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Bona fide interaction-driven topological phase transition in correlated SPT states ZI YANG MENG, Institute of Physics, Chinese Academy of Sciences, YUAN-YAO HE, HAN-QING WU, Department of Physics, Renmin University of China, Beijing 100872, China, YI-ZHUANG YOU, CENKE XU, Department of Physics, University of California, Santa Barbara, California 93106, USA, ZHONG-YI LU, Department of Physics, Renmin University of China, Beijing 100872, China — It is expected the interplay between non-trivial band topology and strong electron correlation will lead to very rich physics. Thus a controlled study of the competition between topology and correlation is of great interest. Here, employing large-scale quantum Monte Carlo simulations, we provide a concrete example of the Kane-Mele-Hubbard model on an AA stacking bilayer honeycomb lattice with inter-layer antiferromagnetic interaction. Our simulation identified several different phases: a quantum spin-Hall insulator (QSH), a xy-plane antiferromagnetic Mott insulator (xy-AFM) and an inter-layer dimer-singlet insulator (dimer-singlet). Most importantly, a bona fide topological phase transition between the QSH and the dimer-singlet insulators, purely driven by the inter-layer antiferromagnetic interaction is found. At the transition, the spin and charge gap of the system close while the single-particle excitations remain gapped, which means that this transition has no mean field analogue and it can be viewed as a transition between bosonic SPT states. At one special point, this transition is described by a (2+1)d O(4) nonlinear sigma model with exact SO(4) symmetry, and a topological term at theta=p. Relevance of this work towards more general interacting SPT states is discussed.

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