SFB/TRR 21 - Colloquium

29. Januar 2016, Tübingen

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Scanning SQUID microscopy – an application in mesoscopic physics and a new type of sensor

Scanning SQUID microscopy uses SQUIDs as highly sensitive magnetic field sensor to probe magnetic properties of a sample. Besides generating images of the local magnetization or susceptibility, it can also be used to probe more complicated aspects of the local magnetic response. As an example that illustrates the power but also the limitations of this technique, I will focus on the measurement of persistent currents in normal metal rings. Despite the resistive nature of such rings, their thermodynamic ground state carries a flux-dependent current whose strength corresponds to a single electron diffusing around a ring. I will furthermore present a new type of SQUID sensor based on dispersive microwave readout. Instead of measuring a DC voltage or current through the SQUID, the latter is integrated in a tank circuit whose resonance frequency changes as a function of the magnetic flux threading the SQUID. This change results in a phase shift of a microwave signal reflected by the SQUID. We find that the sensitivity and bandwidth of such devices designed for scanning applications can be one or two orders of magnitude better than for comparable conventional SQUIDs.

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