Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Toward an Impurity Band PV: Dynamics of Carriers Generated via Sub-band gap Photons JOSEPH SULLIVAN, CHRISTIE SIMMONS, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA, AUSTIN AKEY, MICHAEL AZIZ, Harvard School of Engineering and Applied Sciences, Cambridge, Massachusetts 02138, USA, TONIO BUONASSISI, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139, USA — Intermediate band solar cells are a pathway to cells that surpass the Shockley-Queisser limit by enabling the utilization of sub-band gap photons. A proposed method for fabricating an intermediate band material is to use impurities that introduce electronic levels within the band gap. At sufficiently high dopant concentrations, band formation may lead to a suppression of Shockley-Reed-Hall recombination, an idea known as "lifetime recovery" [1]. We investigate a proposed intermediate band material, silicon hyper-doped with sulfur. This material system exhibits strong sub-band gap optical absorption and metallic conductivity at sufficiently high sulfur concentrations [2], which makes it a strong candidate for an impurity-band material. We employ low-temperature photoconductivity using sub-band gap light to estimate the trapping rate of electrons in the conduction band. We vary the sulfur concentration near the critical value for the metal-insulator transition to test the idea of "lifetime recovery" in the S:Si system.

[1] A. Luque and A. Martí, Adv. Mater. 22, 160 (2010).
[2] M. T. Winkler et.al. Phys. Rev. Lett. 106, 178701 (2011)

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Date submitted: 17 Nov 2012 Electronic form version 1.4