Fragility of the antichiral edge states under disorder

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Chiral edge states are the fingerprint of the bulk-edge correspondence in a Chern insulator. Co-propagating edge modes, known as antichiral edge states, have been predicted to occur in the so-called modified Haldane model describing a two-dimensional semi-metal with broken time reversal symmetry. For energy conservation, the antichiral edge states are compensated by counter-propagating pseudo-bulk states. These counterintuitive edge modes are argued to be extremely robust against disorder. Here, we investigate the robustness of the antichiral edge states and their accompanying pseudobulk states in the presence of Anderson disorder. By computing different localization parameters, we show that, contrary to previous works, the antichiral edge modes are fragile against disorder since they exhibit a localization length comparable to that of their counter-propagating bulk states. They are found to be, as the bulk states, increasingly localized by increasing the disorder amplitude. We benchmark this behavior with that of the chiral modes showing a strong robustness against localization regarding their substantially large localization length compared to the corresponding bulk states. We confirm the fragility of the anitchiral edge states by calculating their backscattering localization length. Our work provides insights to improve the transport efficiency in the burgeoning fields of antichiral topological photonics and acoustics.