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Absence of levitation and annihilation at the topological phase transition of a disordered one-dimensional model in class AIII IAN MONDRAGON-SHEM, Department of Physics, University of Illinois, 1110 West Green St, Urbana IL 61801, JUNTAO SONG, Department of Physics, Yeshiva University, New York, NY 10016, USA, TAYLOR L HUGHES, Department of Physics, University of Illinois, 1110 West Green St, Urbana IL 61801, EMIL PRODAN, Department of Physics, Yeshiva University, New York, NY 10016, USA — We study the disorder-induced topological phase transition of a one-dimensional model belonging to class AIII of the Altland-Zirnbauer classification of fermions. To characterize the topological state, we derive a covariant real-space representation of the integer invariant. Using this invariant, we show that the system remains topological even after all the single particle states of the system become localized and the energy spectrum becomes gapless. For a critical disorder strength which we compute analytically, there emerges a delocalized state at zero energy where the topological invariant changes value and the nontrivial ground state transforms into a trivial one. This type of topological phase transition is fundamentally different from the levitation and annihilation paradigm that is found in higher-dimensional systems e.g. the quantum Hall state. In order to understand this type of phase transition, we map the system to a spin-1/2 model which provides an insightful real-space picture of the underlying physics near the critical point. EP and JTS were supported by U.S. NSF grants DMS 1066045, DMR-1056168, NSFC grant 11204065 and RFDPHEC grant. A2013205168. TLH and IM-S were supported by ONR Grant No. N0014-12-1-0935.

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