

Project 4.5. Optical imaging of single dye molecules in crystalline matrices

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Webpage of the group: <http://www.ifpan.edu.pl/ON-2/on21/kozank.html>

Background:

Optical detection and spectroscopy of single organic dye molecules, developed since 1989, provided invaluable information about the heterogeneity of the nano systems. A wealth of the new information provided by this technique cannot be obtained by traditional ensemble-averaged methods. One of the important parameters that can be probed is imaging of a single molecule orientation. The experimental methods relate experimentally observed electronic transition dipole moment between the S_0 and S_1 states of a molecule to the orientation of this molecule axes. Typical experiments are performed at room temperature using a confocal microscope equipped with an oil immersion, high numerical aperture objective. In the proposed project several crystalline samples will be located in the diffraction limited focus of a confocal objective illuminated by X-polarized light in which the low-angle rays are removed by an annular mask. The resulting confocal intensity patterns will inform about orientation of the transition dipole moment of a dye molecule in respect to the X, Y or Z axes of a host crystal.

Aim:

1. Precise determination of orientation of dopant molecules in respect to the host crystal axes.
2. In guest/host systems, where the crystal structure induces high dipole moment on a doped molecule (like in cases of Tr and DBT in a 2,3-DBN crystal) the response to external electric field will be studied.
3. Collaboration with the single-molecule group of the University of Leiden, the Netherlands, is planned.

Requirements:

- Master diploma in physics, chemistry or photonics (electronics).
- Preferred research experience in experimental optical spectroscopy;
- Sufficient proficiency in English to read scientific papers;
- Good skills in programming will be valuable;