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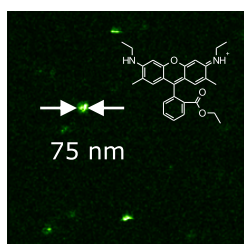
**【Speciality】** Polymer Physics

**【Keywords】** Single Polymer Chain, Surface/Interface  
Near-Field Optics

**【Research Subject】** Properties of Single Polymer Chain at Surface and Interface Studied by Near-Field Optical Spectroscopy

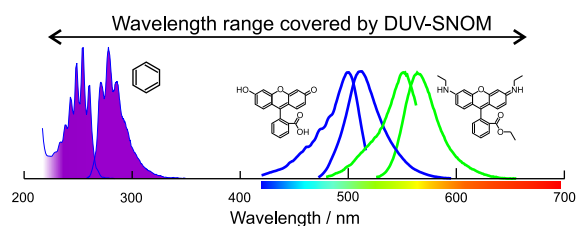
## Research Group Activity

### Near-Field Optical Microscopy



Super-resolution imaging of single Rhodamine molecule by SNOM

### Development of Deep UV Near-Field Spectroscopy



### Single Molecule Spectroscopy

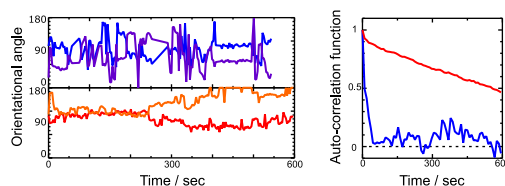
$$\begin{pmatrix} E_x \\ E_y \\ E_z \end{pmatrix} = M \int_0^{\theta_{\max}} d\eta \sin \eta \sqrt{\frac{n \cos \eta}{\cos \eta'}} \begin{pmatrix} e_x \\ e_y \\ e_z \end{pmatrix} \exp(i k \delta z \cos \eta)$$

$$\begin{pmatrix} e_x \\ e_y \\ e_z \end{pmatrix} = i \cos \eta' J_1 E_p^{\perp} \begin{pmatrix} \cos \eta' \\ \sin \eta' \\ 0 \end{pmatrix} + \frac{i \sin \beta}{2} \begin{pmatrix} \cos \eta' (J_0 + J_2 \cos 2\psi) E_p^{\parallel} + (J_0 - J_2 \cos 2\psi) E_p^{\perp} \\ - \cos \eta' J_2 \sin 2\psi E_p^{\parallel} + J_2 \sin 2\psi E_p^{\perp} \\ 0 \end{pmatrix}$$

$$\begin{pmatrix} e_x \\ e_y \\ e_z \end{pmatrix} = i \cos \eta' J_1 E_p^{\perp} \begin{pmatrix} \cos \eta' \\ \sin \eta' \\ 0 \end{pmatrix} + \frac{i \sin \beta}{2} \begin{pmatrix} \cos \eta' (J_0 + J_2 \cos 2\psi) E_p^{\parallel} + (J_0 - J_2 \cos 2\psi) E_p^{\perp} \\ - \cos \eta' J_2 \sin 2\psi E_p^{\parallel} + J_2 \sin 2\psi E_p^{\perp} \\ 0 \end{pmatrix}$$

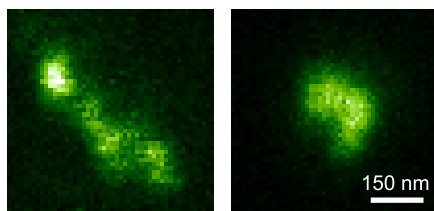
$$S = \frac{c}{8\pi} (\mathbf{E} \times \mathbf{B})$$

Translational/rotational motion of single molecule probed by defocus fluorescence imaging



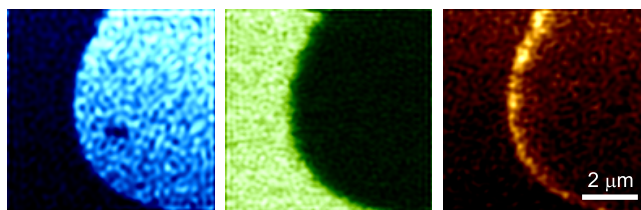
### Polymer Ultra-Thin Film

#### Single Polymer Chain Detection



The property of polymer materials is discussed at the molecule level by the direct observation of the conformation of single chains by SNOM.

#### Structural Analysis of Phase Separation Structure



Phase separation structure of binary polymer blends and diblock copolymer systems is analyzed by several near-field spectroscopy techniques.