Editors

Physical Review Letters

Dear Editors,

Attached please find a manuscript entitled “Itinerant topological magnons in Haldane Hubbard model with a nearly-flat electron band” by Zhao-Long Gu, Zhao-Yang Dong, Shun-Li Yu and Jian-Xin Li, which is submitted for consideration to be published in “Physical Review Letters”.

The interplay between nearly-flat topological bands and strong correlations constitutes a hot issue in condensed matter physics. However, previous studies mainly focus on the charge sector of the electrons (e.g. fractional Chern insulators). The states related to the spin degrees of freedom are also of fundamental importance but has long been ignored. In fact, the itinerant ferromagnetism of electron spins in the ground state is the prerequisite of possible fractional Chern insulators in spinful models. The spin excitations over the ferromagnetic ground state can reveal new physics of nearly-flat topological bands yet have seldom been studied before.

In this letter, we focus on the spin wave excitations of correlated nearly-flat topological bands. Specifically, we elaborate the first theoretical realization of two dimensional itinerant topological magnons, based on the quarter-filled Haldane-Hubbard model. The existence of the itinerant topological magnons is supported by the nonzero Chern number of the magnon band and the in-gap magnon states on magnetic domain walls. Different from the well-studied topological magnons in local spin models, where the linear spin wave theory provides an intuitive understanding for the magnon band topology, previous researches on the itinerant magnons are held back by the lack of such an effective model capturing the spin wave excitations. Remarkably, here we find an exact set of bases for the itinerant magnons in the flatband limit constructed from sublattice particle-hole vectors and derive an effective model to explore the origin of their nontrivial topology. We find that the effective model exhibits a quartic form so that the exact “mass inversion mechanism” in the free topological systems is also responsible for the generation of the itinerant topological magnons.

Our work uncovers the rich physics behind the combination of itinerant ferromagnetism, nearly-flat topological bands and topological magnons, thus should attract broad attentions from all these communities. We believe that it is suitable for a publication in “Physical Review Letters”. Thanks in advance for your kind consideration.

Yours sincerely,

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