

## Control of spin-wave emission characteristics of spin-torque nano-oscillators

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In this talk I review our recent achievements in experimental investigations of spin-wave emission by spin-torque nano-oscillators (STNOs) and studies on the control of the emission characteristics. The experiments were performed by using micro-focus Brillouin light scattering (BLS) spectroscopy, which allowed recording of two-dimensional spin-wave intensity patterns with the spatial resolution of about 250 nm. The used STNOs were lithographically-prepared point contacts with dimensions below 100 nm made on an extended permalloy film.

We show that STNOs emit spin waves in a form of highly-directed beams perpendicular to the direction of the static magnetic field. The efficiency of emission is strongly affected by the nonlinear frequency shift. We demonstrate that the propagation length of the emitted spin waves can be controlled by nonlinear frequency conversion, as well as by modification of the internal magnetic fields under the point contact using micro-magnets built into STNO devices.

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