

# Magnetic interactions in AB-stacked kagome lattices: magnetic structure, symmetry, and duality

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Owing to a recent observation of the anomalous Hall effect in  $\text{Mn}_3\text{Ge}$  and  $\text{Mn}_3\text{Sn}$ , there has been an increased interest in the magnetic properties of compounds with a hexagonal AB-stacked kagome structure. Despite a relatively simple crystal structure, these compounds possess a plethora of various types of magnetic interactions [1]. We investigate the magnetic properties of these systems by constructing the ground state phase diagrams and studying the elementary spin-wave excitations. A minimal model with exchange and Dzyaloshinskii-Moriya interactions is sufficient to stabilize unusual magnetic structures with single and multiple magnetic ordering wavevectors. The spin-wave spectra of the magnetic orders exhibit higher degeneracy than predicted using space group symmetries alone. We explain this degeneracy by considering the spin-space group [2], which includes additional axial spin rotations. Furthermore, we identify a large set of self-duality transformations that provide exact mapping between different parts of the phase diagram. Similar duality transformations have been almost exclusively studied in Kitaev-Heisenberg models on honeycomb and triangular lattices [3-5].

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