Scanning Hall probe and SQUID microscopy

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We develop probes for imaging magnetic properties of materials on microscopic length scales. Two types of sensor that we currently have in use for imaging magnetic field strength are scanning SQUIDs (developed at NIST in Colorado) and scanning Hall probes (developed by our lab). Tha Hall probes are fabricated on a GaAs/$Al_xGa_{1-x}As$ 2D electron gas heterostructure. Among the experiments we have performed with this technique – direct imaging of magnetic fields at surfaces – are searching for a real-space signal of spontaneous time-reversal-symmetry breaking in Sr_2RuO_4 (so far we have not found any) and studying the coexistence of superconductivity and weak ferromagnetism in $ErNi_2B_2C$ (the interaction between the two phases results in a complex sub-micron domain structure). With SQUIDs we currently have a resolution of 2μm and a field sensitivity of 1μG/√Hz, and with Hall probes 100-150nm and 0.1G/√Hz. These high-resolution Hall probes are a new fabrication by our lab and we are in the process of developing them into a reliable system.