

Title: Supplementary Movie 1:

Description: This movie contains the whole set of images shown in Fig. 3a-d, in which $Q = +1$ skyrmion motion after exciting SH wave pulses.

Title: Supplementary Movie 2:

Description: This movie contains the whole set of images shown in Fig. 3e-h, in which $Q = -1$ skyrmion motion after exciting SH wave pulses.