Efimov effect in quantum magnets

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Physics is said to be universal when it emerges regardless of the underlying microscopic details. A prominent example is the Efimov effect, which predicts the emergence of an infinite tower of three-body bound states obeying discrete scale invariance when the particles interact resonantly. Because of its universality and peculiarity, the Efimov effect has been the subject of extensive research in chemical, atomic, nuclear and particle physics for decades. Here we employ an anisotropic Heisenberg model to show that collective excitations in quantum magnets (magnons) also exhibit the Efimov effect. We locate anisotropy-induced two-magnon resonances, compute binding energies of three magnons, and find that they fit into the universal scaling law. We propose several approaches to experimentally realize the Efimov effect in quantum magnets, where the emergent Efimov states of magnons can be observed with commonly used spectroscopic measurements such as the electron spin resonance. Our study thus opens up new avenues for universal few-body physics in condensed matter systems.

[1] Y. Nishida, Y. Kato, and C. D. Batista, Nature Physics **9**, 93–97 (2013).
[2] Y. Nishida, arXiv:1302.5908 [cond-mat.str-el].