Stray field components

Because the MFM scans a space devoid of sources of magnetic field, in practice we can write the latter as the gradient of a magnetic potential, H(r) = $\nabla\phi_m$(r), where ϕ_m(r) satisfies the Laplace equation. For definiteness we assume the sources of the stray field (provided by the sample) are described by a boundary condition on the xy-plane, parallel to the scan plane located at distance z from the top surface of the sample. In the 2D Fourier space utilized in the previous section, this leads to the convenient expression

$$\mathbf{H}(\mathbf{k},z) = (\mathrm{i}k_x, \mathrm{i}k_y, -k)\phi_m(\mathbf{k},z) \tag{3}$$

and therefore also to

$$\mathbf{H}(\mathbf{k},z) = (-\mathrm{i}\frac{k_x}{k}, -\mathrm{i}\frac{k_y}{k}, 1)H_z(\mathbf{k},z) \tag{4}$$

Consequently, the measurement of the z-component of the stray field provides the remaining components as well, and implies that if ICF(k,z) is known the MFM can measure the stray field vector.

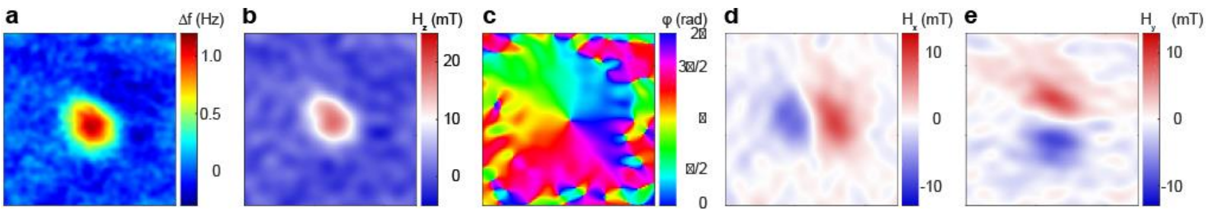

Figure 1: **A** MFM data of a skyrmion in a [Ir1/Co0.6/Pt]$_{x6}$ multilayer thin film. **B** H_z at z = 12 nm obtained from the deconvolution of a using qMFM methods. **D**, **E** H_x, and H_y components obtained from H_z, and **C** color wheel representation of the in-plane stray field components.