Competing magnetic phases and multiferroic behaviour in $Ni_3V_2O_8$ and $Co_3V_2O_8$

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$Ni_3V_2O_8$ and $Co_3V_2O_8$ have a buckled Kagome staircase structure, with two types of magnetic Ni (or Co) ions. Cooling $Ni_3V_2O_8$ yields two different incommensurate magnetic phases (HTI and LTI) and a commensurate antiferromegnetic phase, which also exhibits weak ferromagnetism [1,2]. The phase boundaries between these phases depend strongly on the magnitude and direction of the magnetic field. In addition, the LTI phase exhibits a ferroelectric moment, which can be switched on and off by the magnetic field [3]. Since the ideal Kagome structure is highly frustrated, the actual magnetic structures are explained by group theory and by weak anisotropic (Dzyaloshinskii-Moriya and pseudo-dipolar) and next-nearest-neighbour intra-plane super-exchange interactions. The multiferroic behaviour is explained by a corresponding magnetoelectric interaction [4]. Similarly, $Co_3V_2O_8$ exhibits several incommensurate and locked-in commensurate structures, which are explained by the inter-plane competing interactions [5].

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[1] G. Lawes *et al.*, Phys. Rev. Lett. **93**, 247201 (2004).
[2] M. Kenzelmann *et al.*, Phys. Rev. B (in press); cond-mat/0510386.
[3] G. Lawes *et al.*, Phys. Rev. Lett. **95**, 087205 (2005).
[4] A. B. Harris *et al.*, Phys. Rev. B (in press); cond-mat/0510807.
[5] Y. Chen *et al.*, Phys. Rev. B (in press).