

100nm-scale scanning Hall probes

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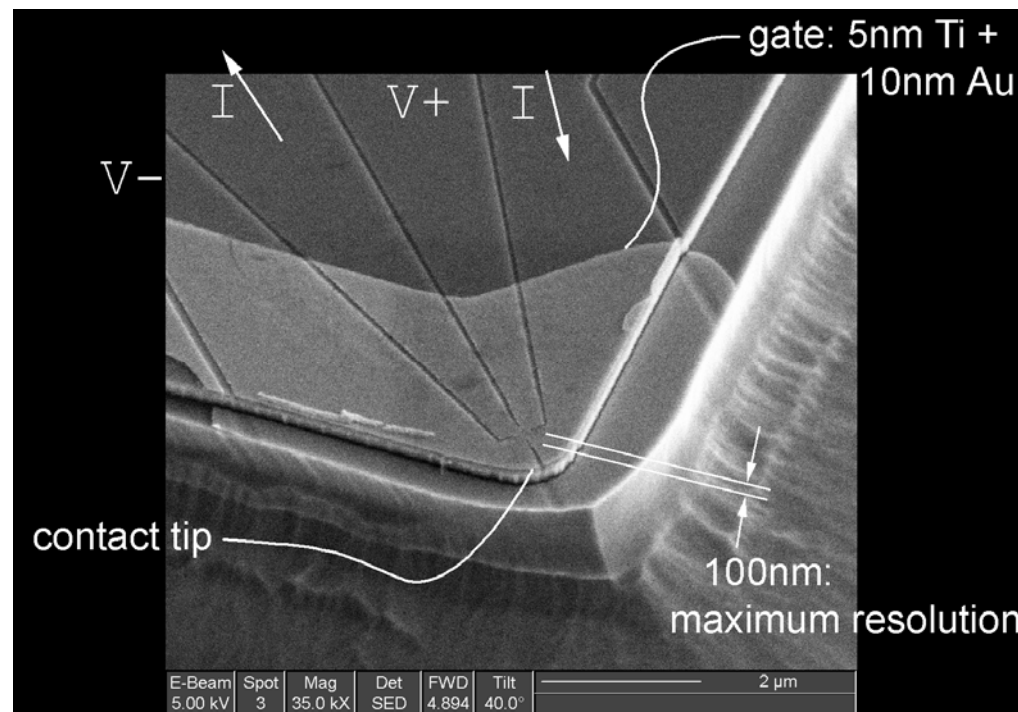
Scanning Hall probes are used to image the magnetic field at surfaces. The features of scanning Hall probes are:

- (1) The signal is linear in magnetic field, the quantity that we wish to measure, simplifying quantitative analysis.
- (2) Hall probes can operate over a wide range of temperatures, not just low temperatures.
- (3) Hall probes can operate in strong magnetic fields.
- (4) The sensitive part of the probe is very simple, which is amenable to fabrication of very high spatial resolution probes.

Table: Sensitivities of Hall probes made in the Moler group, measured at 3Hz and $T < 10K$:

probe size	field sensitivity	spin sensitivity
100 nm	0.5 G/Hz ^{0.5}	$1.2 \times 10^4 \mu_B/\text{Hz}^{0.5}$
150	0.2	1.8×10^4
200	0.10	2.1×10^4
350	0.13	1.5×10^5
500	0.06	2.2×10^5

A 100nm Hall probe made in the Moler group:



Current is passed through the two leads as indicated (labelled 'I', and the leads are the areas *between* the narrow etch lines) and the voltage in the other two leads is proportional to the magnetic field at the small cross near the tip.

Reference: "Noise characteristics of 100nm scale GaAs/Al_xGa_{1-x}As scanning Hall probes", CW Hicks, Lan Luan, KA Moler, E Zeldov, H Shtikman, Applied Physics Letters **90** 133512