

Parabolic mirror nanooptics group

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Scientific interests:

1. Optoelectronic materials

- Morphology-related photophysics properties (exciton diffusion, charge transfer, photocurrent and etc.) and photodegradation of organic semiconductor systems.
- Molecular orientations and orders in small molecule semiconductor crystals
- Plasmon - polariton coupling in metal/semiconductor hybrid systems.
- Optical electronic properties of graphene sheet.

2. Plasmonics

- linear- and non-linear-optical properties of plasmonic nanostructures
- Optical imaging of plasmonic nanoparticles with confocal and SNOM.

Expertise:

1. Scanning near-field optical microscopy (SNOM, Tip-enhanced Raman/fluorescence)

- Hands on skills of building/adjusting confocal and high-resolution optical microscopes
- Hands on skills of building tip scanning heads based on shear-force or tunneling feedback
- High resolution linear or nonlinear optical imaging
- Simultaneous topography, fluorescence and Raman imaging with down to 10 nm optical resolution
- High resolution fluorescence life time imaging in progress
- Integrating further multifunctions, such as scanning photocurrent microscopy.

2. Confocal optical microscopy

- Hands on skills of building/adjusting microscope
- Higher order laser polarizations (Radial, azimuthal and linear polarizations)
- Polarized excitation spectroscopy and microscopy
- Angle resolved emission spectroscopy and microscopy
- Fluorescence and Raman imaging with diffraction limited optical resolution

Sample systems:

1. Morphology (local order, orientation, domain sizes and etc.) related properties of organic conjugated molecules

- Pentacene, perylene, and their derivatives
- Poly(3-hexylthiophene-2,5-diyl) (P3HT), Poly[2,1,3-benzothiadiazole-4,7-diyl[4,4-bis(2-ethylhexyl)-4H-cyclopenta[2,1-b:3,4-b']dithiophene-2,6-diyl]] (PCPDTBT), Phenyl-C61-butyric acid methyl ester (PCBM) and their derivatives

2. Plasmonics

- Wet-chemistry synthesized nanoparticles (e.g. spheres, rods, dendrite, 'flowers')
- Fabricated nanostructures (e.g. Nanocones, nanotriangles, nanopillars, dimer nanoantennas).

3. Hybrids

- Organic/metal hybrids (e.g. semiconductor film/plasmonic nanostructures or tips)
- Inorganic/metal hybrids (e.g. CdSe/plasmonic nanostructures or tips)
- 4. Other interesting systems**
- Quantum dots (CdSe, CdS, Core-shell)
- Graphene (e.g. n-doped)

Lab facilities:

1. Home-built tip-enhanced optical microscopes (ambient)
2. Home-built Shear-force scanning head
3. Home-built Tunneling current scanning head
4. No special restriction of sample transparency
5. Continuous wave laser sources: 636 nm and 532 nm
6. Ultrafast laser source: 774 nm/120 fs; 636 nm/ps
7. Perkin Elmer spectrometer
8. Avalanche photodiode