Novel Phase of the Dzyaloshinsky-Moriya Spiral Magnet $Ba_2CuGe_2O_7$

S. Mühlbauer[a], E. Pomjakushina[b], S. Gvasaliya[a], S. Zhao[a], and **A. Zheludev**[a]

[a]Institute for Solid State Physics, ETH Zürich, Zürich, Switzerland
[b]Laboratory for Developments and Methods, Paul Scherrer Institute PSI, Villigen, Switzerland

We have used neutron diffraction and measurements of the susceptibility in canted fields to re-investigate the magnetic phase diagram of the tetragonal antiferromagnetic (AF) insulator $Ba_2CuGe_2O_7$. Below a transition temperature of $T_N = 3.2\,\mathrm{K}$, non-centrosymmetric $Ba_2CuGe_2O_7$ exhibits an incommensurate, almost AF cycloidal magnetic structure, caused by the Dzyaloshinsky-Moriya interaction [1]. For a magnetic field applied along the tetragonal c-axis the almost cycloidal spin structure distorts to a soliton lattice. For increasing field the distance between solitons increases until a incommensurate/commensurate phase transition is observed at $H_c = 2.4\,\mathrm{T}$. An extended intermediate phase of prior unknown origin observed close to the transition field [2], has been indentified as new phase with an AF cone structure. The AF cone is characteristic of a $2\mathbf{k}$ structure: (i) A large AF commensurate component is aligned perpendicular to the magnetic field. (ii) A small, incommensurate, rotating component of the spins is oriented perpendicular to the commensurate component. The AF cone phase was only found to be stable for the magnetic field applied almost parallel to the c-axis. For a large misalignment of the magnetic field a smooth crossover to a distorded soliton phase was observed instead.

[1]A. Zheludev *et al.*, Phys. Rev. B, **56**, 14006 (1997), A. Zheludev *et al.*, Phys. Rev. B, **59**, 11432 (1999).
[2]A. Zheludev *et al.*, Phys. Rev. B, **57**, 2968 (1998).