

# Coexistence of Anderson Localization and Quantum Scarring in Two Dimension

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We investigate finite two-dimensional disordered systems with periodic confinement. At low energies, eigenstates exhibit strong Anderson localization, while at higher energies a subset of states exhibits variational scarring with anisotropic intensity patterns that deviate from random-wave expectations. Scaling theory predicts that in two dimensions all eigenstates localize in the large-system-size limit, yet the energy-dependent localization length and finite-size effects allow these regimes to coexist. We demonstrate that this coexistence produces distinct, robust signatures in both spatial intensity patterns and spectral statistics that are directly observable in mesoscopic electronic, photonic, and cold-atom systems.

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