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Ultrafast acoustic control of coherent spin dynamics in nanostructures

Initiative: Trilaterale Partnerschaften – Kooperationsvorhaben zwischen Wissenschaftler(inne)n aus der

Ukraine, Russland und Deutschland

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This project will consist of (i) the development of the multilayered ferromagnetic structures where coupling of magnetization and strain does not rely on the intrinsic magneto-elastic effect, and (ii) the elaboration and testing of the method for excitation of the spin waves travelling along the planar ferromagnetic structure. This will allow to create ferromagnetic structures with ultrafast strain control based on a much wider spectrum of ferromagnetic materials and to check transport parameters of spin waves at nanoscale level and related feasibility of spin-wave circuits. Nonequilibrium cavity-polariton condensates demonstrate multistability under resonant and coherent optical excitation, so that condensate states can have different intensities and average spins under fixed external conditions. It is known that strain modifies the polariton resonance energy and thus it supposedly acts to toggle (in)stability of particular macroscopic spin states. Hence, application of a strain pulse is expected to induce dynamical switching of the condensate spin. It is planned to explore feasibility of this concept experimentally using microcavities and strain pulses of various parameters and develop the theoretical approach to quantitatively describe the mechanisms of ultrafast strain-pulse control of the polariton condensate spin. This will allow, in particular, to create tunable coherent light sources whose polarization can be changed between linear, light- and left-circular on the scale of picoseconds.

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