

## Description of Additional Supplementary Files

### Supplementary Movie 1

Supplementary Movie 1 sequentially shows 45  $dI/dV$ -images recorded at  $B_{\perp} = -1.5$  T, while moving the vortex core by 44 equidistant  $B_{\parallel}$  steps with  $\Delta B_{\parallel} = (136, -227)$   $\mu\text{T}$ . These images are also used to determine the core positions shown in Fig. 1f of the main text. Each  $dI/dV$  image covers an area of  $15 \times 15$  nm<sup>2</sup>. Experimentally,  $60 \times 60$  pixels are recorded at  $V = -2$  V,  $I = 1$  nA and modulation voltage of  $50 \text{ mV}_{\text{RMS}}$ . To optimize visibility, additional interpolated pixels are displayed in the movies. The scan frame center is moved linearly between adjacent images by a vector deduced from centering the core in initial and final image.

### Supplementary Movie 2

Supplementary Movie 2 shows the same data as Supplementary Movie 1 in different color scale and overlaid on a separately measured topography of the whole area. Here, the  $dI/dV$ -images are displayed after subtracting the contrast originating from in-plane magnetization and multiplying the image with a Gaussian intensity profile as described in Supplementary Note 3. Additional minor shear and stretch transformations by  $\sim 1\%$  are applied to remove the effects of piezo creep.