

Wafer Integrated Microscale Photovoltaics

High-Efficiency PV Systems in High-Diffuse Areas

A. Tauke-Pedretti, B. Jared, G. Keeler, W. Sweatt, M. Saavedra, W. Miller, C. Alford, S. Paap, J. Mudrick, C. Sanchez, J. Barrios, G. Girard, V. Gupta, P. Resnick, G. Nielson, J. Cruz-Campa, M. Okandan, J. Nelson

Diffuse Light Collection

- *High efficiency concentrated photovoltaic (CPV) systems produce the most power in the smallest footprint*
- *CPV is only financially viable in geographic areas with lots of sunny days and little pollution, such as Albuquerque*
- *Sandia is working on new module architectures to make high efficiency photovoltaics viable in geographic areas with lots of overcast days, such as Seattle*



Photovoltaic array on a cloudy day

Microscale Photovoltaics



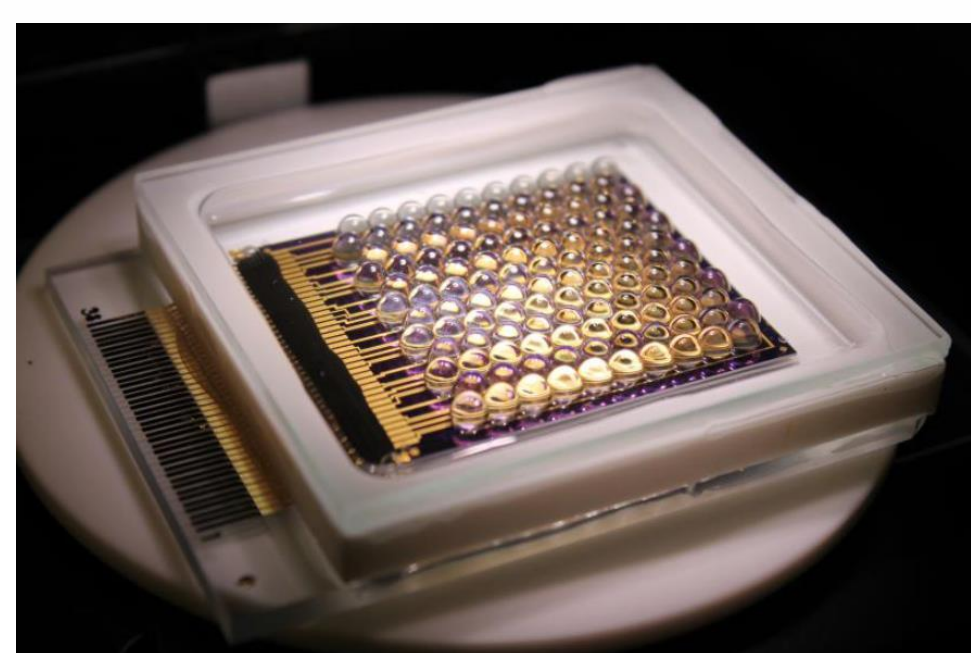
- *Reducing cell size from cm to sub-mm dimensions enables high-efficiency PV architectures with flat panel form factors*



