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Topological invariants in interacting topological insulators: Success and Breakdown YUAN-YAO HE, HAN-QING WU, Department of Physics, Renmin University of China, Beijing 100872, China, ZI YANG MENG, Beijing National Laboratory for Condensed Matter Physics, and Institute of Physics, Chinese Academy of Sciences, Beijing 100190, China, ZHONG-YI LU, Department of Physics, Renmin University of China, Beijing 100872, China — The content of this talk is twofold. In the first part, we provide a paradigm of efficient numerical evaluation scheme for topological invariants via zero-frequency single-particle Green's function in quantum Monte Carlo (QMC) simulations. Especially, we introduce a periodization process to overcome the ubiquitous finite-size effect and make use of symmetry properties of the underlying systems to reduce the computational effort. This scheme is tested to be successful on models of interacting topological insulators, where there is single-particle gap closing at the transition. In the second part, we apply the above scheme to wider classes of interacting topological insulators, in which the breakdown of constructing topological invariant via single-particle Greens functions is presented. These systems host novel interaction-driven topological phase transitions without symmetry breaking, and hence fermionic degree of freedom is not involved at the critical point, instead, collective bosonic mode become critical.

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