

Dissertation press release

01.10.2018

Increasing tension and exciting spin waves

Title of the dissertation Spin-wave excitations in multiferroic heterostructures and CoFeB/YIG bilayers

Contents of the dissertation Spin waves are collective magnetic excitations in magnetic materials that can exhibit long coherence lengths, high group velocities, and wavelengths down to the nanometer scale. These waves propagate without motion of electrons as in conventional electronics and thus, power dissipation by Joule heating can be avoided. The properties of spin waves could be exploited in low-power wave-like computing and in other devices such as microwave filters and data storage elements.

A key factor to utilize spin waves in applications is energy efficient generation of short wavelength spin waves. In this thesis, I present results on spin-wave generation, filtering and confinement in strain-coupled multiferroic heterostructures and YIG/CoFeB bilayers. I show that firmly pinned magnetic domain walls in multiferroic heterostructures can be used to excite short-wavelength spin waves by driving the domain wall into oscillatory motion or by applying a uniform oscillating magnetic field when the system is at magnetic saturation. Furthermore, I demonstrate that pinned domain walls can be exploited as a switchable spin wave filter that can be reversibly re-programmed by modifying the domain wall width. Such programmable device could be used as a building block for magnonic conduits, filters or logic gates. Moreover, the domain wall state is non-volatile and thus, the state can be used to store information.

Field of the dissertation Engineering Physics

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Place of the defence Aalto University School of Science, lecture hall U1, Otakaari 1, Espoo

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