Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Angle-Dependent Performance in Thin-Film and Transparent Photovoltaics[1] MARGARET YOUNG, YUNHUA DING, RICHARD LUNT, Michigan State Univ — Understanding the angle dependent performance is an important consideration for building integrated photovoltaics (PVs), such as transparent PV windows, where illumination angles are rarely at normal incidence. While the transfer matrix model (TMM) has been widely utilized to model optical interference and quantum efficiency in thin-film PVs at normal incidence, self-consistent simulations for PVs under oblique illumination have not yet been demonstrated. We derive an updated model that is self-consistent for all angles, light polarizations, and electrical / optical configurations, and experimentally verify the predicted angular quantum efficiency response of planar heterojunction (PHJ) transparent PVs. We subsequently use this model to optimize PHJ transparent PVs for maximum short circuit photocurrent density (J_{sc}) and transparency as a function of the multivariable landscape under a variety of optical and electrical configurations, showing that it is possible to greatly reduce the angle-dependent roll-off in efficiency by moving in this multi-parameter space. We will provide insights into the lesson learned for designing devices that can reduce this roll-off and increase overall yearly power output.

[1]This work was supported by the National Science Foundation (CAREER award, CBET-1254662). Computational resources have been provided by the Michigan State University High Performance Computing Center.

Margaret Young
Michigan State Univ

Date submitted: 11 Nov 2013 Electronic form version 1.4