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Exploring the Hofstadter spectrum with tunable bichromatic optical lattices[1] PETER DOTTI, TOSHIHIKO SHIMASAKI, University of California, Santa Barbara, SHANKARI RAJAGOPAL, Stanford University, DAVID WELD, University of California, Santa Barbara — We discuss experiments on quantum gases in tunable quasiperiodic optical potentials. Use of a bichromatic lattice with tunable period ratio between the two sublattices enables at least two new measurements. First, studying the frequency-dependent response of a quasiperiodically-trapped gas to lattice modulation offers a direct probe of the multifractal Hofstadter butterfly energy spectrum which also characterizes 2D electron gases in the integer quantum Hall regime. This extends previous experiments at fixed period ratio which have measured 1D slices of this 2D spectrum [1]. Second, observing time evolution of an initially narrow density distribution in a bichromatic lattice at rational and irrational period ratios allows a detailed probe of localization physics and may reveal signatures of a change in eigenvalue statistics across a localization transition.

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