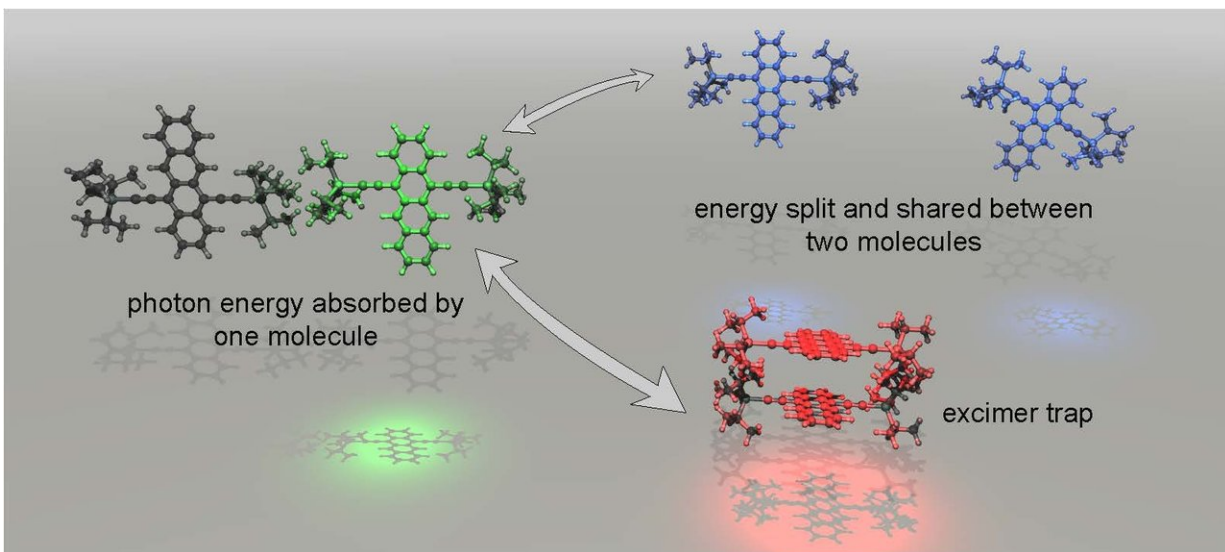


Pathway opens to minimize waste in solar energy capture

January 22 2018



Photon energy splitting is done directly by two molecules, not via an excimer state (in red). Singlet fission materials must avoid excimer formation to reach full potential in enhancing photovoltaic energy conversion. Credit: Professor Timothy Schmidt

Researchers at the ARC Centre of Excellence in Exciton Science have made an important discovery with significant implications for the future of solar cell material design.

The team, led by Professor Timothy Schmidt at UNSW, has been looking at ways to capture the [energy](#) of visible light that is currently

wasted due to the limitations of silicon, which is only able to access approximately 25% of the [solar spectrum](#). To illustrate, silicon on its own is only able to use of about half the energy of green light, which is the peak of the solar spectrum in terms of energy availability.

One of the ways to reduce this waste is through the design of materials that can be coated on top of silicon to capture some of the energy of light that silicon cannot. By incorporating singlet exciton fission, a process that generates two excitons from a single photon, it is hoped that [silicon solar cell](#) efficiencies can be boosted beyond 30%.

The work, published in *Nature Chemistry*, examines the role of a short-lived (~8 billionths of a second), excited molecular complex called an excimer in singlet exciton fission and overturns previous thinking by demonstrating that these singlet fission materials must avoid excimer formation to reach full potential in enhancing photovoltaic energy conversion.

Professor Schmidt explains, "As we look to find ways to bring down the cost of [solar energy harvesting](#), we should be designing materials that avoid excimer formation."

"Singlet exciton fission has enormous promise for improving the efficiency of solar cells, but its dynamics are complex and not well understood. By comparing the fission process when it is run both forwards and in reverse, Schmidt, et al. have performed a remarkably simple test of theories for the mechanism of [exciton](#) fission" comments Professor Marc A. Baldo, member of the Centre's International Scientific Advisory Committee and Director of the Center of Excitonics at MIT.

"Their result suggests that what had previously been considered as an intermediate in the [fission](#) process may in fact be a source of loss. With

this understanding Schmidt, et al. propose an important new direction in our search for materials that enable higher efficiency solar cells."

More information: Endothermic singlet fission is hindered by excimer formation, *Nature Chemistry* (2018).

[nature.com/articles/doi:10.1038/nchem.2926](https://www.nature.com/articles/doi:10.1038/nchem.2926)

Provided by ARC Centre of Excellence in Exciton Science

Citation: Pathway opens to minimize waste in solar energy capture (2018, January 22) retrieved 9 April 2024 from <https://phys.org/news/2018-01-pathway-minimize-solar-energy-capture.html>

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