

Plenary Talk

PV II Mon 9:15 H1

Mesoscopic Magnetic Measurements — ●KATHRYN A MOLER —
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We probe the effects of quantum phase coherence in electronic states using nanomagnetic measurements, including nano-SQUIDs that measure signals smaller than the dipole moment of a hundred electrons.

For example, a mesoscopic normal metal ring should have a persistent current flowing forever around it, despite its finite resistance. Previous experiments disagreed strongly with theory. With our scanning SQUID microscope, we found good agreement between theory and experiment in many individual gold metal rings, measured one at a time [1]. Rings are also a good test of fluctuation theory in 1D superconductors [2].

Nanomagnetic measurement technologies enable us to study vortices in superconductors such as pnictides [3], where we map local materials-correlated variations in the superfluid density, and cuprates [4], where single vortices act like one-dimensional elastic objects moving through materials-determined pinning landscapes.

Finally, nanomagnetic signals provide metrology for devices. A surprising spin-glass-like interface state associated with several metals [5] is likely related to decoherence in superconducting qubits.

- [1] H. Bluhm et al., Physical Review Letters 102, 136802 (2009).
- [2] N.C. Koshnick et al., Science 318 , 1440 (2007).
- [3] C. W. Hicks et al., Physical Review Letters 103, 127003 (2009).
- [4] O. M. Auslaender et al., Nature Physics 5, 35 (2009).
- [5] H. Bluhm et al., Physical Review Letters 103, 026805 (2009).