## Electron magnetic resonance and its modeling for systems with complex magnetic interactions

• Electron magnetic resonance in composite magnetic nanostructures (granular, multi-layered, etc..).

• Modeling of electron magnetic/spin resonance (EMR/ESR) absorption in the electron spin system of magnetically disordered structures.

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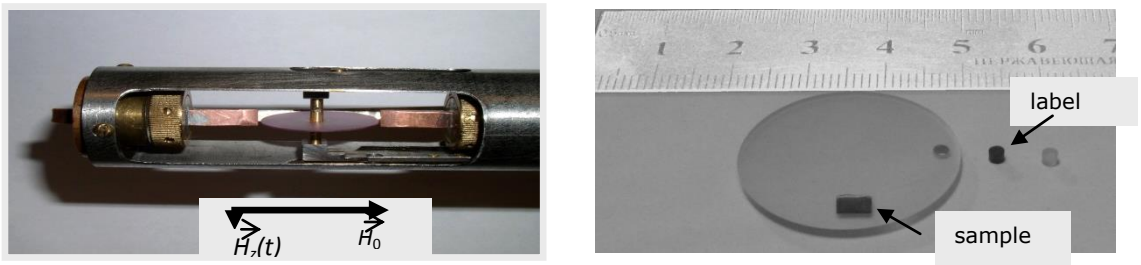
**Research results**

***1… The technique*** of experimental research of two-dimensional granular magnetic nanostructures using radiospectrometers of "Cryomagnetic complex…" (see) – is designed. The experimental cell for electron magnetic resonance (EMR/ESR) for radiospectrometer BURAN – based on disk dielectric resonator (DDR) ***is modernized and optimized***.




a) b)

Fig. 1. The Disk Dielectric Resonator (DDR) for ESR-spectroscopy at 30-100 GHz: ESR cell for adiospectrometer BURAN with ruby DDR (a), sapphire DDR with an adjustable reference label as an ESR-cell (b).

2 .. ***A phenomenological model of Electron Magnetic Resonance absorption in granular magnetic nanostructures*** which effectively reflects a high-frequency magnetic resonance processes near the percolation area, where there are maximum values of the effects of the giant magnetic resistance (impedance) GMR/GMI present. The model allowed to explore the high-frequency properties of granular magnetic nanostructures $(SiO_2)_{100-x}Co_x$/GaAs, $Co_x(NbLiO_3)_{100-x}$, $Co_x(Al_2O_3)_{1-x}$, $(CoFeZr)_xSiO$, $Cox(TiO_2)_{1-x}$, Co + $SiO_2$/quartz, with the spin-dependent effects in a wide temperature range and in the millimeter wavelength band.

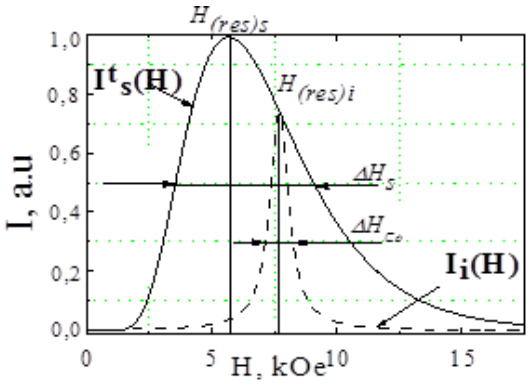



Fig. 2. The integrated ESR line $I_s^t(H)$ – is the integrated line; $\Delta H$ – half-width of the integrated line; $I_i(H)$ - is the ESR line for unit magnetic cluster.

## *3. Radiospectroscopy of the left-handed magnets:*

The left-handed behavior of the doped manganite-perovskites $La_xSr_{1-x}MnO_3$ (x=0.1-1) has been revealed for the microwave frequency band:

The frequency position of area of "left-handed transparency", dependently of the applied magnetic field has been revealed. It is shown that with increasing temperature in the range nearby the Curie temperature, the curves of temperature dependence of the left-hand area transparency (DNG-peak) and the magnetization of the same. The proposed model [4] can be considered as the independent technique of determination the magnetization of the magnetic nanocomposites.

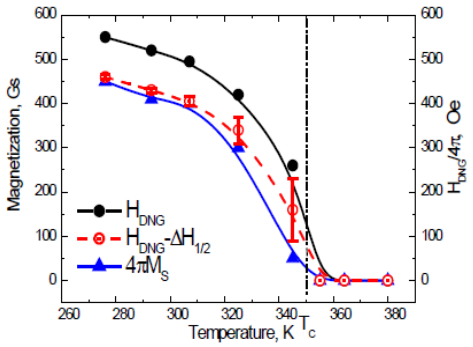



Fig. 3 Temperature dependence of the magnetization of $La_{0.775}Sr_{0.225}MnO_3$ specimen: open circles –are the magnetization of the specimen determined with the help of the DNG-peak; triangles – are the magnetization determined with independent method; closed circles – are the field position of the DNG-peak. [4,3]

**A detailed presentation of the results are given in**

**Referebnces:**

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