

To hop or not to hop? Unravelling the role of disorder on charge and exciton transport in functional organic semiconductors

S. Athanasopoulos

Departamento de Física, Universidad Carlos III de Madrid, Avenida Universidad 30, 28911 Leganés, Madrid, Spain

e-mail: astavros@fis.uc3m.es

Organic materials combine the processing and mechanical advantages of plastics with the electrical properties of semiconductors and can pave the way towards environmentally sustainable electronics. Despite being disordered in nature and far from having the well defined structural organisation of inorganics, organic materials have found a wide range of applications in the electronics and display industry and have an immense commercial potential.

In this talk, I will highlight the importance of understanding the transport properties of charged and neutral excitations for improving the efficiency of organic devices such as solar cells, OLEDs, transistors and sensors. I will further present examples of unravelling the role of disorder by performing computer experiments. Monte Carlo simulations are put on test against spectroscopic experiments and analytical theory, when available, to describe temperature dependent diffusion of excitations that couple by short- or long-range interactions in both equilibrium and at non-equilibrium conditions. I will lay emphasis on how charges, singlet and triplet excitons diffuse by hopping in polymeric and molecular organic materials with an aim to obtain a unified description of their transport properties. I shall conclude by discussing some issues related to the dynamics of charge separation and recombination in organic photovoltaic blends.