
# Book of abstracts

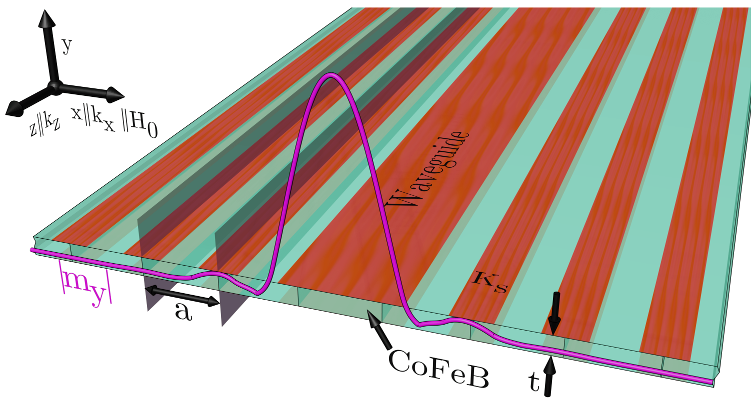
# Bragg mirror–enhanced magnonic waveguides

Grzegorz Centa?a [1], Jaros?aw W. K?os [1]

[1] ISQI, Faculty of Physics, Adam Mickiewicz University, Poland

waveguide | Bragg mirror | surface anisotropy | spin waves |

Magnonics has emerged as a promising solution to mitigate energy losses in wave-based data processing. The magnonic waveguides are then crucial elements in any magnonic circuit realization. Despite extensive studies on waveguides, there is a compelling need for further exploration of alternative designs. In this research, we introduce a new type of magnonic waveguide that utilizes Bragg mirrors to confine and guide spin waves within a uniform CoFeB layer.We proposed the Bragg mirrors for spin waves, which are formed by inducing surface anisotropy in periodic sequences of stripes on both the top and bottom surfaces of the CoFeB layer. This periodic modulation effectively generates a pair of 1D magnonic crystals enveloping the waveguide, consisting of wider strips of anisotropy-applied layer, which is free from unwanted static demagnetizing effects. The localization within the waveguide results from Bragg scattering of spin waves, leading to the formation of magnonic gaps, crucial for achieving the waveguide modes of higher frequencies.To attain a desirable group velocity of spin waves propagating along the waveguide, we applied an external field perpendicular to the waveguide axis, adopting the Demon/Eshbach configuration. Additionally, we carefully selected an appropriate thickness for the magnetic layer, balancing it against the strength of the periodic modulation of the magnonic crystals, determined by the effective volume anisotropy.Our proposed design offers significant advantages. Firstly, it relies on a uniform magnetic layer of low-damping ferromagnet, requiring only the application of a periodic pattern of nonmagnetic material. Secondly, it mitigates the static demagnetizing field and eliminates the presence of edge modes in the waveguide, enhancing the overall efficiency of the magnonic circuit.The authors would like to acknowledge the support from the National Science Center – Poland grants No. 2020/39/O/ST5/02110, 2021/43/I/ST3/00550 and the Polish National Agency for Academic Exchange grant BPN/PRE/2022/1/00014/U/00001.




Scheme of considered structure. A periodically repeated supercell consisting of a = 100 nm wide (x-direction) and t = 6 nm thick 43 elementary cells. On the 50% of the top and bottom surfaces of each elementary cell (except the defect) surface anisotropy was applied-see red area. The strength of surface anisotropy was determined by the surface anisotropy constant. For the sake of symmetry, the defect was placed at the center of the supercell.