Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Detecting vortices in superconductors: Extracting one-dimensional topological singularities from a discretized complex scalar field[1] CAROLYN PHILLIPS, TOM PETERKA, DMITRY KARPEYEV, Mathematics and Computer Science Division, Argonne National Laboratory, ANDREAS GLATZ, Materials Science Division, Argonne National Laboratory — In type-II superconducting material, the dynamics of the vortices play a critical role in determining the performance of the material. In Ginzburg-Landau simulations of superconducting materials, vortices correspond to topological singularities in a discretized complex scalar field. Visualizing the vortices to understand their behavior is a key step in using simulations to engineer optimized pinning landscapes. In the past, vortices have been visualized by examining contour plots and isosurfaces of the magnitude of the field. However, these methods, primarily used for small-scale simulations, blur the fine details of the vortices, scale poorly to large-scale simulations, and do not easily enable isolating and tracking individual vortices. We present a method for exactly finding the vortex core lines from a complex order parameter field. With this method, the vortices can be easily described at a resolution even finer than the mesh itself. The precise determination of the vortex cores allows the interplay of the vortices inside a model superconductor to be visualized in higher resolution than has previously been possible.

[1]Research supported by the U.S. DOE, Office of Science, DE-AC02-06CH11357

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Date submitted: 10 Nov 2014 Electronic form version 1.4