Magnetic Ordering in Multiferroic $GdFe_3(BO_3)_4$

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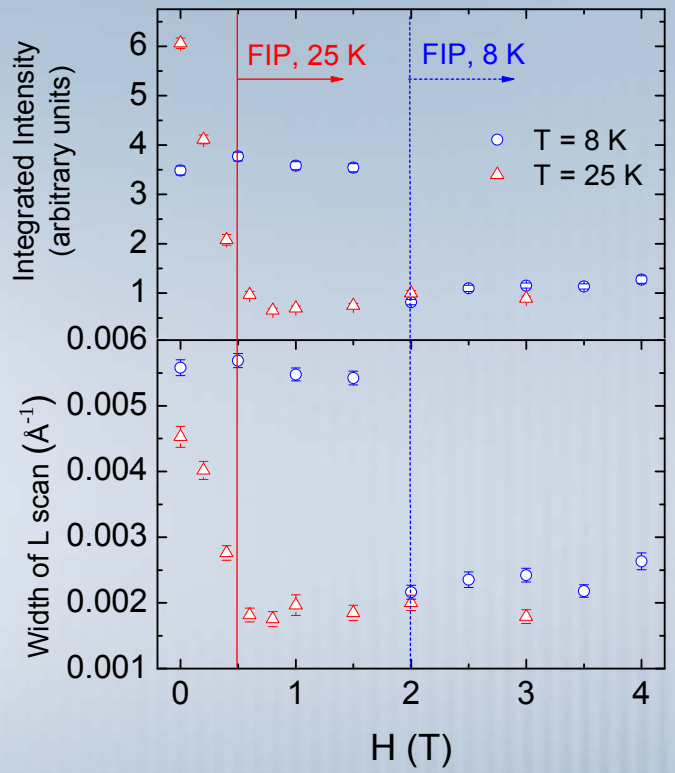
- Multiferroic materials that simultaneously exhibit magnetism and ferroelectric behavior are of great technological interest due to the coupling between the order parameters that can be exploited in magnetoelectric devices.
- By using x-ray scattering techniques to study antiferromagnetic $GdFe_3(BO_3)_4$, we discovered that the onset of ferroelectric ordering coincides with an incommensurate-to-commensurate magnetic structure transition, and that the Fe subsystem develops a ferromagnetic component in the basal plane.
- These measurements provide important information about the multiferroic mechanism in $GdFe_3(BO_3)_4$, and its dependence upon the microscopic magnetic structure.



Field dependence of the (0 0 9/2) magnetic peak intensity (upper) and width (lower), measured at T = 8 (o) and 25 (Δ) K. The vertical lines indicate the critical field for the onset of ferroelectric ordering at the two temperatures.

H. Mo, C.S. Nelson, L.N. Bezmaternykh, and V.L. Temerov, "Magnetic structure of the field-induced multiferroic $GdFe_3(BO_3)_4$," Phys. Rev. B 78, 214407 (2008).

Work performed on beamlines X21 and X22C.