Suncore CPV plant

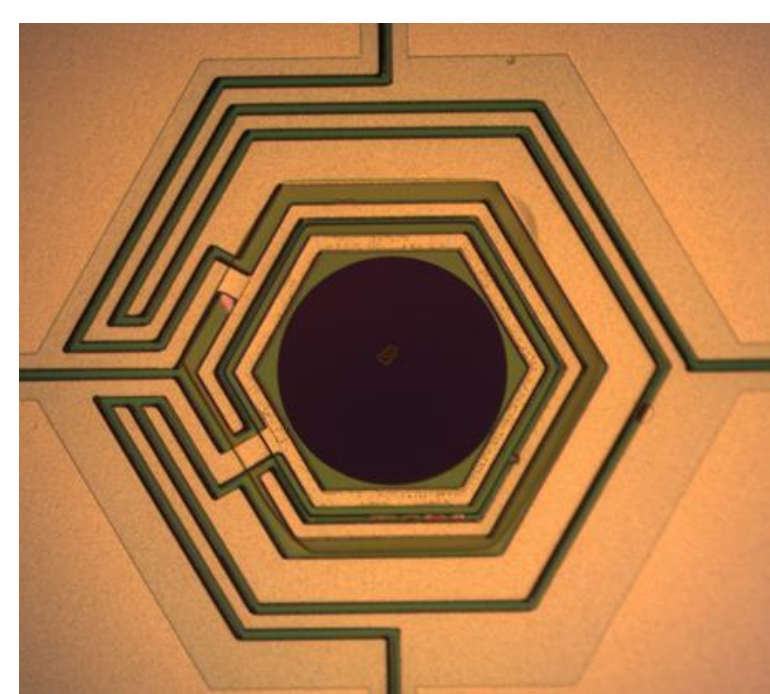


Flat panel photovoltaic module

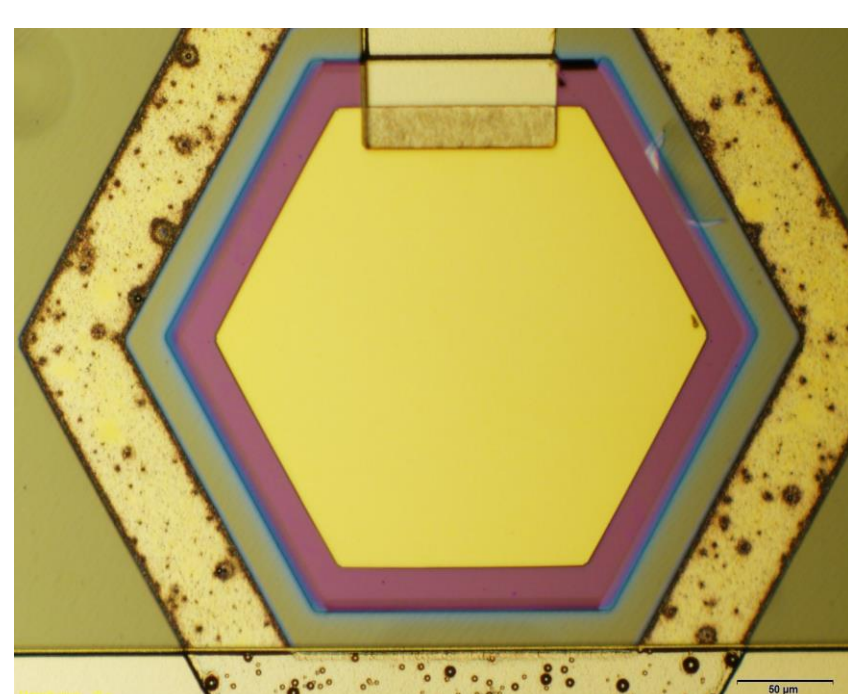


