Unusual diamagnetic response in p-wave superconductors
Sr$_2$RuO$_4$ LU LI, JOSEPH CHECKELSKY, W. F. BRINKMAN, Department of Physics, Princeton University, M. KRIENER, Y. MAENO, Department of Physics, Kyoto University, Kyoto 606-8502, Japan, NAI PHUAN ONG, Department of Physics, Princeton University — The magnetization $M$ of the $p$-wave superconductor Sr$_2$RuO$_4$ has not been measured previously in the geometry with magnetic field $H \parallel c$ because of the small upper critical field ($H_{c2} \sim 660$ Oe) and low $T_c$ (1.4 K). We have used high-resolution torque magnetometry to study in detail the magnetization curves in this geometry. We find that, in the superconducting state, the $M$-$H$ curves display highly unusual hysteretic behavior. In the critical state, whenever $H$ crosses zero, we observe a break in the slope $\partial M/\partial H$. In a broad field interval $[-H_0, H_0]$ bracketing zero field, $M$ is reversible (to our resolution) under reversal of sweep direction. This anomalous behavior is not encountered in conventional type-II superconductors, where the critical-state behavior is always non-reversible. A possible interpretation of these unusual features is the existence of reversible edge currents. We also discuss the magnetization curves with $H \parallel ab$, where $M$ jumps sharply at $H = H_{c2}$. Research supported by NSF grant DMR 0213706.

Lu Li
Department of Physics, Princeton University

Date submitted: 27 Nov 2007
Electronic form version 1.4