



## **NECEM Seminar: Terahertz Spectroscopy of Organic Semiconductors**

**Dr Natalie Banerji, University of Bern, Switzerland**

**14:00pm-15:00pm, 14th December**

**Robert Boyle Lecture Theatre G.42, Ground Floor Armstrong Building, Newcastle University**

**Refreshments available after the seminar**

### **Abstract**

#### **Terahertz Spectroscopy of Organic Semiconductors**

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.

## Dr Natalie Banerji Biography



Natalie Banerji is a Full Professor of Physical Chemistry at the University of Bern since 2017. She studied organic and hybrid materials using ultrafast spectroscopy, in view of solar cell and bioelectronic applications. In 2016, she was awarded an ERC Starting Grant. She studied Chemistry at the University of Geneva and obtained her Ph.D. in 2009 (with Prof. E. Vauthey). She then moved to the University of California at Santa Barbara during a post-doctoral stay with Nobel Laureate Prof. A. J. Heeger. In 2011, she started her independent career at the Ecole Polytechnique Fédérale de Lausanne (EPFL) with an Ambizione Fellowship by the Swiss National Science Foundation (SNSF). She obtained an SNSF-Professorship at the University of Fribourg in 2014 and was nominated tenured Associate Professor in 2015. She was President of the Chemistry Department in Fribourg from 2016-2017.

## Seminar Venue: Robert Boyle Lecture Theatre G.42, Ground Floor Armstrong Building, Newcastle University

