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Stability of Bose Einstein Condensates in Periodically Driven 2D Optical Lattices JAMES MASLEK, THOMAS BOULIER, CARLOS BRACAMONTES, ERIC MAGNAN, TREY PORTO, Univ of Maryland-College Park —
Periodically driven quantum systems offer new possibilities to Floquet-engineer non-trivial Hamiltonians displaying exotic properties. One drawback to periodic driving is the transfer of energy from the drive to the system, re-sulting in heating. A detailed understanding of the underlying many-body mechanisms is necessary for quantum Floquet engineering to mature as a powerful coherent control scheme. So far, such studies are few and focus on unidimensional drives in 1D lattices. We measured heating rates for bosons subject to a bidirectional drive of arbitrary trajectory imposed onto 2D and 3D optical lattices. We report how the heating depends on the frequency, intensity, and the trajectory of the drive. Dynamical instabilities cannot be ignored for higher-dimensional driving, due to a band inversion at certain driving strengths. This results in an increased rate of decay, and imposes constraints on the initial momenta at a given drive. We thus provide a map of timescales available for coherent control throughout the parameter space, along with an understanding of the many-body quantum processes involved.

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