

**EPFL STI IMT-NE PV-LAB**

**Seminar**

**Friday 11th May 2012**

**MT 2 14.00**

Rue A.-L. Breguet 2, CH-2000 Neuchâtel

**Solar Cell Efficiency Enhancement via Light Trapping in Resonant Dielectric Sphere Arrays**

Jonathan Grandidier, Ph. D.  
California Institute of Technology  
1200 E California Blvd  
MC 128-95  
Pasadena, CA 91125

**ABSTRACT**

While texturing is commonly employed to improve light trapping in photovoltaics, thin film device quality often suffers when the active semiconductor material is directly textured. Resonant dielectric structures have recently been introduced, with promise for enhancing efficiency in photovoltaics. We report the experimental demonstration of efficiency enhancement of a flat thin film amorphous silicon solar cell by placing a monolayer array of resonant dielectric nanospheres on top. Freely propagating sunlight can diffractively couple into several modes within the array of wavelength scale dielectric spheres. Incident optical power is then transferred into the thin film cell by leaky mode coupling to the absorber layer. We experimentally demonstrate an enhancement of about 7% at normal incidence. We also report angle resolved measurements for the external quantum efficiency. This 2D colloidal crystal is fabricated using the Langmuir-Blodgett technique. The frequency-dependent absorption enhancement is strongly correlated with the excitation of the whispering gallery modes in the nanosphere array. Numerical simulations using 3D full field finite difference time domain (FDTD) methods support the proposed mechanism of measured efficiency enhancement. This work demonstrates a method of improving the efficiency in a flat solar cell, which can be adapted to many cell architectures and employed after device fabrication.