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Helical strain patterns and charge ordering in $YbFe_2O_4$ ALEXANDER HEARMON, PAOLO RADAELLI, PRABHAKARAN DHARMALINGAM, Clarendon Laboratory, Oxford University, MATTHIAS GUTMANN, ISIS Facility, Rutherford Appleton Laboratory, FEDERICA FABRIZI, Clarendon Laboratory, Oxford University, DAVE ALLAN, Diamond Light Source Ltd — The $R\mathrm{Fe}_2\mathrm{O}_4$ compounds exhibit simultaneously charge ordering (CO) of the Fe^{2+} and Fe^{3+} ions,[1] together with magnetic ordering of the Fe spins[2] and possible multiferroic behavior.[3] Synchrotron data collected below the 3D CO transition show intensity concentrated around peaks separated by $\sim 1/3\ c^*$ but slightly displaced in the (a^*, b^*) plane. Calculations modelling an oxygen displacement pattern are in excellent agreement with the data, suggesting an incommensurate charge ordering of the Fe ions close to the commensurate $\sqrt{3} \times \sqrt{3}$ structure, associated with a helical strain pattern. At high temperature, ordering wavevectors corresponding to many different displacement patterns are simultaneously populated by the system, leading to diffuse but highly structured features in reciprocal space.

[1]Ikeda *et al*, Nature **436** 1136 (2005)
[2]Christianson *et al*, PRL **100** 107601 (2008)
[3]S-W Cheong *et al*, Nat. Mater. **6** 13 (2007)

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