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Single crystal studies on multiferroic LiFe(WO4)2

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Due to their application potential for new types of memory devices, the research on multiferroic materials has attracted strong interest during the last decades. A prominent mechanism that drives multiferroic behavior is given by the inverse Dzyaloshinskii-Moriya interaction, which yields the shift of a non-magnetic ligand ion due to a non-collinear magnetic structure. It was shown on a powdered sample of $LiFe(WO_4)_2$ that the onset of a spiral spin structure is accompanied by an evolving ferroelectric polarization, whose direction is consistent with the inverse DMI [1]. Here, we report on our single crystal investigations on $LiFe(WO_4)_2$, for which we utilized neutron scattering experiments on HEIDI and on KOMPASS [2]. It was possible to determine the magnetic structure of both incommensurate phases at low temperature, which follow the typical sequence of magnetic phases for a type-II multiferroic material. First, in the intermediate phase a spin-density wave forms and subsequently in the multiferroic phase, a chiral spin structure evolves. Furthermore, longitudinal neutron polarization analysis on the cold three-axes spectrometer KOMPASS revealed a partially unbalanced multiferroic domain distribution that develops in the multiferroic phase and even in absence of external fields. [1] Liu et al., Phys. Rev. B 95, 195134 (2017) [2] Biesenkamp et al., Phys. Rev. B 103, 134412 (2021)

Author: BIESENKAMP, Sebastian (II. Physikalisches Institut, Universität zu Köln)

Co-authors: GORKOV, Dmitry (FRM2); Dr BRÜNING, Daniel (II. Physikalisches Institut, Universität zu Köln); BERTIN, Alexandre (University Of Cologne); Dr FRÖHLICH, Tobias (II. Physikalisches Institut, Universität zu Köln); Dr FABRÈGES, Xavier (Laboratoire Léon Brillouin); Dr GUKASOV, Arsen (Laboratoire Léon Brillouin); MEVEN, Martin (RWTH Aachen University, Institute of Crystallography - Outstation at MLZ); Prof. BECKER-BOHATÝ, Petra (Abteilung Kristallographie, Institut für Geologie und Mineralogie, Universität zu Köln); Prof. BOHATÝ, Ladislav (Abteilung Kristallographie, Institut für Geologie und Mineralogie, Universität zu Köln); Prof. LORENZ, Thomas (II. Physikalisches Institut, Universität zu Köln); BRADEN, Markus (Universität zu Köln)

Presenter: BIESENKAMP, Sebastian (II. Physikalisches Institut, Universität zu Köln)

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