Abstract Submitted
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Weyl points in three-dimensional optical lattices: synthetic magnetic monopoles in momentum space[1] HRVOJE BULJAN, TENA DUBCEK, Department of Physics, Faculty of Science, University of Zagreb, 10000 Zagreb, Croatia, COLIN KENNEDY, LING LU, WOLFGANG KETTERLE, MARIN SOLJACIC, Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA — We show that Hamiltonians with Weyl points can be realized for ultracold atoms using laser-assisted tunneling in three-dimensional (3D) optical lattices. Weyl points are synthetic magnetic monopoles that exhibit a robust, 3D linear dispersion (e.g., see [1]). They are associated with many interesting topological states of matter, such as Weyl semimetals and chiral Weyl fermions. However, Weyl points have yet to be experimentally observed in any system. We show that this elusive goal is well-within experimental reach with an extension of the techniques recently used to obtain the Harper Hamiltonian [2]. We propose using laser assisted tunneling to create a 3D optical lattice, with specifically designed hopping between lattice sites that breaks inversion symmetry [3]. The design leads to creation of four Weyl points in the Brillouin zone of the lattice [3], which are verified to be monopoles of the synthetic magnetic field [3]. [1] L. Lu, L. Fu, J. D. Joannopoulos, and M. Soljačić, Nature Photonics 7, 294 (2013). [2] H. Miyake, G.A. Siviloglou, C.J. Kennedy, W. Cody Burton, and W. Ketterle, Phys. Rev. Lett. 111, 185302 (2013). [3] T. Dubček, C.J. Kennedy, L. Lu, W. Ketterle, M. Soljačić, H. Buljan, arXiv:1412.7615 [cond-mat.quant-gas]

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