Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Studying Anomalous Open-Circuit Voltage Drop-Out in Concentrated Photovoltaics Using Computational Numerical Analysis MARGARET STEVENS, CHANDLER DOWNS, THOMAS VANDERVELDE, SCOTT MACHLACHLAN, JAMES ADLER, Tufts University — Under high solar concentration, an anomalous open-circuit voltage drop-out has been observed experimentally, but not understood theoretically. This anomaly has often been attributed to various thermal effects, but the effect is also observed in flash testing, where thermal effects do not have time to accumulate. We discuss our theoretical examination of semiconductor performance under high optical generated carrier injection. Under these conditions, the number of optically generated charge carriers increase past the number of equilibrium charge carriers. The effect of dynamically changing charge carrier compositions on fundamental electrical properties, such as open-circuit voltage, has yet to be explored in detail. Using the Newton-Raphson method, we solved the carrier continuity equations for the optically generated charge carriers as a function of material depth in bulk III-V semiconducting materials. Ultimately, we implemented these carrier concentration functions in our simulations of p-n band structures to characterize the impact of solar concentration on the electrical behavior of photovoltaic devices.

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Date submitted: 14 Nov 2014 Electronic form version 1.4