Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Room-temperature quantum spin Hall effect in HgTe honeycomb superlattices[1] CRISTIANE MORAIS SMITH, Institute for Theoretical Physics, Utrecht University, The Netherlands, WOUTER BEUGELING, MPI for Physics of Complex Systems, Dresden, Germany, EFTERPI KALESAKI, IEMN-Dept. ISEN, UMR, CNRS, Lille, France, Y.-M. NIQUET, L Sim, SP2M, UMR-E CEA/UJF-Grenoble 1, INAC, Grenoble, France, CHRISTOPHE DELERUE, IEMN-Dept. ISEN, UMR, CNRS, Lille, France, DANIEL VANMAEKELBERGH, Debye Institute for Nanomaterials Science, Utrecht University, The Netherlands — The recent experimental realization of self-assembled honeycomb superlattices of truncated semiconducting nanocrystals has opened a new path to engineer graphene-like structures. Atomistic band-structure calculations for honeycomb lattices of PbSe and CdSe have shown a rich band structure, with Dirac cones at the s- as well as at the p-bands, in addition to a flat p-band. By controlling the chemical composition of the nanocrystals, lattices with strong spin-orbit coupling can be artificially designed. We show that for HgTe a huge non-trivial gap, of order of 50 meV, opens at the K-points. We calculate the edge states using both, an atomistic calculation that takes into account 10^6 atomic orbitals per unit cell, as well as an effective 16-bands tight-binding model, and find that the quantum spin Hall effect should be observable in this material at temperatures of the order of room temperature.

[1]Financial support from ANR, NWO and FOM is acknowledged.

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Date submitted: 15 Nov 2013 Electronic form version 1.4