Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Generics of the diamagnetism, Nernst signal, and finite size effects in superconductors above the transition temperature S. WEYENETH, T. SCHNEIDER, Physics Institute, University of Zurich, CH-8057 Zurich, Switzerland — Various superconductors exhibit peculiar features above the transition temperature T_c. In particular the observation of a large Nernst signal N and a remarkable diamagnetism above T_c in cuprate and conventional superconductors attracted considerable attention. Noting that in these materials the spatial extent of the homogeneous domains is limited, we explore the relevance of a zero dimensional (0D)-model, neglecting thermal fluctuations, to describe the isothermal magnetization curves $m_{\rm d}\,(H)$ in various superconductors above T_c. It is shown that for cuprates as well as for Pb nanoparticles, both, the full 0D-model as well as its Gaussian approximation, mimic the essential features of the magnetization curves above T_c rather well. Furthermore, the isothermal Nernst signal of a superconducting $Nb_{0.15}Si_{0.85}$ film is fully consistent with this scenario. Accordingly, the observed diamagnetism above T_c in Pb nanoparticles, in the cuprates $La_{1.91}Sr_{0.09}CuO_4$ and $BiSr_2Ca_2CuO_{8-\delta}$, as well as the Nernst signal in $Nb_{0.15}Si_{0.85}$ films, are all in excellent agreement with the scaling properties emerging from the here discussed 0D-model. Therefore, singlet Cooper pairs subjected to orbital pair breaking in a 0D-system are the main source of the observed diamagnetism and Nernst signal in an extended temperature window above T_c.

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Date submitted: 24 Nov 2010 Electronic form version 1.4