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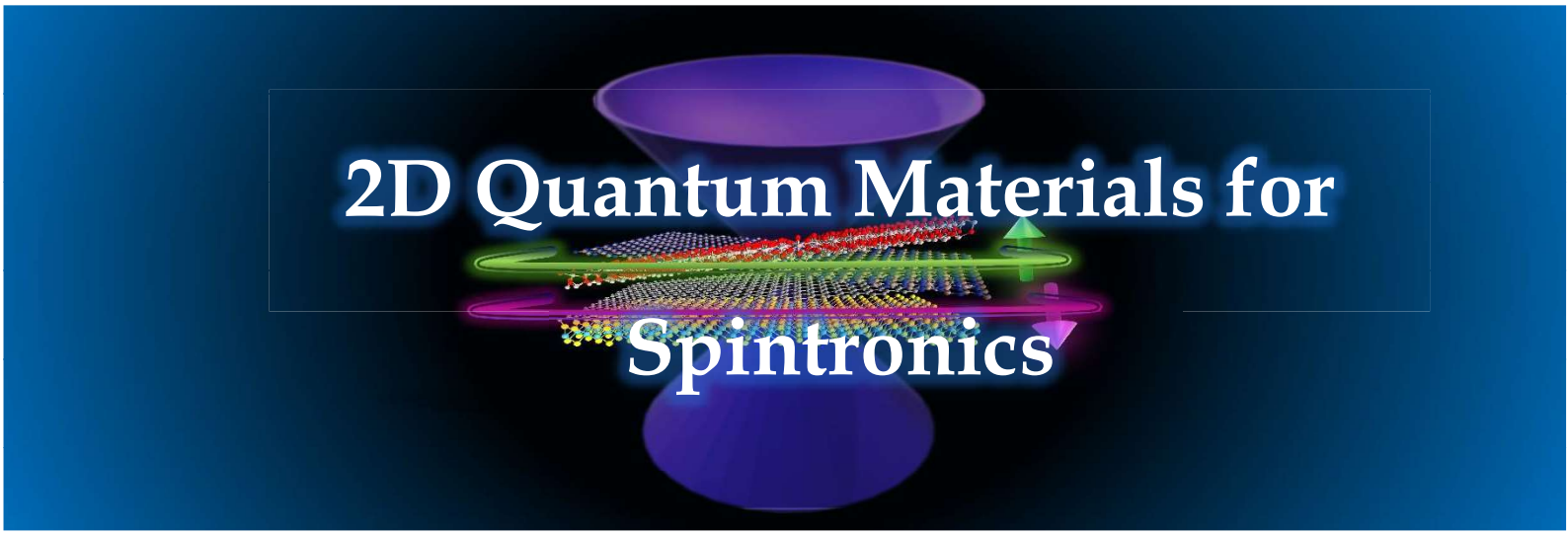

– Book of Abstracts –

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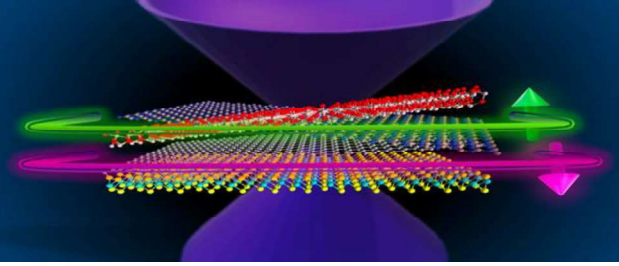

Compact localised states in magnonics

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In bipartite lattices, the sites from sublattice A have the nearest neighbours (NN) in sublattice B only. Therefore, the mods occupying one sublattice are not able to propagate (in tight-binding models with NN hopping) and the dispersion relation can be described as flat bands with zero group velocity. Such modes, localized without defects in a perfectly periodic and infinitely extended system, are called compact localized states (CLS) [1]. The well-known type of bipartite lattice is a Lieb lattice [2]. The CLS were already observed in photonic crystals based on Lieb lattices [3] but the studies on CLS in the magnonic system still need to be performed. We proposed a perpendicularly magnetized Ga-doped YIG layer as a base for a magnonic Lieb lattice where the lattice sites are mimicked by cylindrical inclusion made of YIG (without Ga-doping). We tailored the structure to observe the oscillatory and evanescent spin waves in inclusions and matrix, respectively. We calculated the dispersion relations exhibiting Dirac cones, almost touching each other at the M-point (with a very narrow gap ~15 MHz), intersected by a relatively flat band of magnonic CLS. Then, we supplemented our studies by considering the extended magnonic Lieb lattices, characterized by a larger number of weakly dispersive bands specific for CLS. The computations were performed by finite element method, using COMSOL Multiphysics.

[1] J.-W. Rhim and B.-J. Yang, *Phys. Rev. B* **99**, 045107 (2019).
[2] E. H. Lieb, *Phys. Rev. Lett.* **62**, 120 (1989); erratum 62, 1927 (1989).
[3] D. Leykam et al, *ADV PHYS-X* **3**, 1473052 (2018).

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