

Department of Physics

Condensed Matter Physics

Clarendon Laboratory, Parks Road, Oxford OX1 3PU



CONDENSED MATTER SPECIAL SEMINAR

Thursday 13 December at 2.15pm

“Terahertz Spectroscopy of Organic Semiconductors”

Prof Natalie Banerji

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While transient absorption (TA) spectroscopy gives information about the population of photogenerated excitons and charges, both the population and short-range mobility of charge carriers determines the photoconductivity dynamics in optical-pump-THz-probe (OPTP) measurements. By combining both techniques, the evolution of only the mobility at different times after photoexcitation can be extracted. This is then further substantiated by the mobility and localization parameters obtained from analyzing the real and imaginary parts of the complex photoconductivity spectra at selected time delays with an appropriate model. Here, we have undertaken such a study with pBTTT:PCBM blends having controlled phase morphologies, which are excellent model systems to study the charge carriers in organic photovoltaics (OPVs). We can thus follow changes in the short-range mobility as the charges evolve between different neat and intermixed regions of the blend.

Moreover, we have investigated thin films of a narrow-bandgap conjugated polyelectrolyte, which was shown to become self-doped (conductive) upon dialysis treatment. The doping is directly evident in the absorption spectrum, where a polaron band appears around 1200 nm. Charges are thus present in the ground state and we have investigated their short-range mobility properties using time-domain THz spectroscopy (TDTS, without need of photoexcitation). Those are compared to the carrier properties of photo-generated charges in blends of the corresponding non-ionic polymer backbone with PCBM. We have also carried out TA spectroscopy in solutions and thin films of the doped system, with pumping in either the excitonic or the polaronic band. Surprisingly similar, correlated and very short-lived dynamics were observed. All data was compared to un-doped reference systems and the fluence-dependence was recorded. This brought novel insights to the electronic structure of doped conjugated polymers.

Host: Dr Moritz Riede

Audrey Wood Seminar Room, Clarendon Laboratory