

30 million years ahead - how the butterfly beat technology to it

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Butterflies have evolved a unique mechanism to create a dazzling display of colour which puts physicists in the shade. Modern light emitting devices have traditionally been inefficient because most of the light created can't escape, but now in a paper published in *Science*, University of Exeter scientists have discovered the butterfly has been doing what physics couldn't, for more than 30 million years.

Image: Peter Vukusic. (Copyright: University of Exeter)

In order for LEDs (light emitting diodes) to function efficiently physicists have spent years analysing their design to come up with features which help to maximise the amount of light released. These

include a specialised mirror to reflect light and micro holes which stop light from being trapped inside the device or from spreading sideways.

But it seems anything we can do nature can do better. When Dr Pete Vukusic studied African Swallowtail butterflies he found the creatures had evolved to include exactly these adaptations. This butterfly emits blue-green light, which it uses for signalling, using a fluorescent pigment on its wings.

Dr Pete Vukusic, of the School of Physics said: "It's amazing that butterflies have evolved such sophisticated design features which can so exquisitely manipulate light and colour. Nature's design and engineering is truly inspirational. Pigment on the butterflies' wings absorbs ultra-violet light which is then re-emitted, using fluorescence, as brilliant blue-green light. This adds to the colour intensity of the wing. Much of this light would be lost, resulting in a much duller effect, but the pigment is located in a region of the wing which has evenly spaced micro-holes through it."

He continues: "The function of the micro-scales is identical to those in the LED; they prevent the fluorescent colour from being trapped inside the structure and from being emitted sideways. The scales on the wing also have a specialised mirror underneath them, again very similar in design to that in the LED. This mirror upwardly reflects all the fluorescent light that gets emitted down towards it. The result is a very efficient system for fluorescent emission that gives the butterfly significant control of the direction in which the light is emitted."

Source: University of Exeter

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