Sandia microscale PV module

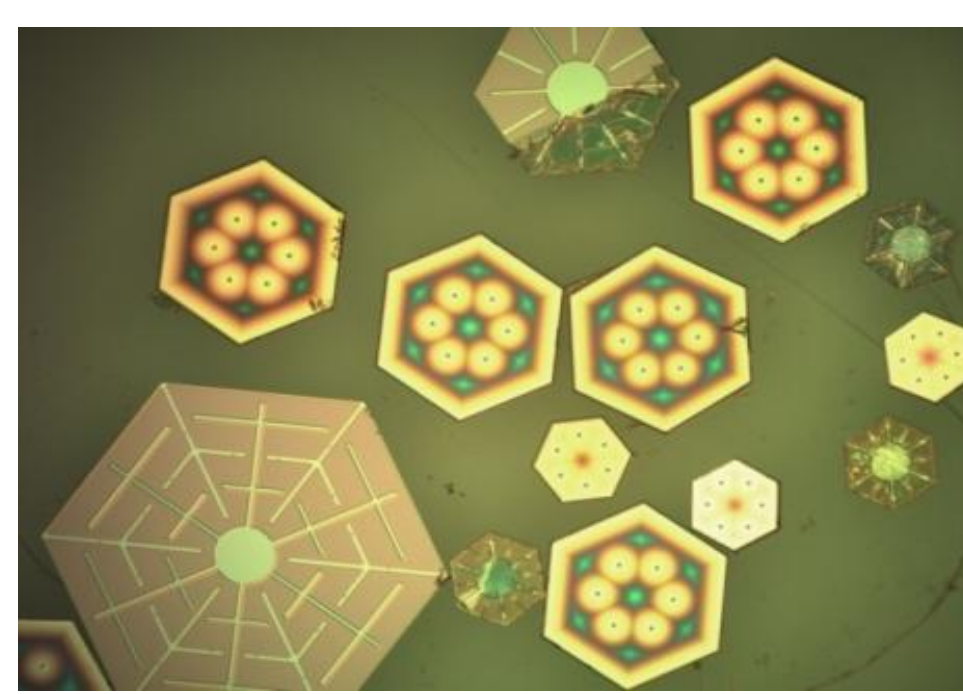
Sandia Microscale Photovoltaic Cells



