

# Supplementary Materials

## Two-channel anomalous Hall effect originating from the intermixing in Mn<sub>2</sub>CoAl/Pd thin films

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### THE REVERSE PROCESS OF LABYRINTH DOMAINS

Figure S1 shows the hysteresis loop and typical labyrinth domains near the start and the end of domain reversal processes for MgO(1.6 nm)/Mn<sub>2</sub>CoAl(2.6 nm)/Pd(3.2 nm) stack. The magnetic domain images were taken in one branch scan from negative to positive magnetic field. In figure S1(b), the reversed labyrinth domains (black area) start to be nucleated by sweeping the field from negative to 0.6 mT. By sweeping to 1.6 mT, the reversed domains merge, and some unreversed labyrinth domains (grey area) still remain (see figure S1(c)).

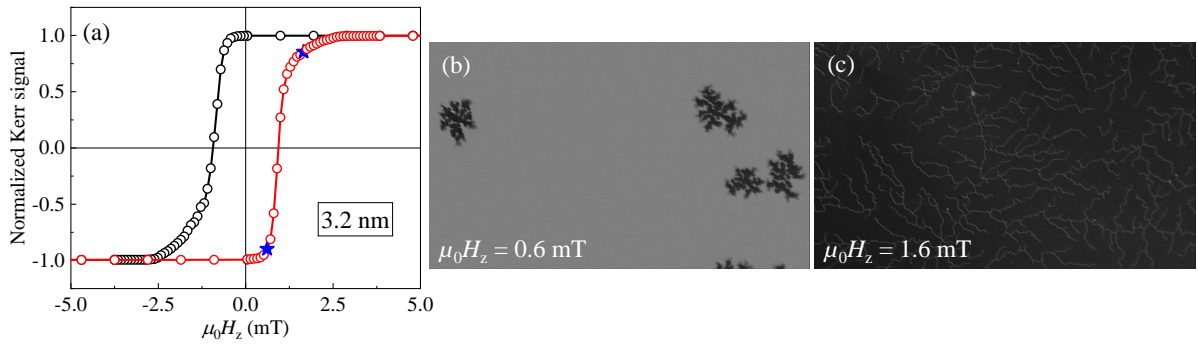


FIG. S1: The hysteresis loop and typical labyrinth domains MgO(1.6 nm)/Mn<sub>2</sub>CoAl(2.6 nm)/Pd(3.2 nm) trilayer measured at ambient temperature. The star marks represent the magnetic field where the images were taken.

### MAGNETIC FIELD SWEEPING RATE DEPENDENCE OF HALL EFFECT

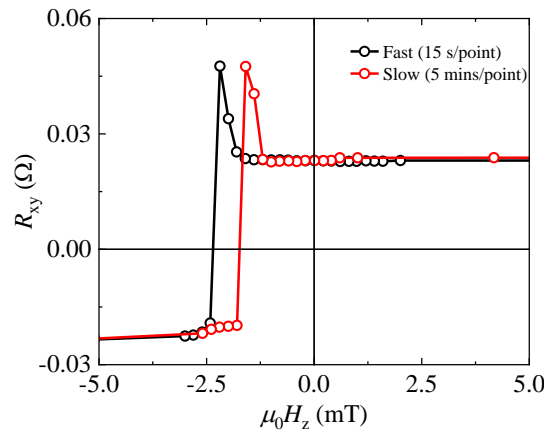


FIG. S2: The Hall effect of MgO(1.4 nm)/Mn<sub>2</sub>CoAl(2 nm)/Pd(2.7 nm) trilayer measured with different field sweep rate at 300 K.

Figure S2 shows the Hall effect of MgO(1.4 nm)/Mn<sub>2</sub>CoAl(2 nm)/Pd(2.7 nm) stack under a magnetic field with a fast and slow magnetic field sweeping rate, respectively. For the fast (slow) sweep measurement, the magnetic field was stabilized to terminated field first, and then wait for 15 seconds (5 minutes) before taking the resistance measurement. One can see that the curve just shifts to left for the slow measurement. More importantly, the peak shows the same value for both measurements suggesting that the value of peak is independent of magnetic field sweeping rate. This sweep rate behavior can be understood in the conventional magnetization reversal process rather than the topologically non-collinear spin textures [1].

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[1] D. Kan, T. Moriyama, and Y. Shimakawa, Physical Review B **101**, 014448 (2020).