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Adiabaticity in a dimerised optical lattice site with increasing laser intensity SCOTT TAYLOR, CHRIS HOOLEY, University of St Andrews, UK — Recent experiments attempting to simulate magnetic phenomena with cold atoms in optical lattices rely on systems of a few atoms in dimerised lattice sites. These atoms may be manipulated by deformations of the lattice potential, which often need to be adiabatic, but must also happen quickly. We consider such a system of two fermions in a time-dependent double well potential, described by a two-site Hubbard model with time-dependent hopping and interaction energies. The adiabaticity of the following process is analysed: the system is prepared in the ground state of a shallow potential, which is smoothly transformed to a deep potential over some period of time. Experimentally, this corresponds to ramping up the intensity of the lasers generating the lattice. We present numerical and analytical results, demonstrating principles to design fast, adiabatic ramp profiles.

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