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Propagation of pulsed surface spin-wave signals at millikelvin temperatures[1] ARJAN VAN LOO, RICHARD MORRIS, ALEXY KARENOWSKA, Clarendon Laboratory, Department of Physics, University of Oxford — Propagating microwave-frequency magnons in magnetic films attract increasing attention on account of their potential interface with superconducting quantum circuit and qubit systems. Their rich dynamics and slow speeds make magnons an interesting addition to the circuit quantum electrodynamics toolbox and, at the same time, superconducting circuit technology promises to be a powerful tool in the investigation of their quantum properties. We have studied the propagation of pulsed surface spin-wave signals over millimeter distances in yttrium iron garnet waveguides at $\sim 10\,\mathrm{mK}$. Input microwave pulses and pulse trains with various envelope shapes were applied to an inductive input antenna, and the resulting magnons were detected by an output antenna of identical design. The shape of the output signal was observed to depend on the frequency content (carrier and pulse shape) of the input pulse. By performing measurements at varying frequencies and magnetic fields we have been able to map out the dispersion relation for surface magnon modes. These experiments were undertaken as a first step towards coupling propagating magnons in thin films to other quantum systems with microwave-frequency transition energies, and superconducting qubits in particular.

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