Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Visualizing the Atomic-scale Influence on Superconductivity and Vortex Pinning of High-Energy Ion Irradiation in FeSeTe PETER SPRAU, Cornell University, FREEK MASSEE, Brookhaven National Laboratory, Cornell University, YONGLEI WANG, Argonne National Laboratory, J. C. SEAMUS DAVIS, Brookhaven National Laboratory, Cornell University, University of St. Andrews, Kavli Institute at Cornell for Nanoscale Science, GENDA GU, Brookhaven National Laboratory, WAI-KWONG KWOK, Argonne National Laboratory — The maximum sustainable supercurrent density, JC, may be greatly enhanced by preventing dissipative motion of quantized vortices. Irradiation of superconductors with heavy ions is often used to create nanoscale defects with deep pinning potential for the vortices and this approach holds great promise for high current applications of iron-based superconductivity. However, for these compounds virtually nothing is known directly about the atomic-scale interplay between the crystal damage from high-energy ions, the superconducting order parameter, and the vortex pinning processes. Here, we visualize the atomic-scale effects of irradiating $FeSe_{0.45}Te_{0.55}$ with 249 MeV Au ions and find two distinct forms of damage: compact regions of crystal disruption ascribable to the actual ion trajectory along with single atomic-site 'point' defects. We show directly that the superconducting order is virtually annihilated within the former while it is strongly altered by the latter. Simultaneous atomically-resolved images of the crystal defects, the superconducting density-of-states, and the vortex cores, then reveal how the vortex pinning evolves with increasing field in irradiating $FeSe_{0.45}Te_{0.55}$.

Peter Sprau
Cornell University

Date submitted: 14 Nov 2014 Electronic form version 1.4