Abstract Submitted for the MAR14 Meeting of The American Physical Society

Spin-Seebeck effect due to thermally driven spin-polarized electron transport on the surface of a three-dimensional topological insulator¹ PO-HAO CHANG, FARZAD MAHFOUZI, Department of Physics and Astronomy, University of Delaware, NAOTO NAGAOSA, RIKEN Center for Emergent Matter Science, BRANISLAV NIKOLIC, Department of Physics and Astronomy, University of Delaware — We study the spin Seebeck effect on the surface of a three-dimensional topological insulator (TI), such as Bi₂Se₃, in a geometry in which temperature bias is applied parallel to the surface. This generates spin-polarized charge current with polarization component $P_x \simeq 60\%$ along the direction of transport due to surface spin-orbit coupling. The spin current injected from the surface into a third nonmagnetic voltage probe, covering portion of the TI surface across its width, is converted via the inverse spin Hall effect (ISHE) into the voltage signal yielding the spin-Seebeck coefficient $|S_{xy}|^{\text{max}} \simeq 30 \text{ nV/K}$ (assuming the SH angle of Pt voltage probe). Our prediction relies crucially on specific orientation of quintuple layers of Bi_2Se_3 with respect to the TI surface and direction of transport, as well as on the corresponding proper coupling of electronic spin states with support on the Bi and Se sublattice to spins emitted or absorbed by the three attached normal metal leads.

¹NSF Grant No. ECCS 1202069

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Date submitted: 15 Nov 2013

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