A Spectrum of Semiconductor Photodetectors: from Nanowire Terahertz Sensors to Perovskite Solar Cells

Semiconductor devices that convert light into an electrical signal have over the last 60 years revolutionised our way of life. From active pixel arrays in mobile phone cameras to solar panels, silicon technologies dominate detection and conversion of visible light. To access infrared photons used in low-loss optical fibre communications or to collect low energy photons in multi-junction solar cells Group III-V alloys such as InGaAs and InGaAsP are utilised. The performance and maturity of these existing technologies are impressive so new materials and devices must offer significant benefits to be viable alternatives. In this seminar I will discuss recent progress on two novel semiconductor systems: nanostructured conventional semiconductors for accessing underexploited parts of the electromagnetic spectrum and thin film perovskite semiconductors for efficient multi-junction solar cells. I will describe how the unique properties of Group III-V semiconductor nanowires [1] have enabled us to develop a compact detector [2] for far infrared (terahertz frequency) light [3]. In the area of photovoltaics, a decade ago using the technique of vapour deposition, we developed the first efficient planar heterojunction solar cell based on metal halide perovskite solar cells [4,5]. I will introduce this method, outline recent progress and highlight the challenges we still face in developing stable high-efficiency solar cells via this method.