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# PHYSICS COLLOQUIUM 293

**Nanoparticle Solar Cells: Upconversion, Downconversion, Transport**

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## ABSTRACT

Recent research on nanoparticle solar cells will be reviewed. First, various implementations of the exciting downconversion mechanism of carrier multiplication will be reviewed. Second, a new paradigm will be proposed to further boost the energy conversion efficiency, the implementation of the leading up conversion mechanism called intermediate band mechanism. It will be argued that recent experiments by the Los Alamos group have brought this implementation tantalizingly close. Finally, the charge transport in nanoparticle systems will be analyzed. An atoms-to-devices hierarchical model has been developed to simulate transport. A quantitative agreement with FET transport experiments will be demonstrated. Then the metal-insulator transition will be analyzed. Time permitting, percolation and commensuration effects will be discussed as well.

## BIO:

Gergely Zimanyi got his Ph.D. in Hungary, studying Anderson localization and the Kondo effect. In the US, he was an IBM postdoc where he developed an early model for high Tc superconductivity, and studied dissipative Josephson junction arrays. After joining the UC Davis faculty, he studied cold atom problems and vortex physics in high Tc materials. In the last ten years, he focused on Energy Science. He works with Toyota to develop better permanent magnets. His primary research project focuses on nanoparticle solar cells. Finally, very recently he invented photovoltaic desalination.