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Interaction induced destruction of resonant tunneling in the nonlinear Wannier-Stark problem SANDRO WIMBERGER, RICCARDO MANNELLA, ENNIO ARIMONDO, Dipartimento di Fisica, Universita' di Pisa — Bose-Einstein condensates loaded into periodic optical lattices can be subjected to a controlled dynamical evolution, determined by the shape and time-dependence of the potentials. We propose a scheme to measure the temporal decay rates arising from *many* successive Landau-Zener events. We show that from a measurement of the atomic densities or from a combined density and phase measurement, we can compute the time-dependent survival or recurrence probability of the condensate, respectively. The tunneling of the condensate in a tilted optical lattice is resonantly enhanced for a suitable choice of the static Stark field (or the relative acceleration of two counter-propagating standing waves). Resonantly enhanced tunneling by more than an order of magnitude is predicted for essentially non-interacting atoms. Small mean-field interactions, as readily realized in state-of-the-art experiments, systematically tend to wash out the resonant tunneling peaks. Hence, even in a parameter regime far away from any dynamical instability in the condensate, i.e., where the kinetic and the potential energy usually dominate the dynamics, the atom-atom interactions eventually lead to a destruction of the very sensitive resonant tunneling. This example of the *dynamical* interplay between coherent single-particle tunneling and nonlinear mean-field interactions opens new perspectives for the study of complex quantum transport with ultracold atoms.

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