Quantum Physics

Quantum and Classical Dynamics of a BEC in a Large-Period Optical Lattice

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We experimentally investigate diffraction of a Rb-87 Bose-Einstein condensate from a 1D optical lattice. We use a range of lattice periods and timescales, including those beyond the Raman-Nath limit. We compare the results to quantum mechanical and classical simulations, with quantitative and qualitative agreement, respectively. The classical simulation predicts that the envelope of the time-evolving diffraction pattern is shaped by caustics: singularities in the phase space density of classical trajectories. This behavior becomes increasingly clear as the lattice period grows.

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