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Single Vortex Imaging and Shaking in a $YBa_2Cu_3O_{6.991}$ Single Crystal LAN LUAN, O. M. AUSLAENDER, Stanford University, E. ZELDOV, Weizmann Institue of Science, K. A. MOLER, Stanford University, D. A. BONN, RUIXING LIANG, W. N. HARDY, University of British Columbia — We image and manipulate individual vortices in a detwinned $YBa_2Cu_3O_{6.991}$ single crystal, using magnetic force microscopy (MFM). We observe a strong dynamic asymmetry between the fast and slow directions of the raster imaging pattern, when the MFM tip-vortex force exceeds the depinning force. The vortex can be dislodged hundreds of nanometers along the raster direction, while perpendicular to it, along the slow direction, it can be stretched up to several microns by the same applied force. We attribute this effect to single vortex shaking, in analogy with vortex matter shaking induced by applying an oscillating magnetic field or current. Here, we raster the tip, shaking the top of one vortex to help it explore different configurations, which are determined by the interplay between pinning and elasticity. In this process, elastic energy associated with stretching along the slow direction can be released, thus allowing the vortex to be dragged further. We are currently studying shaking in an underdoped $YBa_2Cu_3O_{7-\delta}$ single crystal, where the Josephson coupling along crystal c-axis is much reduced, rendering elasticity weaker.

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