

- Seminar Series on Current Developments in Condensed Matter Physics •

Nanophotonics for renewable energy applications

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4:15pm-5:30pm

The Graduate Center / CUNY

365 5th Avenue, New York, NY

Room #6421

Abstract

Nanophotonics is an emerging field that can be utilized to mold the flow of light on a single chip. Recently, nanophotonics has found very interesting applications in telecommunications, next generation photovoltaics, biophotonics and medical imaging. In this talk, I will first talk about basic physics of nanophotonics, especially photonic crystals and its analogy to electrons in solid state semiconductors. After giving an introduction on the available renewable energy sources on earth, I will talk about next generation solar cells utilizing photonic crystals, and our recent research on optoelectronic properties of composite (structurally designed) materials at *nm* scale for the applications on energy related materials and devices. Utilizing current microelectronics technology and measurement techniques, it is possible to study these novel energy related materials and devices in ways that were unimaginable a decade or two ago. In order to improve next generation thin film solar cell efficiency (2nd generation solar cell), we have developed a new light-trapping scheme that can tremendously enhance optical path length and make light almost completely absorbed at AM1.5 solar spectrum by using novel photonic materials structure on the backside. It makes incident light strongly bent and reflected almost parallel to the surface of the absorption layer, hence the optical path length can be enhanced more than two orders of magnitude longer than that obtained by conventional light trapping schemes. Furthermore, it provides extremely high reflectivity with large omnidirectional bandgap over several hundred nanometers in the solar spectrum range. As a result, the overall efficiency of the solar cell based on our photonic structure is improved significantly. Lastly, I will talk about many potential challenges and future work to be pursued in clean energy fields that require good control of photons and electrons at nanometer scale. This capability can efficiently convert sunlight energy to electricity and meet our demand for clean and renewable energy in the future.

Yasha Yi recently joined CUNY-CSI with interests on nanophotonics and its various applications to renewable energy, biology, and telecommunications.

This talk is part of a Fall 2009 series of Thursday seminars held at The Graduate Center CUNY.

The series will address current developments in condensed matter physics.

Sponsors: College of Staten Island and Ph.D. Program in Physics, Graduate Center / CUNY

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