“Light absorption in perovskite and silicon solar cells”

Lecturer:

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University:

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Area:

Nanophotonics for photovoltaics, surface plasmons, light trapping, novel materials for photovoltaics, solar fuels.

Abstract:

The global photovoltaic market is worth $100 billion, and is completely dominated by crystalline silicon. In order to take advantage of the decades of development of silicon technology and massive economies of scale that have been developed, it makes sense to develop the technology to the highest efficiencies possible. To do this, it is essential that optical losses are minimised. We show that nanostructured black silicon in conjunction with metal nanoparticles and a diffuse reflector can provide excellent anti-reflection and light trapping. There is also increasing interest in combining emerging materials such as perovskites with silicon to form high efficiency tandems. For such tandems, sophisticated designs that minimize optical loss are crucial in order to go beyond the break-even point, and to realize the potential of the high bandgap material. We show that current levels of optical losses lead to required top-cell efficiencies of 18% at a bandgap of 1.5eV just to break even and 23% to reach tandem efficiencies of 30% and we outline pathways to increase the efficiency beyond 30%. We also use spectrally-resolved photoluminescence to determine the absolute value of the band-to-band absorption coefficient perovskite methylammonium lead iodide, extending the range of absorption data for this material by 14 orders of magnitude.

Biography:

Kylie Catchpole is Associate Professor at the Centre for Sustainable Energy Systems in the Research School of Engineering at the Australian National University. She was previously a post-doctoral fellow at FOM Institute AMOLF, in the Netherlands, and at the University of New South Wales. A/Prof. Catchpole's research focuses on plasmonics and nanophotonics for solar cell and solar fuel applications, as well as new materials for solar cells. Her work on plasmonic solar cells was named as one of the top 10 emerging technologies in 2010 by MIT Technology Review. She has published over 80 papers, and her work has also been featured in the news sections of Science magazine and The Economist. She has been invited to give talks at over 30 international scientific conferences and workshops. In 2015 she was awarded the John Booker Medal for Engineering Science from the Australian Academy of Science.