Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Measuring magnon propagation in magnonic crystals at millikelvin temperatures[1] ALEXY KARENOWSKA, ARJAN VAN LOO, RICHARD MORRIS, SANDOKO KOSEN, University of Oxford, Department of Physics, ANDRII CHUMAK, ALEXANDER SERGA, BURKARD HILLEBRANDS, Technische Universitaet Kaiserslautern — Magnon systems are increasingly widely recognized as a potential basis for solid-state quantum information processing. Propagating magnons are readily excited over the same range of microwave frequencies as are used in established quantum circuit technologies, and couple readily to electromagnetic fields. These facts, in combination with the relatively slow speeds and highly tunable dispersion of the excitations, make them a particularly interesting proposition in the context of quantum devices. Here, we present the first experimental study of microwave-frequency magnonic crystals (magnon systems with an artificially engineered bandgap) at millikelvin temperatures. Our magnonic crystals were prepared by etching grooves into a magnon waveguide made from a film of the magnetic insulator, yttrium iron garnet. The high signal-to-noise afforded by our low-temperature measurement environment makes it possible to make detailed observations of the dispersion of externally excited propagating magnon modes within the crystals. Our results lead us to suggest a range of device applications of dispersion-engineered magnonic systems in the context of microwave-circuit based quantum information processing.

[1]The authors acknowledge support from the EPSRC (EP/K032690/1).

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Date submitted: 06 Nov 2015 Electronic form version 1.4