量子もつれ二光子吸収測定系の構築

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Construction of entangled two-photon absorption measurement system ([1]*Graduate School of Engineering, Yokohama National University*, [2]*JSPS*) ○Sena Hashimoto,[1,2] Tomoyuki Horikiri,[1]

It has been theoretically estimated that entangled photon pairs which have time and frequency entanglement enhance the two-photon absorption efficiency and selectivity of energy level for molecules[1)]. In this study, we have constructed an entangled two-photon absorption measurement system (Fig. 1). Entangled two-photon pairs (photon pairs) were generated by BBO crystal pumped by a continuous wave laser. Coincidence counts of photon pairs were measured by single photon counting modules (SPCM-1, 2) and a coincidence counter (CC). Entangled two-photon absorption rate was measured as difference of the coincidence counts with solvent and dye molecules solutions. In addition, normal two-photon absorption measurement system using a laser was constructed for comparing the two-photon absorption efficiency of dye molecules.
Keywords : Entangled photon; Two-photon absorption; Dye molecules

量子もつれ光子対を用いると、その時間相関と周波数相関により古典光よりも二光子励起効率と励起準位の選択性が増強されることが理論研究から示されている[1)]。本研究ではパルスレーザー光よりも波長・強度の安定性が高い連続レーザー光を励起光に用いる量子もつれ二光子吸収測定系を構築した（Fig. 1）。波長変換媒質には非線形結晶（BBO）を用いて量子もつれ光子対（光子対）を発生させ、強度比 1 : 1 のビームスプリッター（BS）で二分し、単一光子計数器（SPCM-1, 2）と同時計数器（CC）を用いて光子対を同時検出した。光子対が溶媒を透過した場合の同時検出頻度を基準とし、色素溶液の場合との差から二光子吸収効率を算出した。さらに、レーザー光を用いる通常の二光子吸収測定系を構築し、二つの測定系を用いて二光子吸収効率を比較した。

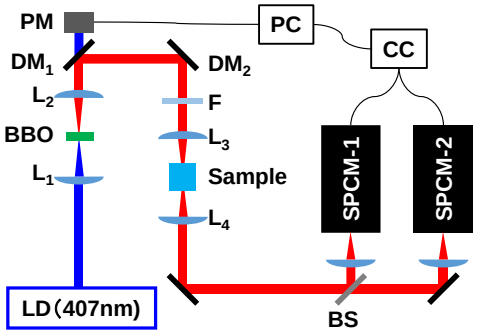

Fig. 1. Two-photon absorption measurement system using entangled photon pair generated by continuous wave laser （LD: Laser Diode, L: convex Lens, BBO: BBO Crystal, DM: Dichroic Mirror, PM: Power Meter, F: long-pass Filter, BS: Beam Splitter, SPCM: Single Photon Counting Module, CC: Coincidence Counter）

1) H. Oka, *Phys. Rev. A* **81**, 2010, 063819.