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How not to overestimate exciton diffusion: a novel tool for more accurate results

Uncoupling exciton diffusion from exciton-exciton annihilation in the organic semiconductor Y6

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Energy transfer is at the core of photosynthesis, enabling the photons absorbed from the sun to move in the form of excitons to the reaction centre, where charges are separated. Similarly, in Organic Photovoltaics (OPVs), understanding the spatial dynamics of nanoscale exciton transport beyond the temporal decay is essential for further improvements in the morphology of the devices. Nowadays, OPVs reach power conversion efficiencies of over 19%, which could be increased up to 25% in cells designed with materials exhibiting optimized characteristics. Among the most promising materials utilized today for OPVs, a special place is occupied by the non-fullerene electron acceptor Y6.?

Y6 exhibits a high exciton diffusion coefficient, which is a key-parameter for the optimization of OPVs. However, the exciton diffusion competes with fast singlet-singlet annihilation (SSA) and the OPV diffusion is often overestimated as the two are hard to disentangle.

ICFO researchers **Giulia Lo Gerfo Morganti**, **Dr. Luca Bolzonello** and **ICREA Prof at ICFO Niek van Hulst** (Molecular Nanophotonic Group), in collaboration with **Francisco Bernal-Texca** and **UPC Prof at ICFO Jordi Martorell** (Organic Nanostructured Photovoltaics), all part of the **Clean Planet Program**, have **developed a method able to decouple the exciton diffusion coefficient from SSA**. This way they correctly determined the diffusion coefficient in a Y6 film to be D = 0.017 ± 0.003 cm2 /s, which gives a Y6 film diffusion length of L = 35 nm.

This new tool enables a **direct and free-of-artefacts determination of diffusion coefficients, which researchers expect to be pivotal for further studies on exciton dynamics in energy materials.**

Such collaborative efforts lie at the heart of ICFO's Clean Planet Program, which brings together researchers from a variety of energy-related disciplines. Working together enables them to explore new scientific directions, potentially leading to the development and use of novel renewable energy technologies.

The study has been published in **The Journal of Physical Chemistry Letters** and the Graphic Art representing their paper is featured in the Front Cover of the corresponding issue.