Topologically protected zero modes in electronic and optical systems

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While ordinary states in quantum systems are normally very sensitive to perturbations, topologically protected states are far more robust. I will discuss true and false signatures of such states in topological insulators and superconductors, as well as optical analogues in 1-dimensional and 2-dimensional lattice models. Besides a theoretical description of the origin of the states I also present experimental evidence from microwave experiments.

Zero-voltage conductance peak from weak antilocalization in a Majorana nanowire
D. I. Pikulin, J. P. Dahlhaus, M. Wimmer, H. Schomerus, and C. W. J. Beenakker
New J. Phys. 14, 125011 (2012)

Fermion-parity anomaly of the critical supercurrent in the quantum spin-Hall effect
C. W. J. Beenakker, D. I. Pikulin, T. Hyart, H. Schomerus, and J. P. Dahlhaus
Phys. Rev. Lett. 110, 017003 (2013)

Transport signatures of pseudo-magnetic Landau levels in strained graphene ribbons
D. A. Gradinar, M. Mucha-Kruczynski, H. Schomerus, and V. I. Fal'ko
Phys. Rev. Lett. 110, 266801 (2013), arXiv:1303.3140 [cond-mat.mes-hall].

Parity anomaly and Landau-level lasing in strained photonic honeycomb lattices
H. Schomerus and N. Yunger Halpern
Phys. Rev. Lett. 110, 013903 (2013), arXiv:1208.2901 [cond-mat.mes-hall].

Topologically protected midgap states in complex photonic lattices
H. Schomerus
Optics Letters 38, 1912 (2013), arXiv:1301.0777 [physics.optics].