

The Phase Diagram of Vortex Matter

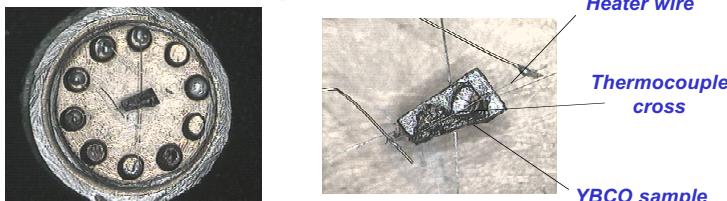
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MOTIVATION

Investigate the Effect of Disorder in the Vortex Solid & Liquid

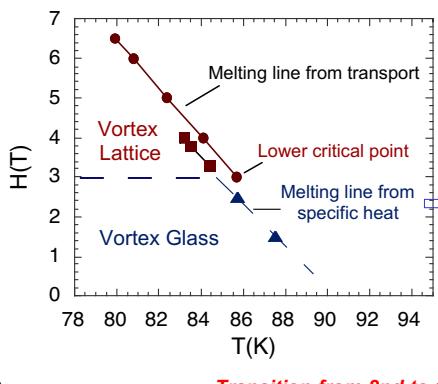
- Discover New Phases and Transitions of Vortex Matter
- Probe the Behavior of the Critical Points
- Understand Pinning in the Vortex Liquid State

AC Thermocouple Calorimeter

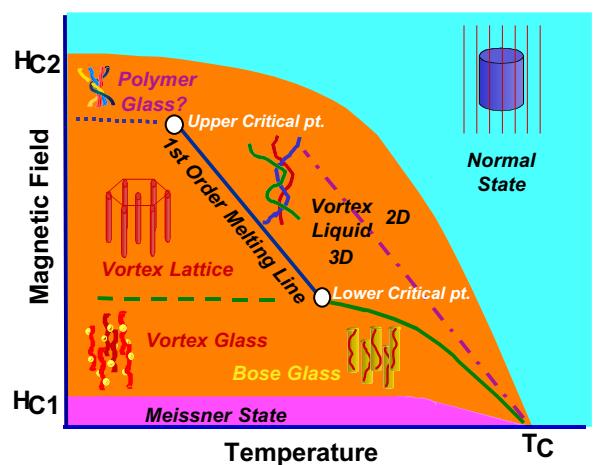
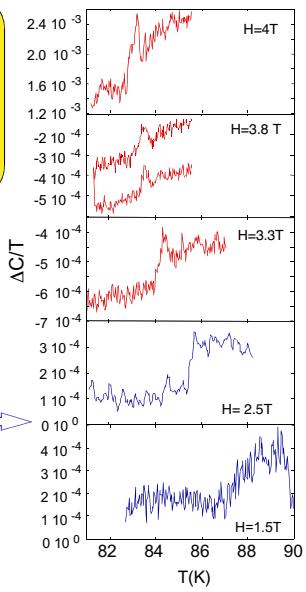


Effect of weak point disorder via proton irradiation on untwinned $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$

- Upward shift of the lower critical point
- Thermodynamic determination of the Vortex glass transition

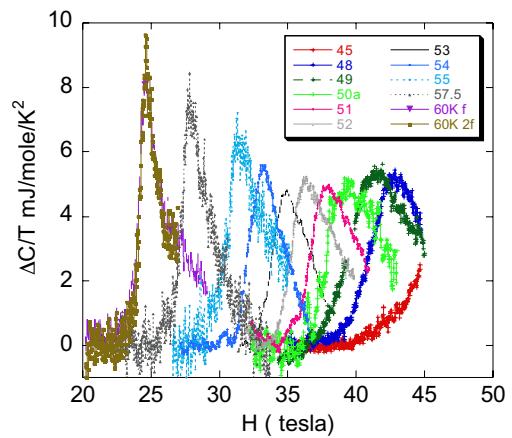


Transition from 2nd to 1st Order Melting



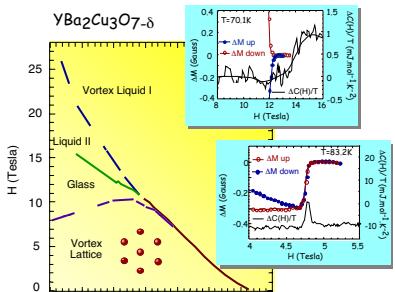
Probing 3D to 2D vortex melting in YBCO

- Record Upper Critical Point!
- Nature of transition near theoretical 3D-2D crossover

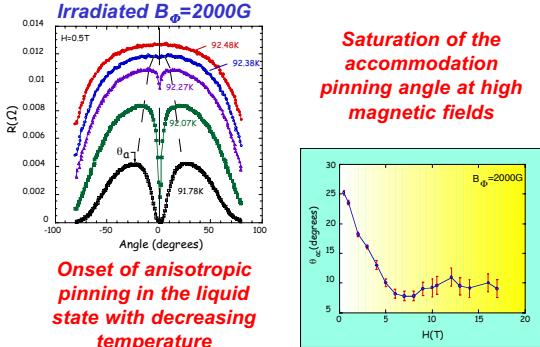


35 Tesla Upper Critical Point in Overdoped YBCO

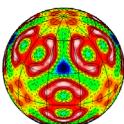
Effect of dilute columnar defects via heavy ion irradiation on untwinned $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$



Unirradiated YBCO (reference)

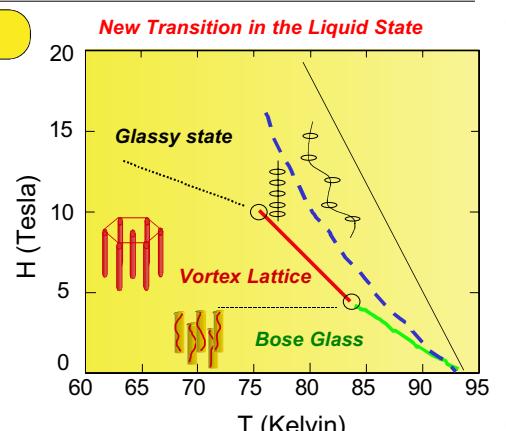


F. Bouquet et al., Nature 411, 448 (2001)



BES - DOE

This work is supported by the U.S. DOE, BES--Materials Science and Division of Nuclear Physics under contract #W-31-109-ENG-38 and the NSF-Office of Science and Technology Centers under contract #DMR91-20000. The work at the National High Magnetic Field Laboratory was supported by the National Science Foundation under contract #DMR95-27035



MSD - ANL