GaAs/InGaP cell



InGaAs cell

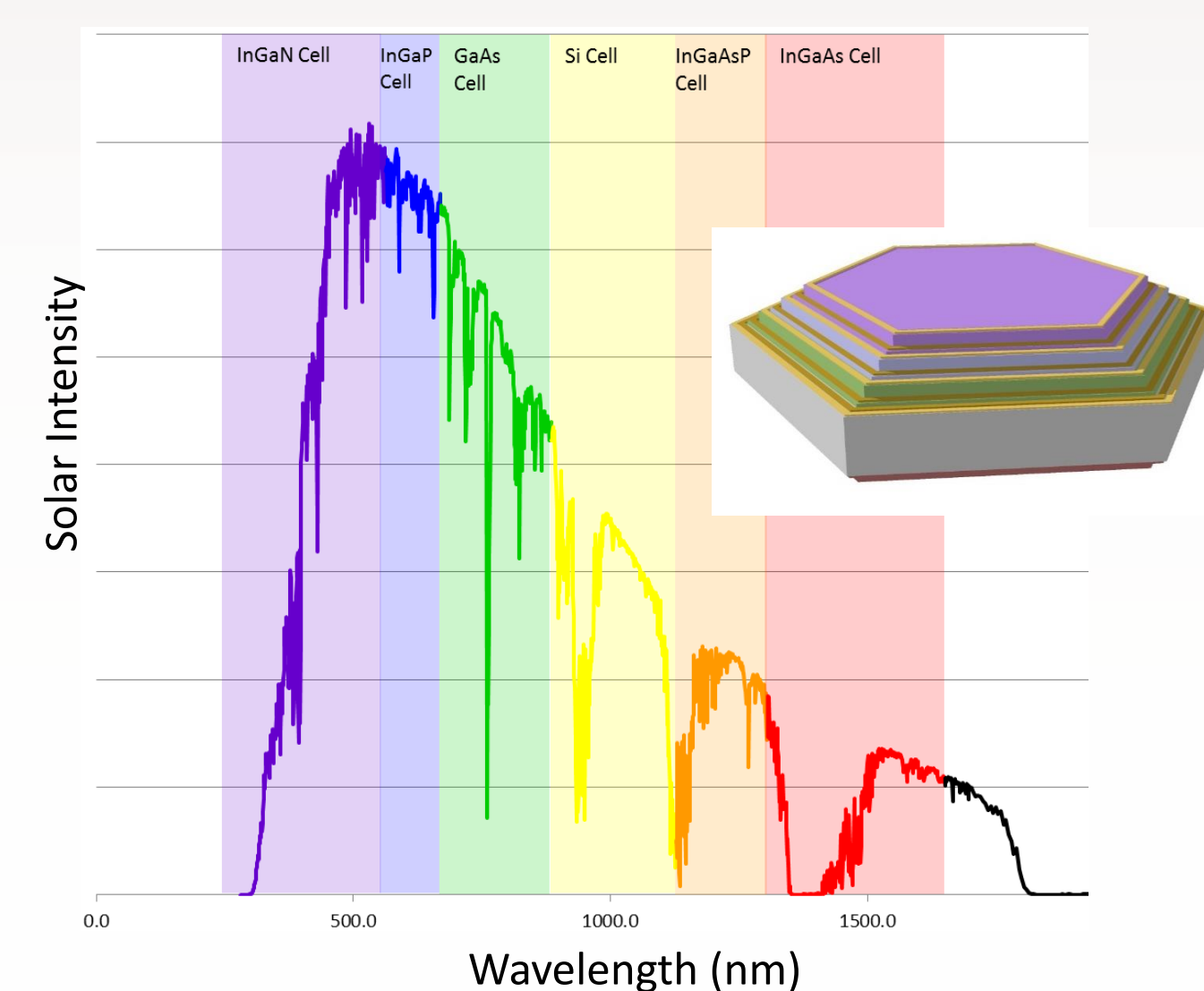
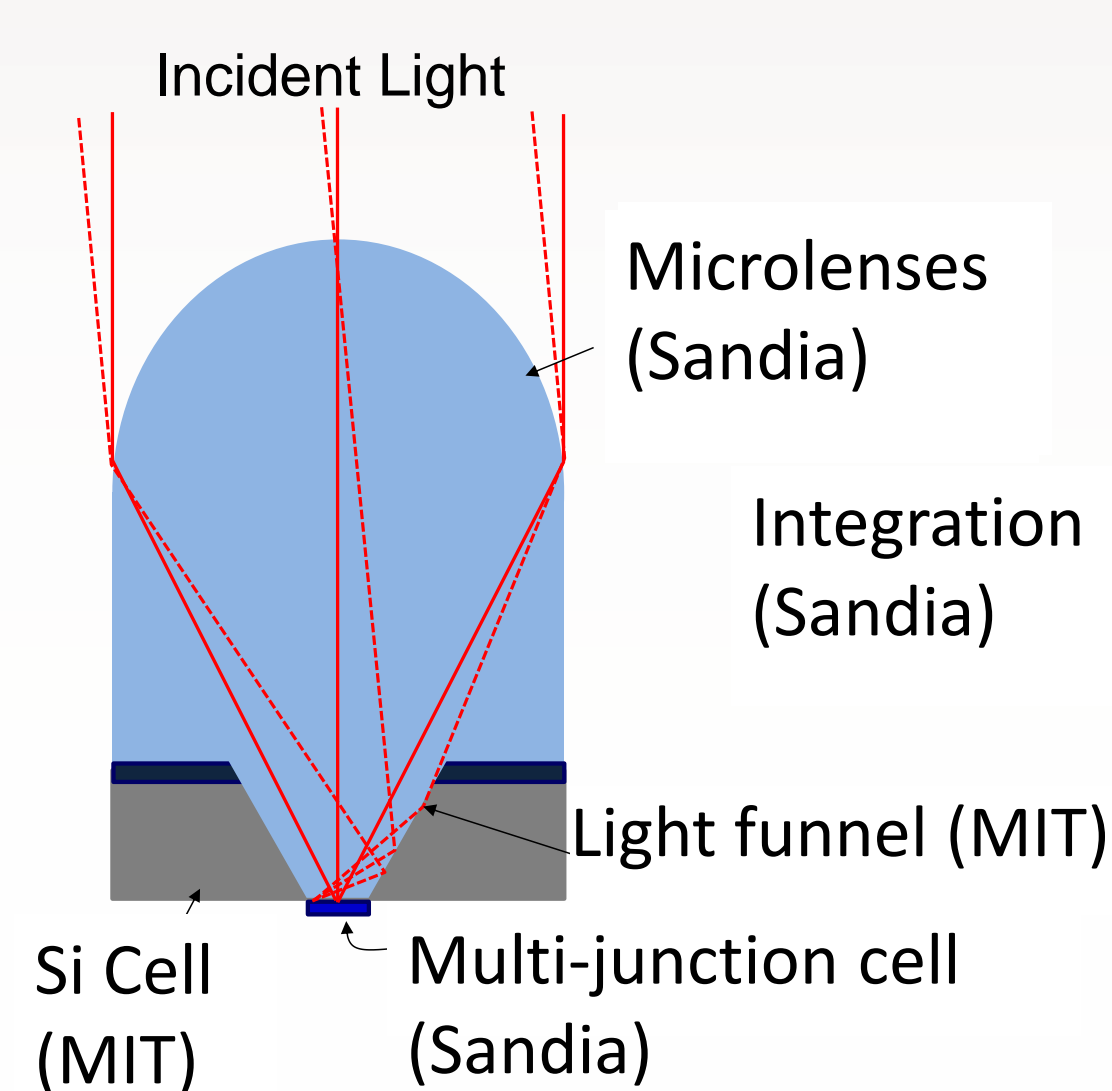


