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Eigenfunction scarring in distorted quantum wells ESA RASANEN, Tampere University of Technology, PERTTU LUUKKO, University of Jyvaskyla, ANNA KLALES, Harvard University, BYRON DRURY, Massachusetts Institute of Technology, LEV KAPLAN, Tulane University, ERIC HELLER, Harvard University
— Conventional scarring refers to pronounced localization of eigenfunctions along unstable classical periodic orbits [1]. Here we apply a highly efficient eigenvalue solver of arbitrary two-dimensional (2D) systems [2] to study scarring phenomena in generic situations. In particular, we report unexpectedly strong scarring in 2D quantum wells perturbed by random potential bumps of variable characteristics [3]. The scars resemble classical periodic orbits of the unperturbed system (no bumps), but there appears to be no clear connection to the periodic orbits of the perturbed system, as would be the case for conventional scarring. The scars are also robust to increasing distortion amplitude, and show a tendency to pin to the potential bumps. We have used a variety of tools to analyze the origin of the scarring, in particular its relation with Anderson localization. [1] E. J. Heller, Phys. Rev. Lett. 53, 1515 (1984); [2] P. J. J. Luukko and E. Rasanen, Comp. Phys. Comm. 184, 769 (2013); [3] P. J. J. Luukko, A. Klales, B. Drury, L. Kaplan, E. J. Heller, and E. Rasanen (2015).

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