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Unconventional Quantum Phases in Kicked Rotors

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Abstract:

The kicked rotor is a canonical chaotic model that exhibits rich physics. A prominent property that distinguishes this deterministic chaotic system from genuine disordered systems is the extreme sensitivity of its behavior to the value of a (dimensionless) parameter, Planck's quantum, h_e. For the (conventional) periodically kicked rotor, the rotor's energy exhibits a universal linear-quadratic crossover for rational (`resonant') values of $h_e/(4\pi)$ while the rotor's behavior exhibits peculiar behavior, namely pseudo-semiclassics, close to certain `resonant' values, in contrast to the celebrated dynamical localization phenomenon for irrational values. For the quasiperiodically kicked rotor, for irrational values of $h_e/(4\pi)$, the quantum phase transition exhibited in this system falls into the universality class of Anderson (metal–insulator) transition in disordered electronic systems; for rational values, the rotor-Anderson insulator turns into a 'supermetal' (i.e. the static conductivity diverges) and the system exhibits metal–supermetal transition.