Si cell

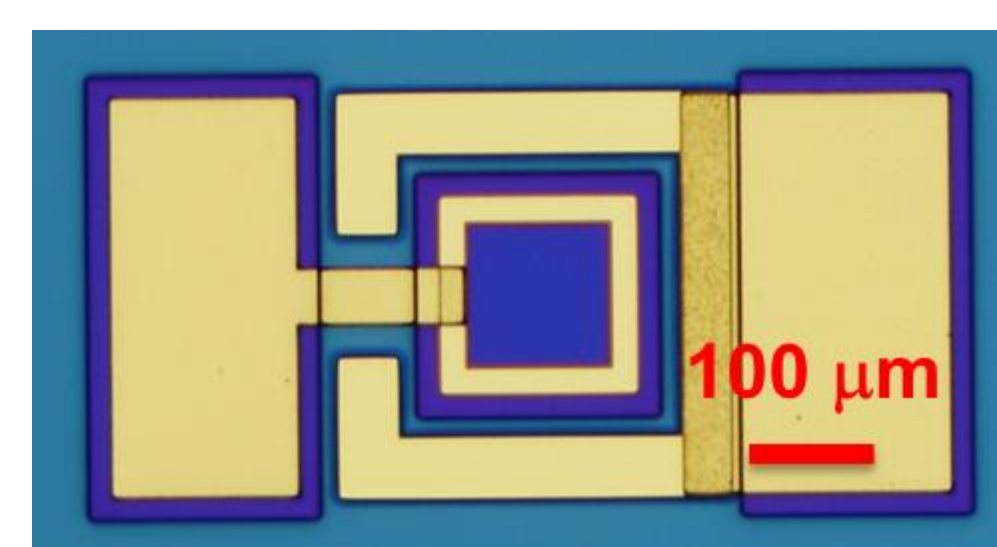
Wafer-integrated Photovoltaic System



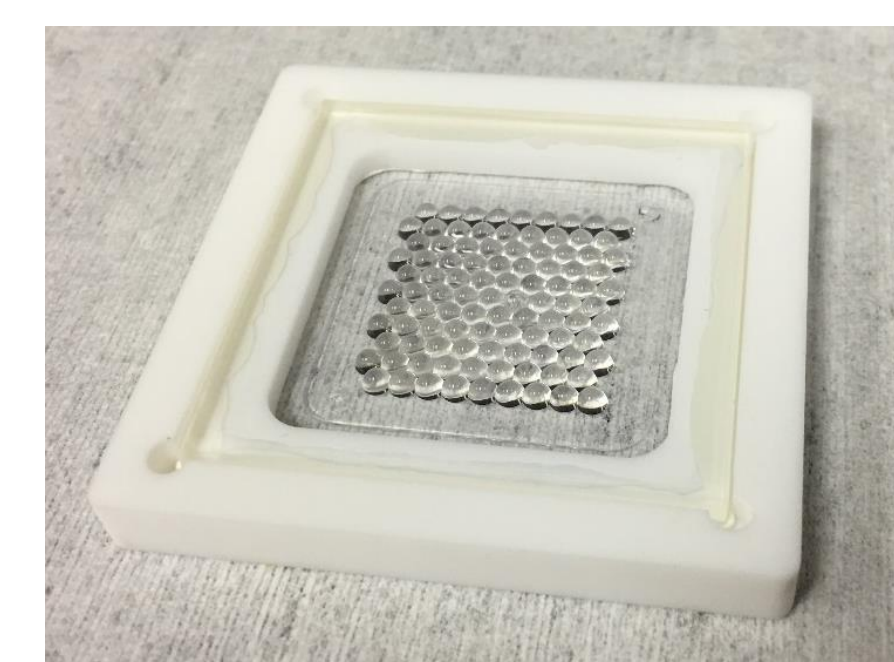
- *Si wafer platform enables a hybrid PV approach with:*
 - *Light funnel*
 - *Mounted III-V multi-junction cells*
 - *Si cell to collect light that escapes funnel*



- *Design, fabrication and characterization of microscale III-V cells in MESA*
- *Sandia's advanced manufacturing capability fabricates microlenses and assembles module*



Microscale GaAs/InGaP photovoltaic cells



Micro-optic assembly