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利用形態　:機器利用
利用課題名（日本語）　:
Program Title (English)　: Revealing the Chiroptical Response of Plasmonic Nanostructures at the Nano-Femto Scale
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1. 概要（Summary）

Time-resolved photoemission electron microscopy (PEEM) was employed to measure near-field spatial distributions, spectra and spatiotemporal dynamics of plasmonic modes associated with chiroptical responses of Au dimer nanostructures at the nano-femto scale, verifying the characteristic near-field mode distributions and a huge spectral dichroism. Moreover, eigenmode excitations and their contributions to ultrafast plasmonic chiroptical response in the space-time domain were directly revealed, promoting fully understanding of ultrafast chiral origin in complex nanostructures.

2. 実験（Experimental）

【利用した主な装置】

超高精度電子ビーム描画装置（EBL, ELS-F125-U, Elionix); ヘリコンスパッタリング装置 (MPS-4000C1/ HC1, ULVAC); 高分解能電界放射型走査型電子顕微鏡 (JSM-6700FT, JEOL).

【実験方法】

Arrays of Au nanorod dimers were fabricated by EBL, sputtering and lift-off techniques. Near-field properties of structures were investigated using multi-photon PEEM with femtosecond laser pulses as the excitation source.

3. 結果と考察（Results and Discussion）

Symmetric Au nanorod dimers including two orthogonally oriented nanorods were fabricated on ITO-coated glass substrates. The morphology of the structures was observed by a FE-SEM, revealing high structural quality.

PEEM images were acquired under obliquely incident fs-laser excitations with a tunable wavelength range from 690 nm to 1040 nm. When overlapped with the laser spectrum, plasmonic resonances of Au nanorod dimers could be efficiently excited with strong local field enhancement (Fig. 1). UV light source, leading to one-photon photoemission, was used to observe the morphology of Au nanorod dimers. After adding fs-laser source together, plasmonic hot-spots in Au nanorod dimers superimposed on the UV PEEM image could be clearly identified with the near-field enhancement mainly located in the gap region for left-handed circular polarization (LCP) and at the end region of nanorod in the right side for right-handed circular polarization (RCP). The dominant excitation of antisymmetric (symmetric) mode for LCP (RCP) light contributes to the chiroptical response in Au nanorod dimers, which was verified by FDTD simulations.

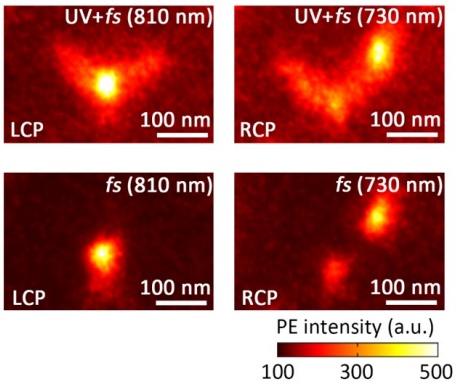

Fig. 1 PEEM images of Au nanorod dimers under obliquely incident light excitations at the resonant wavelength for LCP and RCP fs-laser excitations together with or without UV light.

4. その他・特記事項（Others）

Main collaborators: Quan Sun, En Cao, Tomoya Oshikiri, Hiroaki Misawa (Research Institute for Electronic Science, Hokkaido University)

5. 論文・学会発表（Publication/Presentation）

N/A

6. 関連特許（Patent）

N/A