

Study of the magnetic structure of the helimagnet YBaCuFeO₅ using neutron and x-ray scattering

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The oxygen-deficient double perovskite YBaCuFeO₅ was reported, from powder samples [1], to be the type-II multiferroic compound with a transition temperature close to 200 K. By studying a single crystal of YBaCuFeO₅ (YBCFO), instead of observation of the long-range ferroelectric ordering, we observed YBCFO showing the dielectric relaxation behavior at T_{N2}~175 K at where the commensurate spin ordering transfers to an incommensurate ordering with a propagation wavevector along c-axis. Using high-resolution neutron diffraction and resonant x-ray scattering, we further demonstrate that the incommensurate spin ordering consists of two components, from Fe and Cu respectively, forming a double helical spin ordering. By studying a single crystal of YBCFO using neutron/x-ray diffraction, magnetization and dielectric measurements, we provide the experimental evidence that YBCFO possesses a double-helical spin ordering with a magnetic moment lying on the *ab*-plane, which also explains the absence of the spontaneous polarization in YBCFO [2].

[1] M. Morin, *et. al.*, Phys. Rev. B 91, 064408 (2015)

[2] Y.-C. Lai, *et. al.*, J. Phys.: Condens. Matter 29, 145801 (2017)

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