Abstract Submitted
for the APR10 Meeting of
The American Physical Society

Synthetic gauge fields and Dirac physics in ultracold atoms[1]
CHARLES W. CLARK, Joint Quantum Institute, National Institute of Standards and Technology and University of Maryland, JAY Y. VAISHNAV, Bucknell University, INDUBALA I. SATIJA, George Mason University, NEXT-GENERATION ATOMTRONICS TEAM — Optical lattices provide defect-free substrates for ultracold atoms, which move within the lattice much like electrons in an ideal crystal. Beyond emulating condensed matter systems, ultracold atoms can be used to implement variants of the Dirac equation and quite general gauge potentials, Abelian and non- Abelian. We present several recent examples of work along these lines, such as the realization of *Zitterbewegung* [1], field-effect spin transistors [2] and topological insulators [3], and discuss possibilities for realizing relativistic wave equations for particles with intrinsic angular momentum greater than $\hbar/2$.

[1] J. Y. Vaishnav and C. W. Clark, *Phys. Rev. Lett* **100**, 153002 (2008)
[2] J. Y. Vaishnav, *et al.*, *Phys. Rev. Lett* **101**, 265302 (2008)
[3] T. D. Stanescu, *et al.*, *Phys. Rev. A* **79**, 053639 (2009)

[1]Supported by the National Science Foundation under Physics Frontiers Center grant PHY-0822671.

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Date submitted: 23 Oct 2009 Electronic form version 1.4