Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

The effective mass of ultracold atoms in one-dimensional optical lattices FEDERICO DUQUE GOMEZ, J.E. SIPE, Department of Physics, University of Toronto — According to the effective mass theorem, in the presence of an external force the wavepacket associated with a crystal electron in one band accelerates as a particle with an effective mass. However, when the force is turned on suddenly, the expectation value of the acceleration initially behaves according to the electron's bare mass, and afterwards oscillates around the value given by the usual effective mass.[1] These oscillations are difficult to measure in typical solid state systems because they decay after a time of the order of femtoseconds.[2] We consider this oscillatory behaviour with ultracold atoms in a one-dimensional optical lattice where the time scale of the oscillations and the coherence times are much longer. Our theoretical analysis is based on a perturbation scheme that decouples the bands to any order in the external force.[3] We check the validity of this perturbative approach, comparing its results with those obtained from a full numerical calculation. Experimental investigations are underway.[4]

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[3]G. H. Wannier, Phys. Rev. **117**, 432 (1960).
[4]A. Steinberg, private communication.

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Date submitted: 19 Dec 2011 Electronic form version 1.4