Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Vortex cutting in superconductors[1] VITALII K. VLASKO-VLASOV, ALEXEI E. KOSHELEV, ANDREAS GLATZ, ULRICH WELP, WAI-K. KWOK, Argonne National Laboratory — Unlike illusive magnetic field lines in vacuum, magnetic vortices in superconductors are real physical strings, which interact with the sample surface, crystal structure defects, and with each other. We address the complex and poorly understood process of vortex cutting via a comprehensive set of magneto-optic experiments which allow us to visualize vortex patterns at magnetization of a nearly twin-free YBCO crystal by crossing magnetic fields of different orientations. We observe a pronounced anisotropy in the flux dynamics under crossing fields and the filamentation of induced supercurrents associated with the staircase vortex structure expected in layered cuprates, flux cutting effects, and angular vortex instabilities predicted for anisotropic superconductors. At some field angles, we find formation of the vortex domains following a type-I phase transition in the vortex state accompanied by an abrupt change in the vortex orientation. To clarify the vortex cutting scenario we performed time-dependent Ginzburg-Landau simulations, which confirmed formation of sharp vortex fronts observed in the experiment and revealed a left-handed helical instability responsible for the rotation of vortices.

[1]This work was supported by the U.S. Department of Energy, Office of Science, Materials Sciences and Engineering Division.

Vitalii Vlasko-Vlasov
Argonne National Laboratory

Date submitted: 07 Nov 2014 Electronic form version 1.4