



Assoc. Prof. **Martin VACHA**

Graduate School of Science and Engineering
 Department of Organic
 and Polymeric Materials

Contact: Tel./Fax: 03-5734-2425; vacha@op.titech.ac.jp
 Lab HP: <http://www.op.titech.ac.jp/lab/vacha/index.html>

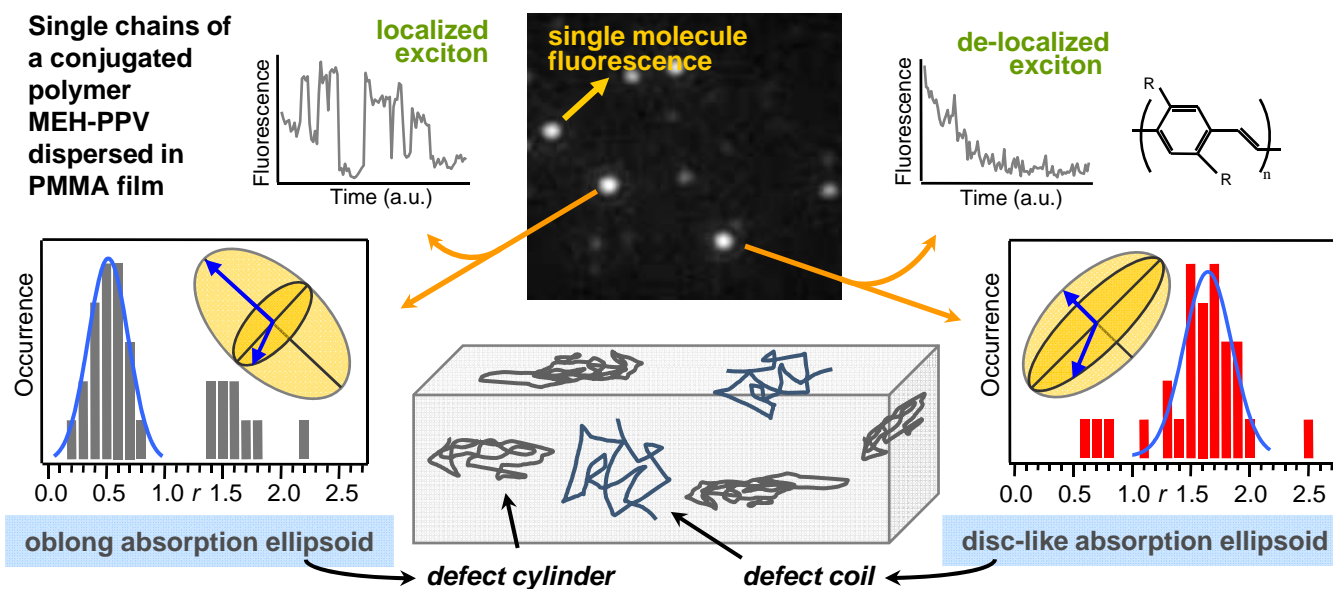
Research field: Optical properties of organic materials

Research topics conducted within the G-COE project

We use **single molecule detection and spectroscopy** to study structure and optical properties of organic and polymeric materials on nanoscale level. By measuring single molecules of the material it is possible to reveal distributions of the material physical properties and of local dynamics that are otherwise hidden in the ensemble average. Alternately, the material can be doped with an organic dye which, on a single molecule level, directly senses its own immediate environment and its dynamics. In this way, it is possible to study nanoscale physical properties of non-luminescent complex systems such as polymer thin films.

The following research topics are studied:

1. Relationship between structure and optical properties of single conjugated polymer chains.
2. Luminescence properties of single molecules of phosphorescent EL materials.
3. Nanoscale physical properties of polymer thin films studied by single molecule detection.
4. Structure and function relationship in chlorosome antennae of green photosynthetic bacteria.



Representative publications

- T. Sugimoto, Y. Ebihara, K. Ogino and M. Vacha: Structure dependent photophysics studied in single molecules of polythiophene derivatives. *ChemPhysChem* 8 (2007) 1623
- A. Hattori, H. Sato and M. Vacha: Microscale polarity in polymer films probed by fluorescence of a benzanthrene derivative on ensemble and single-molecule level. *Chem. Phys. Lett.* 435 (2007) 311
- Y. Koide, S. Takahashi and M. Vacha: Simultaneous two-photon excited fluorescence and one-photon excited phosphorescence from single molecules of an organometallic complex $\text{Ir}(\text{ppy})_3$. *J. Am. Chem. Soc.* 128 (2006) 10990
- Y. Ebihara and M. Vacha: A method for determining the absorption ellipsoid of single conjugated polymer molecules and single luminescent nanoparticles. *J. Chem Phys.* 123 (2005) 244710