Abstract Submitted
for the DAMOP09 Meeting of
The American Physical Society

Experiment on Matter wave self-Imaging in pulsed optical standing wave field[1] KE LI, LU DENG, M.G. PAYNE, NIST, M.S. ZHAN, Wuhan Institute of Physics and Mathematics, NIST COLLABORATION, WUHAN INSTITUTE OF PHYSICS AND MATHEMATICS COLLABORATION — In this Paper we report a non-Raman-Nath regime diffraction of a condensate by an optical standing wave. We demonstrate atomic CM motion-based bidirectional, high-order matter-wave self-imaging and condensate momentum oscillation. We emphasize that this phenomenon exists in the non-Raman-Nath regime that is also far away from typical Bragg regime, where the atomic CM motion plays a key role. We further note that the matter-wave self-imaging effect reported here is very different from the temporal matter-wave Talbot effect reported previously. To the best of our knowledge, such a full matter-wave self-imaging due to CM motion has never been demonstrated before. We consider a system of two electronic states and n momentum states, and take numerical simulation of the diffraction probabilities for the first few significant diffraction orders. It shows that at $\tau_P \approx 23\mu s$ the zeroth-order diffraction probability is near 100% whereas all high orders are very small. This approximately agrees with the observed time of $\tau_P = 25\mu s$ when all n $\geq$ 1 orders are very small.

[1]We thank Dr. Thomas Lucatorto and Dr. Jay Vaishnav for valuable suggestions and comments. We thank Dr. Baolong Lu of WIPM for assistance. K. Li and M.S. Zhan acknowledge financial support by the National Natural Science Foundation of China.

Ke Li
NIST

Date submitted: 26 Jan 2009 Electronic form version 1.4