

### **Supplementary Movie 1**

Current-driven motion of an elongated antiskyrmion ( $n = 4$ ) under 90 ns pulse excitations, with current flowing parallel to the horizontal stripes at  $j = 0.78 \times 10^{11} \text{ A}\cdot\text{m}^{-2}$  and 0 mT external field.

### **Supplementary Movie 2**

Current-driven motion of an elongated antiskyrmion ( $n = 4$ ) under 90 ns pulse excitations, with current flowing perpendicular to the vertical stripes at  $j = -0.59 \times 10^{11} \text{ A}\cdot\text{m}^{-2}$  and 0 mT external field.

### **Supplementary Movie 3**

Current-driven motion of an elongated antiskyrmion ( $n = 4$ ) under 110 ns pulse excitations, with current flowing parallel to the horizontal stripes at  $j = 0.78 \times 10^{11} \text{ A}\cdot\text{m}^{-2}$  and 0 mT external field.

### **Supplementary Movie 4**

Current-driven motion of an elongated antiskyrmion ( $n = 4$ ) under 150 ns pulse excitations, with current flowing perpendicular to the vertical stripes at  $j = -0.59 \times 10^{11} \text{ A}\cdot\text{m}^{-2}$  and 0 mT external field.