

## Electric field effect on the magnon dispersion in $\alpha$ -Cu<sub>2</sub>V<sub>2</sub>O<sub>7</sub>

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The recent inelastic neutron scattering study on the noncentrosymmetric anti-ferromagnet  $\alpha$ -Cu<sub>2</sub>V<sub>2</sub>O<sub>7</sub> revealed unusual magnon band splitting resulting from symmetry breaking [1]. The magnon band splitting is due to the Dzyaloshinskii-Moriya (DM) interaction, and introduces the difference in the phase velocity of the counterrotating modes. For linearly polarized magnons, the difference of the phase velocity results in the rotation of the polarization direction. This effect is analogous to the optical rotation in noncentrosymmetric medias and may be used in future spintronics device.

Under the application of external electric field ( $E$ ) in insulating polar compounds, the cations and anions may be moved in opposite directions. This way, the DM interaction may be enhanced through the strengthened symmetry breaking. This would lead to the putative electric-field-induced magnonic Faraday effect [2]. Therefore, in this experiment, we study the effect of  $E$  on the magnon dispersion of  $\alpha$ -Cu<sub>2</sub>V<sub>2</sub>O<sub>7</sub> at SIKa in Australian Nuclear Science and Technology Organization.

In the experiment, we applied  $E$  along the crystallographic  $a$ - and  $c$ -axis of  $\alpha$ -Cu<sub>2</sub>V<sub>2</sub>O<sub>7</sub>. The figure shows the magnon dispersion of  $\alpha$ -Cu<sub>2</sub>V<sub>2</sub>O<sub>7</sub> around 020 reflection (a) under zero  $E$  and (b)  $E \sim 14.3$  kV/cm along the crystallographic  $c$ -axis, at the base temperature ( $\sim 3$ K) collected with fixed final energy at 5 meV. We could not observe the change in the magnon dispersion due to  $E$ . For the application of  $E$  along the crystallographic  $a$ -axis, we were unable to confirm the change of the dispersion due to electrical discharge.

[1] G. Gitgeatpong, et al, Phys. Rev. Lett. 119, 047201 (2017)

[2] R. Cheng, et al, Sci. Rep. 6, 24223 (2016)

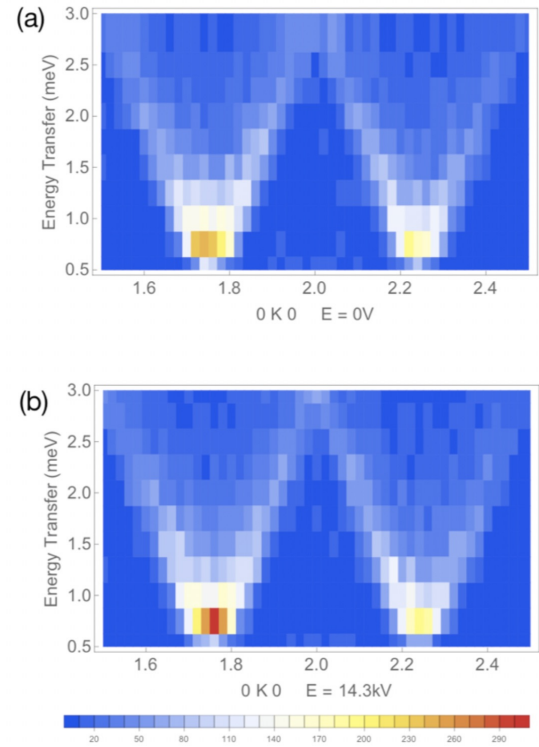


Fig. 1. Magnon dispersion of  $\alpha$ -Cu<sub>2</sub>V<sub>2</sub>O<sub>7</sub> around 020 reflection under (a) zero  $E$  and (b)  $E \sim 14.3$  kV/cm applied along crystallographic  $c$ -axis.