

On-line SPICE-SPIN+X Seminars



Wednesday, 3rd March 2021, 15:00 (German Time)

The seminar will be via Zoom ([Meeting ID: 858 5004 3935](#)) and live streamed in the SPICE YouTube Channel.



Ulrich K. Rößler

IFW Dresden

Improper Dzyaloshinskii spirals and metamagnetic textures - and where to look for them

Chiral magnetic textures have been theoretically predicted for systems violating criteria of the Landau theory for continuous phase transitions [1,2]. Their experimental discovery followed with a characteristic time-lag [3,4]. Proper Dzyaloshinskii spiral states, kinks or soliton lattices, and skyrmions as twisted and localized textures of a (axial) vector order-parameter-field in non-centrosymmetric magnets now are best known examples of such textures. Theoretically, more complex states may be expected in magnetism and beyond by coupling several ordering modes. I will discuss the corresponding concept of improper Dzyaloshinskii textures that can be realized near multicriticality. The concept has led to the first observation of a metamagnetic texture in the non-centrosymmetric antiferromagnet $\text{Ca}_3\text{Ru}_2\text{O}_7$ [5]. I will sketch the phenomenology of such states and present a selection of further candidate systems. Metamagnetic textures, or more generally improper textures, are mixtures of different ordering modes. They may form either extended modulated states or localized lumps, i.e. static, mostly non-topological solitons, that can condense into mesophases. In a wide class of clean magnetic crystals, where inversion symmetry is broken, a conventional magnetic long-range order could even be avoided, owing to a specific geometric frustration enforced by the twisting influence of a static background gauge field. I will conclude with some conjectures about the existence of classical chiral spin-liquid states in acentric magnets and the question of amorphous ground-states in systems without quenched disorder.

[1] I.E. Dzyaloshinskii, Sov. Phys. JETP 19, 960 (1964)

[2] A.N. Bogdanov, D.A. Yablonskii, JETP 95, 178 (1989)

[3] P. Bak, M.H. Jensen, J.Phys. C 13, L881 (1980); O.Nakanishi et al., Solid State Comm. 35, 995 (1980)

[4] S. Mühlbauer et al., Science 323, 915 (2009); X.Z. Yu et al. Nature 465, 901 (2010)

[5] D. A. Sokolov et al., Nat. Phys. 15, 671 (2019)