Near-field terahertz spectroscopy of organic semiconductors

Organic materials have attracted great interest over the years for their unique characteristics and potential in optoelectronic applications - for example as organic transistors, organic light emitting diodes and organic solar cells. In comparison with inorganic devices, their organic counterparts are lightweight, flexible and inexpensive. Consequently, a lot of efforts are dedicated to increase the efficiency and stability of these materials.

We have recently developed a unique near-field microscope that can generate and detect radiation in the deep infrared region of the electromagnetic spectrum, i.e., the terahertz (THz) frequency range. This microscope can detect the time dependent free carrier absorption of materials after photo-excitation with ultrashort optical pulses and with subwavelength spatial resolution, which allows to determine the carrier mobility and free carrier density.

In this project we will investigate the properties of organic semiconductors using THz near -field microscopy and, more specifically, how these properties can be modified and enhanced using resonant (nanophotonic) structures, which can interact with the semiconductor. The impact of this research is in improving the performance of organic opto-electronic devices using novel nanophotonic concepts and to use THz microscopy to characterize this improvement.

Skills that you will acquire: working with (ultra-fast) laser systems and THz systems, performing high precision optical measurements, analyzing these measurements and obtaining information to decide further steps to improve the behavior of organic semiconductors and optoelectronic devices.

If you are interested in this project, please contact Prof. Jaime Gomez Rivas (j.gomez.rivas@tue.nl) or Stan ter Huurne (s.e.t.t.huurne@tue.nl).