Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Arrays of Ultrasmall Nanoscopic Ferromagnetic Rings[1] DEEPAK SINGH, Dept. of Physics, UMASS, HONGQI XIANG, Dept. of Polymer science and Engineering, UMASS, ROBERT KROTKOV, Dept. of Physics, UMASS, TING XU, Dept. of Polymer Science and Engineering, UMASS, QIJUN XIAO, Dept. of Physics, UMASS, THOMAS RUSSELL, Dept. of Polymer Science and Engineering, UMASS, MARK TUOMINEN, Dept. of Physics, UMASS — There has been a considerable amount of recent interest in the magnetic properties of ultrasmall ferromagnetic rings. This is largely motivated by the unique stability of the vortex state of magnetization and its relevance in future data storage elements. In this work, we discuss experimental research on ultra small cobalt nano rings. We fabricate arrays of ultra small rings using a technique involving self-assembled diblock copolymer templates, glancing angle evaporation and ion beam etching. The nanoscopic rings have an outer diameter of 13 nm and inner diameter of 5 nm. The magnetization properties of these arrays are measured in both parallel and perpendicular field orientations in SQUID magnetometer. We compare these measurements to analytical calculations for different magnetic configurations that take into account the competition between exchange energy, Zeeman energy and magnetostatic energy. Based on analytical calculation and magnetic measurement we find that for such ultrasmall ring structures vortex states are the dominant remanent magnetic states.

[1]This work is supported by NSF grant DMR-0306951.

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Date submitted: 30 Nov 2005 Electronic form version 1.4