Physics
AT QUEENS COLLEGE

Colloquium Notice

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Nanophotonics for next generation photovoltaics and renewable energy applications

Nano-scale photonics is one of the key components in future clean renewable energy, which plays the central role in next generation photovoltaics and solar cells. 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(2^{nd} 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.

Monday
May 3, 2010
Starts at 12:15 PM
Coffee at 12:00 PM
Physics Conference Room, SB B326