Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Nernst effect and diamagnetism in a vortex liquid DANIEL PODOLSKY, University of California at Berkeley, SRINIVAS RAGHU, Stanford University, ASHVIN VISHWANATH, University of California at Berkeley — When a superconductor is warmed above its critical temperature T_c, superconductivity is destroyed by fluctuations in the order parameter. These fluctuations are seen in a variety of experimental probes, including conductivity, diamagnetism, and the Nernst effect – the thermoelectric analogue of the Hall effect. In this talk we will discuss a regime in which superconductivity is destroyed by phase fluctuations arising from a dilute liquid of mobile vortices. The local superconducting correlations in this state lead to unusual properties, which are theoretically captured by a thermally fluctuating XY model in which amplitude fluctuations remain effectively frozen. We find that the Nernst effect and diamagnetic response differ dramatically from those arising from Gaussian fluctuations – in particular, a more rapid decay with temperature is obtained. We predict a rapid onset of Nernst effect at a temperature $T_{\rm onset}$, and show that this scale tracks T_c rather than the pairing temperature. We predict a close quantitative connection with diamagnetism – the ratio of magnetization to transverse thermoelectric conductivity α_{xy} reaches a universal value at high temperatures. We compare our results to Nernst effect measurements on the underdoped cuprates, and interpret these results in terms of a dilute vortex liquid over a fairly wide temperature range above T_c.

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Date submitted: 19 Nov 2006 Electronic form version 1.4