

Abstract Submitted  
for the MAR15 Meeting of  
The American Physical Society

**Theory of space charge limited currents in films and nanowires with dopants**<sup>1</sup> XIAOGUANG ZHANG, Department of Physics and Quantum Theory Project, University of Florida, SOKRATES PANTELIDES, Department of Physics and Astronomy, Vanderbilt University — We show that proper description of the space charge limited currents (SCLC) in a homogeneous bulk material must account fully for the effect of the dopants and the interplay between dopants and traps [1]. The sharp rise in the current at the trap-filled-limit (TFL) is partially mitigated by the dopant energy levels and the Frenkel effect, namely the lowering of the ionization energy by the electric field, which is screened by the free carriers. In nanowires, lack of effective screening causes the trap occupation at small biases to reach a high level comparable to the TFL in bulk. This explains the high current density in SCLCs observed in nanowires. [1] X.-G. Zhang and S. T. Pantelides, Phys. Rev. Lett. 108, 266602 (2012).

<sup>1</sup>This work is supported by the LDRD program at ORNL. Portion of this research was conducted at the Center for Nanophase Materials Sciences, which is a DOE Office of Science User Facility.

Xiaoguang Zhang  
Department of Physics and Quantum Theory Project, University of Florida

Date submitted: 13 Nov 2014

Electronic form version 1.4