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Preparing quasienergy states on demand: a parametric oscillator YAXING ZHANG, Physics Department, Yale University, MARK DYKMAN, Physics and Astronomy Department, Michigan State University — We study a parametrically driven nonlinear oscillator where the driving frequency is close to twice the oscillator eigenfrequency. We show that, by judiciously choosing the frequency detuning, one can prepare any even quasienergy (Floquet) state of the oscillator by adiabatically increasing the driving strength where the oscillator is initially in the ground state. This is a consequence of a remarkable feature of the system: the quasienergies of the Floquet states do not cross each other with the varying field strength, but can cross with the varying frequency detuning. For sufficiently strong field, the lowest (or highest, depending on the sign of the Duffing nonlinearity parameter) quasienergy state is a symmetric or an antisymmetric superposition of two (generally squeezed) coherent states of the oscillator with the same amplitudes and opposite phases. We find the Wigner distribution of the prepared states. We also discuss the Landau-Zener transitions in the Floquet dynamics and show that one can prepare on demand a superposition of quasienergy states via controlled nonadiabaticity. Of special interest is the transient radiation emitted by the oscillator after it has been prepared in a given quasienergy state. We find the characteristic spectrum of this radiation.

Yaxing Zhang
Physics Department, Yale University

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