MESTRADO EM FÍSICA
(Perfis: Física Fundamental e Física Aplicada)

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Proposta de tese

Título/Tema: Light Trapping in Plasmonic Solar Cells

Orientadores: Anura Samantilleke and Mikhail Vasilevskiy

Objetivos: To design plasmonic nanostructures to couple incident sunlight into localized resonant modes and propagating waveguide modes of an ultrathin semiconductor for enhanced photocurrent conversion in thin film solar cells.

Resumo: Subwavelength nanostructures enable the manipulation of light in nanoscale dimensions. By controlling and designing the complex dielectric function and nanoscale geometry, the coupling of light into specific active materials can be controlled, and macroscale properties such as reflection, transmission, and absorption can be tuned. Applying the methods of nanophotonics to solar cells allows for the possibility of shrinking the absorbing layers while maintaining high levels of absorption, which enables higher efficiency, low cost, stable photovoltaic devices. Light trapping is particularly critical for thin-film amorphous Si (a-Si:H) solar cells, which must be made less than optically thick to enable complete carrier collection. By enhancing absorption in a given semiconductor volume, devices with high efficiencies may be achieved with less than 100 nm of active region. In this thesis we will explore the use of designed plasmonic nanostructures to couple incident sunlight into localized resonant modes and propagating waveguide modes of an ultrathin semiconductor for enhanced photon-to-current conversion. We will then integrate plasmonic nanostructures with thin film solar cells in order to explore the enhancement of photocurrent by designed nanostructures.

Ref: Plasmonic solar cells, Catchpole and Polman, OPTICS EXPRESS Vol. 16, No. 26 pp. 21793,