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A Study of Nonadiabatic Effects When a 1D Optical Lattice is Turned on Rapidly[1] T. BERGEMAN, H. SHIM, D. PERTOT, B. GADWAY, D. SCHNEBLE, SUNY Stony Brook — Nonadiabatic effects that can occur when Bose condensates are subject to a rapidly rising optical lattice have attracted much interested in regard to experiments such as [1], which was carefully adiabatic. For a systematic study, we have performed 3D calculations to model new experiments that involve a nearly isotropic harmonic trap plus a rising 1D optical lattice. As seen in experiments with a 3D lattice [2], we find that the visibility of the interference pattern after atom release is close to unity immediately after ramping up the lattice, but then decreases after varying hold time. The decrease is most rapid when the lattice turn-on is most rapid. Our calculations, using split operator methods applied to the time-dependent Gross-Pitaevskii equation, qualitatively mimic the experimental results. The calculations show that quadrupole excitations associated with weak (50 Hz) transverse confinement can contribute to the reduction of the visibility of the interference pattern.

[1] Orzel et al., Science **291**, 2386 (2001).
[2] Gericke et al. J. Mod. Opt. **54**, 735 (2007).

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