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NON-UNIFORM SOFTENING OF SPIN WAVES IN TWO-DIMENSIONAL MAGNONIC CRYSTALS AS A TOOL FOR A REVERSIBLE TUNING OF OMNIDIRECTIONAL BAND GAPS

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The change of the external magnetic field at low fields leads to the non-uniform shift of spin waves (SWs) frequencies [1,2]. The non-uniformity refers to two different effects: different shift for different modes and/or k-dependent shift within the single mode. In this work, we study the mechanisms of both types of non-uniform shift in two-dimensional (2D) magnonic crystals (MCs). We address these features to the growing influence of the demagnetizing field combined with the spin wave profile of the mode. We show that the non-uniform mode softening can be utilized to the reversible control of band gaps just by changing of the external magnetic field magnitude. We propose 2D MCs, with the structure feasible for the experimental realization with the current technology, for which the SW spectrum exhibits omnidirectional band gaps with a different sensitivity of the gap width to the external field magnitude.

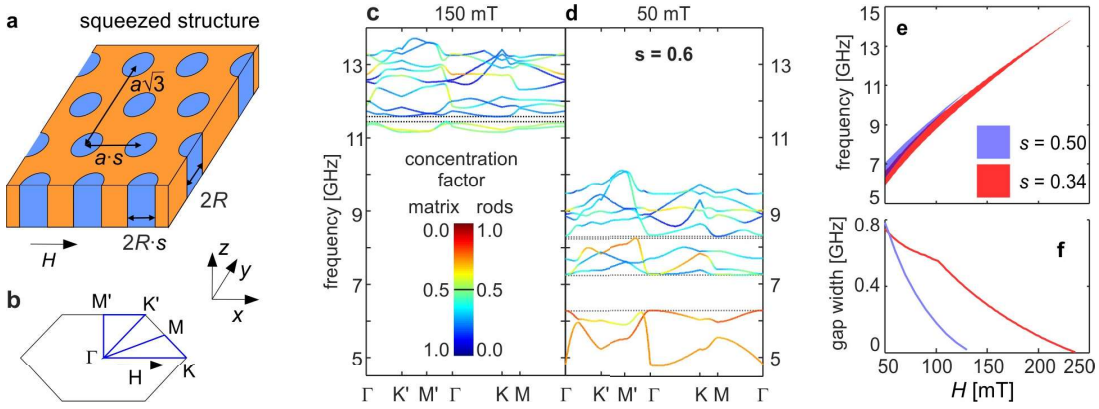

Fig. 1 : (a) 2D MC based on the hexagonal lattice squeezed in the direction of the external field H by the structure ratio s. (b) The FBZ for the squeezed structure. (c, d) Spin wave spectra for Co/Py 2D MCs over the high symmetry path in the FBZ for $s = 0.6$ and two values of H. Line colors depict concentration factor according to the color scale shown in the inset. Dotted horizontal lines represent bounds of the complete magnonic gaps. (e) Omnidirectional gaps vs. H for two values of s. (f) The dependence of the gap width on H for both gaps shown in (e)

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