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Hall magnetometry of micromagnets for single-electron spin qubits DANY LACHANCE-QUIRION, JULIEN CAMIRAND LEMYRE, LAURENT BERGERON, MICHEL PIORO-LADRIÈRE, Université de Sherbrooke —
The coherence time of a single-electron spin can reach tens of milliseconds when placed in the right environment [1]. The electric-dipole interaction between such a single spin and an electric field can be engineered by the inhomogeneous magnetic field of a micromagnet [2]. This effective spin-orbit interaction can be used to manipulate the spin through electric-dipole spin resonance [2], but also to couple a single spin to the electric field of a microwave cavity in the circuit QED architecture [3]. We selected the material and improved the shape of the micromagnet in order to maximize magnetic field gradients and remanence. We perform Hall magnetometry of those improved micromagnets using Hall bars electrostatically defined in an AlGaAs/GaAs two-dimensional electron gas. The gate-voltage dependent width of the Hall bar enables us to map the averaged magnetic field of the micromagnet, which validates simulations of the inhomogeneous magnetic field profile created by the magnet. We can therefore deduce that our micromagnets can produce magnetic field differences over 200 nm of more than 200 mT.

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Dany Lachance-Quirion
Université de Sherbrooke

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