"Light trapping schemes using Mie resonators for ultrathin film Si solar cells"

2 positions

Project description:
Si solar cells continue to dominate the PV market. To have a far-reaching impact, new innovations in thin film Si solar cell technology that enable minimal material usage and lower manufacturing costs without compromising cell efficiency are necessary. The production cost for a crystalline Si (c-Si) solar cell is mainly determined by the thickness of the c-Si wafer. In recent years, light trapping schemes for Si thin film solar cell (10 µm and less) technologies are being intensely investigated. The central issue is to maximize light absorption when the cell thickness reduce by an order of magnitude compared to the bulk single junction solar cells. The project investigates Si nanodisk Mie resonators to provide unique ways for broadband antireflection, resonant absorption and Lambertian light scattering to enhance the overall absorption in the solar cell.

The work will focus on electromagnetic design and simulations of surface Mie resonator arrays to provide broad-band antireflection and near-Lambertian light scattering in the visible-NIR. This will include detailed analysis of wavelength dependent light scattering from Mie resonators and the effect of back mirrors. Importantly, the electromagnetic (light trapping) effects are combined with electrical properties to evaluate solar cell performance in realistic device geometries (pn junction, film thickness etc). The design and simulation work is performed using the Lumerical software tools. The experimental part of the work will focus on validation of light trapping by spectrometry using structures which optically mimic the device structure.

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