Abstract Submitted
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Photo-induced topological phase transition in graphene studied by exact simulation of pump-probe photoemission spectroscopy MICHAEL SENTEF, Stanford Institute for Materials and Energy Sciences (SIMES), ALEXANDER KEMPER, LBNL Berkeley, BRIAN MORITZ, Stanford Institute for Materials and Energy Sciences (SIMES), JAMES FREERICKS, Georgetown University, THOMAS DEVEREAUX, Stanford Institute for Materials and Energy Sciences (SIMES) — The idea of inducing a nontrivial topological band structure using circulary polarized light was triggered by the observation that in a steady "Floquet" state, periodically driven Dirac fermions can be mapped [1] to the Haldane model for a quantum Hall state without Landau levels [2]. A recent observation of Floquet-Bloch states on the surface of a spin-orbit driven topological insulator and a surface state energy gap opened by time-reversal symmetry breaking [3] poses the question how a topological phase transition occurs in real time on ultrashort time scales. We use a well developed Keldysh Green function technique [4] to compute the exact time evolution of tight-binding electrons on the honeycomb lattice coupled to realistic short laser pulses. The time- and angle-resolved photoemission response reveals a photo-induced topological phase transition with energy gaps > 100 meV at the Dirac point that should be observable experimentally. [1] T. Oka and H. Aoki, Phys. Rev. B 79, 081406 (2009); T. Kitagawa et. al., Phys. Rev. B 82, 235114 (2010); N. H. Lindner et. al., Nature Physics 7, 490-495 (2011). [2] F. D. M. Haldane, Phys. Rev. Lett. 61, 2015-2018 (1988). [3] Y. H. Wang et. al., Science 342, 453 (2013). [4] M. Sentef et. al., arXiv:1212.4841 (Phys. Rev. X 2013).

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