\kappa = (0, \frac{1}{4}, 0)$. In-field X-ray diffraction measurements show that the quadratic magneto-elastic coupling breaks down with applied field as shown by the observation of the 1st harmonic lattice reflections above and below $H_C$. This indicates that magnetic field induces a linear magneto-elastic coupling. We argue that the commensurate phase can be described by an ordering of Mn-O-Mn bond angles.

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