Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

The coexistence of type-I and type-II superconductivity in mesoscopic single crystals MILORAD MILOSEVIC, 1, FRANCOIS PEETERS, 1, ANDREAS RYDH, 2,3, MICHAEL ZACH, 2, RUOBING XIE, 2, ZHILI XIAO, 2, DANIEL ROSENMANN, 2, ULRICH WELP, 2, WAI-KWONG KWOK, 2, GEORGE CRABTREE, 2, SIMON BENDING, 4, 1 DEPARTMENT OF PHYSICS, UNIVERSITY OF ANTWERP, BELGIUM. TEAM, 2 MATERIALS SCIENCE DIVISION, ARGONNE NATIONAL LABORATORY, USA. TEAM, 3 DEPARTMENT OF PHYSICS, STOCKHOLM UNIVERSITY, SWEDEN. TEAM, 4 DEPARTMENT OF PHYSICS, UNIVERSITY OF BATH, UK. TEAM — We show that the well established criteria for type-I to type-II transitions in bulk materials do not apply to mesoscopic superconductors, as the dual point depends both on the material properties and on temperature. In electrochemically formed triangular Pb single crystals, we even found the coexistence of both types of superconductivity – while retaining Meissner behavior with increasing magnetic field all the way through the superheated phase, the sample can still capture vortices in the metastable regime. When the field is swept back, in realistic type-I structures with intrinsic pinning, the vortices can survive in the sample even when the field changes polarity, contrary to conventional behavior. All findings are substantiated by state-of-the-art 3D Ginzburg-Landau simulations and μ-Hall probe measurements.

Milorad Milosevic
Department of Physics, University of Antwerp, Belgium.

Date submitted: 14 Dec 2005 Electronic form version 1.4