

## **In Field Incommensurate-Commensurate Phase Transition in the Multiferroic TbMnO<sub>3</sub>**

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Orthorhombic TbMnO<sub>3</sub>[1] is a multiferroic compound that exhibits a flop in the electrical polarization from c to the a-direction with a applied magnetic field either along a or b axis. We have studied the magnetic field dependence of the incommensurate wave vectors ( $q_{Mn}$   $q_{Tb}$ ) associated with the polarization and the magnetic ordering by neutron and x-ray single crystal diffraction with  $H\parallel a$  and b. The polarization flop transition corresponds to first-order transition from an incommensurate multi-q-structure to a commensurate single q-structure with  $q=1/4$  at  $H\parallel a$ ,  $H>9T$   $T_C\sim 28K$ . In our X-ray measurements, the induced magneto-elastic coupling is observed as a structural modulation at twice the magnetic wavevector ( $2q_{Mn,Tb}$ ). The temperature and field dependence of the magnetic and superlattice reflections are consistent with a soliton formalism which predicts a stable commensurate single  $q=1/4$ -phase.

[1] Kimura et al., *Nature*, 2003, **426**, 55.

**Keywords:** 1/4-phase, polarization flop, soliton formalism