

Interplay of chirality and nonlinear spin excitations in molecular based crystals

Roman Morgunov

*Institute of Problems of Chemical Physics, Chernogolovka, Russia
Email: morgunov2005@yandex.ru*

Resonant modes corresponding to a spin-soliton resonance (SSR) and spin-wave resonance (SWR) have been detected and distinguished in the spectra of the electron spin resonance (ESR) of two dimensional $[\text{Cr}(\text{CN})_6][\text{Mn}(\text{S})\text{-pnH}(\text{H}_2\text{O})]\text{H}_2\text{O}$ (Green Needle - GN) chiral single crystals and three dimensional $[\text{Mn}\{\text{R/S}\}\text{-pn}]_2 [\text{Mn}\{\text{R/S}\}\text{-pn}]_2 (\text{H}_2\text{O})[\text{Cr}(\text{CN})_6]_2$ (Yellow needle - YN) single crystals. The spin-soliton resonance has been detected in the ESR spectrum of chiral YN crystals and has never been observed in spectra of racemic GN crystals.

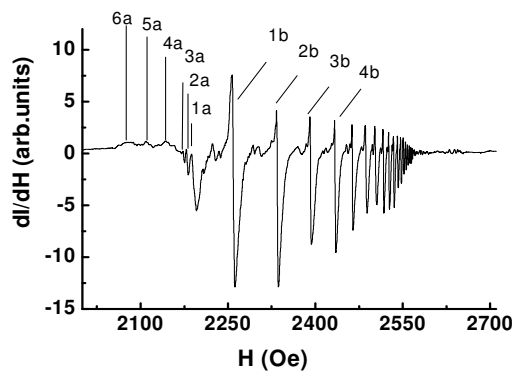


Fig.1. Spectra of the linear spin-wave (a) and spin-soliton (b) resonances in chiral crystals at 4 K.

This is the first direct experimental evidence that the collective spin excitations in molecular magnetic crystals depend on the crystal chirality. Temperature and angular dependences of effective exchange constants obtained from ESR spectra are in a good agreement with experimental data received by means of a SQUID magnetometry. Temperature dependencies of magnetic susceptibilities corresponding to integral intensities of resonance lines are different for the SSR and SWR contributions to the ESR spectrum. It enables to distinguish the nature of resonant lines in the intermixture of two sequences of resonance lines, measured for arbitrary orientations of the static external magnetic field.

Author thanks to Prof. K.Inoue and Prof.J.Kishine for the samples preparation and discussions of the basic ideas. This work was supported by JSPS and carried out with the help of ESR technique in the Institute for Molecular Sciences (Okazaki).

[1] R.Morgunov, M.Kirman, K.Inoue et al., *Phys.Rev. B* **77**, 184419(2008).

[2] J. Kishine, K.Inoue, Y. Yoshida, *Progress of Theoretical Physics Supplement* **159**, 82 (2005).