NMR and ESR study of Quasi-2D Antiferromagnet $CuCrO_2$ in electrically polarized state. Long range ordered polar nematic phase.

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$CuCrO_2$ is an example of quasi-two-dimensional antiferromagnet (Tc ~ 24 K) with triangular lattice structure. In this system exotic types of magnetic orderings are expected due to geometrical frustrations of in-plane and inter-planar exchange interactions. We carried out ESR and Cu NMR investigations in the presence of electric field. The ESR study in electric field allows to find the magneto electric constants and examine the nature of electrical polarization in this multiferroic. Electric polarization studies of $CuCrO_2$ in pulsed magnetic fields up to 92 T [1,2] revealed a number of phase transitions, the nature of which was uncertain. We carried out Cu NMR investigations in magnetic field up to 45 T [3,4]. According to our data the magnetic field destroys inter-plane order and the system goes from three-dimensional (3D) to 2D state. We suppose that this 2D phase is, in fact, a 3D-polar phase with tensor order parameter and can be classified as a p-type nematic phase. To verify this, we carry out a control experiment in which Cu NMR spectra are measured after cooling in electric field.

[1] Eundeok Mun, et al., Phys. Rev. B **89**, 054411 (2014).

[2] Shi-Zeng Lin, et al., Phys. Rev. B **89**, 220405(R) (2014).

[3] Sakhratov, Yu.A., et al., JETP **119**, 880 (2014).

[4] Sakhratov, Yu.A., et al., Phys. Rev. B **94,** 094410 (2016).