Control and instability of a periodically-driven Bose-Einstein condensate

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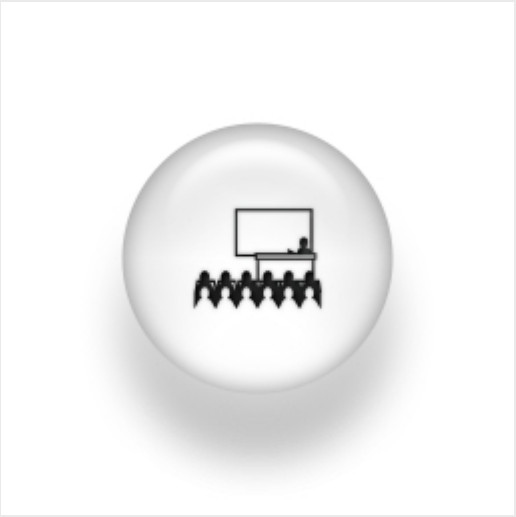

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ABSTRACT:
Applying an optical lattice potential to a Bose-Einstein condensate gives the opportunity to study coherent quantum phenomena in extremely clean and controllable conditions. One such effect is termed “coherent destruction of tunneling”, in which periodically shaking the lattice causes the intersite tunneling to be renormalised to an effective value. Using a mean-field approach I will first show how the dynamical stability of the condensate crucially depends upon the sign of the effective tunneling. I will then show how controlling the tunneling can be used to precisely control the localization and entanglement of individual particles, and how this effect can be harnessed to investigate the interplay between nonlinearity and dispersion, notably in the production of solitons.