

Description of Additional Supplementary Files

Supplementary Movie 1 | Dynamic motions of the single BP and non-BP cores

Movies are full image sets taken from time-resolved X-ray microscopy in the single BP and non-BP cores. The images were acquired with an interval of 0.5 ns over 10 ns while a Gaussian field pulse with the amplitude of $V_{pp} = 4V$ (~ 50 Oe) and the width (FWHM) of $\sigma = 3$ ns was applied to the disk.

Supplementary Movies 2 and 3 | Simulations on dynamic motions of the single BP and non-BP cores

Movies 2 and 3 are full sets of simulated images for the dynamic motions of vortex cores and the BP triggered by injecting field pulse with the amplitude of $V_{pp} = 4V$ and the width of $\sigma = 3$ ns in the single BP and non-BP cores. The displacements of vortex cores and the BP during the dynamic process on the x - and y -axis are also added.