Symmetry protected zero modes in graphene grain boundaries

MADELEINE PHILLIPS, E.J. MELE, University of Pennsylvania — We study
electronic states in graphene grain boundaries using topological band theoretic ar-
guments. Using bulk eigenstates, we calculate a geometric phase that counts the
number of zero modes in projected bulk gaps. We argue that these localized zero
modes are protected by a hidden chiral symmetry. We apply our topological theory
to various grain boundary geometries and corroborate our results using numerical
calculations on a tight binding lattice.

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