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Topologically protected unidirectional edge spin waves[1] XIANG RONG WANG, Hong Kong Univ of Sci & Tech, XIANSI WANG, University of Electronic Science and Technology of China, YING SU, The HK University of Sci. and Tech — Magnetic materials are highly correlated spin systems that do not respect the time-reversal symmetry. The low-energy excitations of magnetic materials are spin waves whose quanta are magnons. Like electronic materials that can be topologically nontrivial, a magnetic material can also be topologically nontrivial with topologically protected unidirectional edge states. These edge states should be superb channels of processing and manipulating spin waves because they are robust against perturbations and geometry changes, unlike the normal spin wave states that are very sensitive to the system changes and geometry. Therefore, the magnetic topological matter is of fundamental interest and technologically useful in magnonics. Here, we show that ferromagnetically interacting spins on a two-dimensional honeycomb lattice with nearest-neighbour interactions and governed by the Landau-Lifshitz-Gilbert equation, can be topologically nontrivial with gapped bulk spin waves and gapless edge spin waves. These edge spin waves are indeed very robust against defects under topological protection. Because of the unidirectional nature of these topologically protected edge spin waves, an interesting functional magnonic device called beam splitter can be made out of a domain wall in a strip. It is shown that an in-coming spin wave beam along one edge splits into two spin wave beams propagating along two opposite directions on the other edge after passing through a domain wall.

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