Professor Alison Walker: The Power of Light

It is easy to underestimate the degree of scientific and engineering sophistication in some of the devices that we now take for granted. Light emitting diodes (LEDs) are now in our CD players, mobile phones, our TVs and increasingly replace ordinary incandescent bulbs. According the Prof. Walker, we may even get to replace our wallpaper with a plastic layer glowing with mood-suiting gentle light. Last year's LEDs are small, hard bulbous devices: this year's and next year's "organic" LEDs are thin, flexible sheets that can generate light if you attach them to a voltage source. Every time we start to take LEDs for granted, new technical developments open new options. We probably cannot image the range of applications that will begin to appear when these devices become cheap and reliable

There, of course, is the rub. The older LEDs - the ones we are starting to take for granted - are becoming cheap, they last for a very long time and are extremely efficient at converting electricity into light. Newer developments have yet to meet all of those technical challenges at the same time. We can hope that they will - but there may be fundamental problems. (For example, the molecular structure of the organic LED material may be damaged by the high energy blue photons it is itself generating.)

Solar cells are the exact reverse of LEDs: you put light in and get electricity out. In fact, some of the new generation of materials will work in both directions. Once again, older photovoltaic cells are becoming cheap and efficient and are well on the way to being taken for granted. We are beginning to forget their disadvantages (inflexible, and they quickly loose efficiency if they are angled away from the Sun). The new PV materials are better in some respects, but worse in others, and without high-volume sales may not get the economies of scale required to make them cheap, or the research input needed to make them reliable...but until they are cheap and reliable they will not get the high volume sales.

I would have liked to hear more from Prof. Walker on the fundamental science underlying these devices, rather than a survey of different type of device and what we might do with them if..... Without this, I found it difficult to judge whether present difficulties are likely to be overcome or whether the recent developments are likely to be physics curiosities confined to niche applications. Nevertheless, one cannot help thinking about all the things one might construct from light, flexible light-emitting materials.

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Professor Walker's well illustrated lecture covered the developments taking place in both the conversion of solar light to power using photovoltaic (PV) cells and the use of light emitting diodes (LEDs) to produce light efficiently from an electrical power source. The lecture covered both of these aspects: the strengths and weaknesses of existing PV methods of converting solar energy to produce electrical power and the evolution of new techniques to produce light efficiently by means of LEDs.

Apart from their use as energy efficient lights in domestic and commercial environments LEDs are now found in CD players, mobile phones and TVs. According to Professor Walker we may even get to replace our wallpaper with a plastic layer glowing with mood-suiting gentle light. The lecture dealt with the various formats in which the whole light to energy and energy to light conversion process is being researched. This covered the research and development of Organic Light Emitting Diodes (OLEDs), Hybrid (organic-inorganic) Perovskite Solar Cells (PSCs) and Organic Solar Cells (OSCs).

The older LEDs are now becoming cheap, last for a very long time and are extremely efficient at converting electricity into light. Newer developments have yet to overcome all the technical challenges at the same time. For example, the molecular structure of the organic LED material may be damaged by the high energy blue photons it is itself generating.

The lecturer demonstrated the effectiveness of a small thin film solar cell in powering a miniature fan and discussed the pros and cons of PV cell developments. Whereas traditional PV installations suffer from the disadvantages of inflexibility and inefficiency when angled away from the sun they have the advantage of cheapness and have proven capabilities. On the other hand, the newer PV materials are better in some respects, but worse in others, and without high-volume sales may not get the economies of scale required to make them cheap, or the research input needed to make them reliable.

In sum, the lecture drew attention to the fascinating advances in the range of opportunities that may arise as new materials are developed.