Abstract book

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NONTRIVIAL PROPERTIES OF COMPACT LOCALIZED STATES IN MAGNONIC BIPARTITE LATTICE

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In the eighties, Bill Sutherland predicted the existence of flat bands for simple models based on tight-binding approximation [1]. The studies on the flat bands and localization in bipartite lattices were extended later by B. H. Lieb [2]. These early works laid the cornerstones for the numerous studies on nontrivial wave localization in the periodic system in the absence of defects – called compact localization. Lately, this concept has been explored in electronics, optics, and photonics [3], however, there have been no reports on compact localization in magnonics. In our work, we suggest the possible realization of the magnonic Lieb lattice and discuss its nontrivial properties.

We consider a realistic 2D magnonic crystal consisting of a Ga-dopped YIG layer with cylindrical inclusions (without Ga content) arranged in a Lieb lattice (see Fig. 1). We tailored the structure to observe the oscillatory and evanescent spin waves in inclusions and matrix, respectively. Such a design reproduces the functional magnonic Lieb lattice of ferromagnetic inclusions coupled to each other by the ferromagnetic matrix. In this system, we found the compact localization of spin waves (for spectrum see Fig. 2). The numerical calculations were done by the finite element method software COMSOL Multiphysics.

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[1] B. Sutherland et al, Phys. Rev. B **34**(8), 5208-5211 (1986)
[2] E. H. Lieb, Phys. Rev. Lett. **62**, 1201 (1989), erratum **62**, 1927 (1989)
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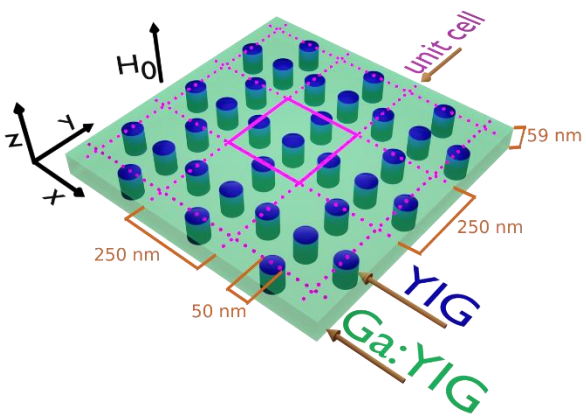

Fig.1. Basic Lieb lattice structure designed for magnonics

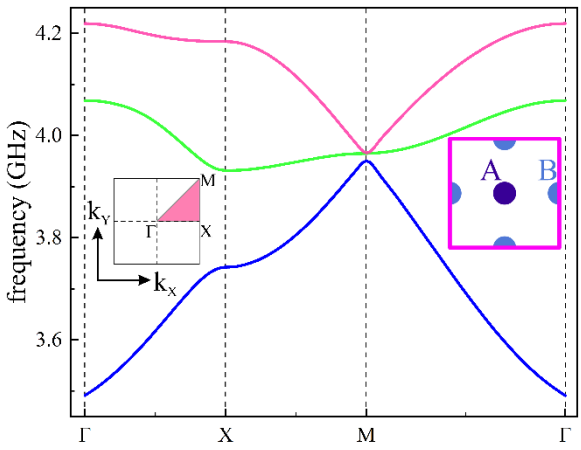

Fig. 2. Dispersion relation for basic Lieb lattice configuration