Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Coherent manipulations of atomic wavefunctions in optical lattices VLADYSLAV IVANOV, University of Washington, A. ALBERTI, M. SCHIOPPO, G. FERRARI, LENS, Italy, G.M. TINO, University of Florence, Italy, LENS TEAM — We report on the realization of dynamical control of transport for ultra-cold ^{88}Sr atoms loaded in accelerated and amplitude-modulated optical lattices. Cold atoms trapped in vertical optical lattices give rise to localized states, the Wannier-Stark states. Delocalization can be recovered by introducing a resonant coupling among neighboring lattice sites. We demonstrated this by applying a modulation either to the phase or the amplitude of the lattice potential. Atomic samples loaded into modulated vertical optical-lattice potentials exhibit a resonant delocalization dynamics arising from intraband transitions among Wannier-Stark levels [1]. We demonstrate the coherent control of the spatial extent of atomic wavefunctions by reversibly stretching and shrinking the wavefunctions over a distance of more than one millimeter [2]. Furthermore we tailor the dispersion law of atomic traveling wave-packets and show the ability to reversibly switch between localization regime and tunneling one. From this a novel atom mirror in optical lattices is demonstrated by reversing the group velocity of the atoms.

[1] V. V. Ivanov *et al.,* Phys. Rev. Lett. **100**, 043602 (2008)
[2] A. Alberti, V. V. Ivanov, G. M. Tino and G. Ferrari, Nature Physics **5**, 547 (2009)

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Date submitted: 06 Jan 2010 Electronic form version 1.4