電子研講演会の御案内

この度、京都大学の藤田晃司先生、および、台湾交通大学の Anwar Usman 博士による講演会を下記の通り開催致します。プラズモン共鳴を利用したレーザー発振制御技術および光トラッピングを利用した液晶操作技術に関する講演をそれぞれ行って頂く予定にしております。多数の方々が御参加下さいますよう御案内申し上げます。

記

日時:　平成 23 年 9 月 9 日(金)13:30－15:30

場所:　北海道大学 電子科学研究所 1階 セミナー室 1-2

13 : 30 〜14 : 30

講師 1:　藤田 晃司先生
(京都大学・准教授)

演題 1:　Plasmonically controlled lasing oscillation with metallic-dielectric core-shell nanoparticles

14 : 30〜15 : 30

講師2:　Anwar Usman 博士
(台湾国立交通大学・博士研究員)

演題2:　Optical Reorientation, Optical Trapping, and Phase Transition of Liquid Crystals by Highly Focused Laser Beams

講演要旨:
詳細は添付別紙に記載

連絡先: 北海道大学 電子科学研究所 光システム計測研究分野
藤原英樹、笹木敬司((内)9395)

Plasmonically controlled lasing oscillation with metallic-dielectric core-shell nanoparticles

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Abstract

A random laser is a gain-containing disordered system which utilizes multiple light scattering to elongate the residual time of photons so as to realize light amplification [1]. The emerging field of plasmonics has imbued a random laser with significant enhancement regarding laser threshold and emission efficiency compared to dielectric counterparts. We demonstrate the capability to control the stimulated emission properties in amplifying random systems utilizing local field enhancement by surface plasmons [2]. Incorporating Ag@SiO_2 core-shell nanoparticles into a gain medium composed of dye solution, the optical feedback and pump threshold can be controlled by changing the shell thickness. It is found that an optimal shell thickness of ~ 2 nm exists, bringing about a lowest pump threshold (Fig. 1). The observed phenomena are analyzed in terms of the modification of fluorescence properties, including pump and absorption rates, by local field enhancement. Recently, we also have prepared Au@SiO_2 nanoparticles-containing gain media and observed that the pump threshold exhibits a minimum when the optimal shell thickness is ~ 15 nm.

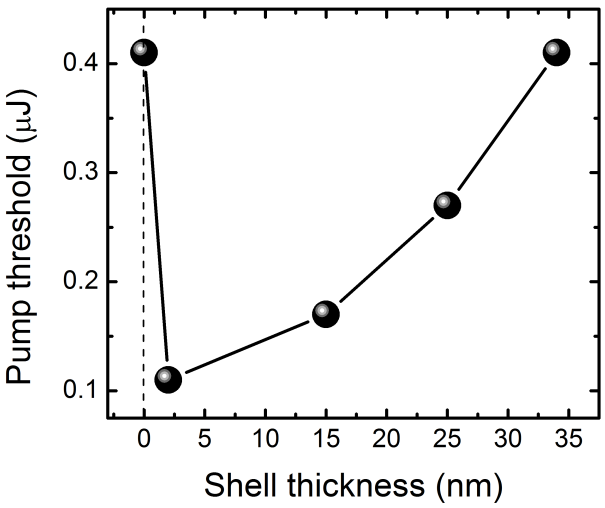

Figure 1: Dependence of pump threshold on the shell thickness.

References:

1. D. S. Wiersma, *Nature Phys*. **4**, 359 (2008).
2. X. Meng K. Fujita, S. Murai, T. Matoba, and K. Tanaka., *Nano Lett*. **11**, 1374 (2011).

Optical Reorientation, Optical Trapping, and Phase Transition of Liquid Crystals by Highly Focused Laser Beams

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We present laser trapping-induced phase transition of 4'-n-pentyl-4-cyanobiphenyl liquid crystalline (LC) micro-droplets from smectic to transient twisted configuration, and that from nematic to deorientation for the LC thin slab. For the LC micro-droplets, there are two distinctive optical trapping behaviors with a clear threshold power; (i) below which the droplet is optically trapped and its intrinsic lamellar configuration remains intact, and (ii) above which the optical trapping is followed by smectic-to-transient twisted configuration (phase) transition throughout the inside of the droplet, although the droplet size is larger than the focal spot. We propose that likely mechanism involves optical reorientation at focal volume, leading to symmetry breaking throughout the inside of confined droplet, and modification of droplet-liquid interfacial anchoring effect. We demonstrate the relevance of the mechanism in term of the droplet size-dependent threshold power.[1]

The highly focused laser beam can induce the formation and expansion of a micro-sized LC domain in nematic thin slab film. We proposed that the domain is formed by the balance between generated gradient force (due to the refractive index mismatch upon optical reorientation), elastic force, anchoring effect, and cooperative motions.[2] Local orientation dynamics at the beam center observed by anisotropy Raman intensity microspectroscopy indicates that local orientation at the vicinity area of focal spot is clearly depolarized due to the transition from nematic to either deorientation or isotropic configuration with a possible densification.

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[1] A. Usman, W.-Y. Chiang, T. Uwada, H. Masuhara, *J. Phys. Chem. C* **2011**, to be submitted.

[2] A. Usman, T. Uwada, H. Masuhara, *J. Phys. Chem. C* **2011**, doi:10.1021/jp200721f