Theoretical and Practical Limits for Transparent Photovoltaics
RICHARD LUNT, Michigan State University — Transparent photovoltaics (TPVs) offer a new paradigm for solar energy harvesting, integration, and deployment. These devices have recently been shown to be enabled by exploiting the excitonic nature of molecular and organic semiconductors. Here, we present the theoretical and practical efficiency limits of these novel electronic architectures as a function of bandgap, transparency and aesthetic quality for both single and multi-junction cells. For example, power-production from ultraviolet and near-infrared photons alone leads to a theoretical single-junction efficiency of 21% in completely transparent structures, compared to 33% for opaque-junctions. This approach for transparent photovoltaics will be contrasted with other semi-transparent approaches, where TPVs with selective absorption offer the highest possible potential for combined transparency and efficiency. The impact of transparent PVs will be discussed for a range of applications from electronic displays to window integration.