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【612】Propagating spin-wave spectroscopy in a liquid-phase epitaxial nanometer-thick YIG film at millikelvin temperatures

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To realise large-scale integrated magnonic circuits for quantum applications it is required to perform propagating spin-wave spectroscopy in nanostructures at low temperatures. In this work, we demonstrate all-electrical spin-wave propagation in a 100nm-thick yttrium-iron-garnet (YIG) film at temperatures down to 45mK. The extracted spin-wave group velocity and the YIG saturation magnetisation agree well with the theoretical values. We show that the gadolinium-gallium-garnet (GGG) substrate influences the spin-wave propagation characteristics only for the applied magnetic fields beyond 75mT, originating from a GGG magnetisation up to 62kA/m (45mK). Our results demonstrate that the developed fabrication and measurement methodologies enable the realisation of integrated magnonic quantum nanotechnologies at millikelvin temperatures.

Theoretical Work

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