量子もつれ二光子吸収効率に対する濃度依存性

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Concentration Dependence on Entangled Two-Photon Absorption Efficiency ([1]*Graduate School of Engineering, Yokohama National University*, [2]*JSPS*, [3]*Faculty of Engineering, Kanagawa University*) ○Sena Hashimoto,[1,2] Tomoyuki Horikiri,[1] Izumi Iwakura[3]

When pulsed laser light, is used as a two-photon excitation source, it is necessary to increase the photon flux density by focusing the light. However, high photon flux density induces thermal processes or higher-order multiphoton processes simultaneously, which may damage the measurement samples. On the other hand, when entangled photon pairs (signal light and idler light) with potential simultaneity due to quantum correlation are used as a two-photon excitation light source, it was theoretically estimated that two-photon excitation is possible even at low photon flux density[1]. However, the values of entangled two-photon absorption cross sections reported experimentally so far differ from one report to another[2-4], and may depend on concentration, focusing conditions, and other factors. In this study, in order to evaluate the concentration dependence under the same excitation conditions, we generated entangled photon pairs by spontaneous parametric downward conversion (Figure 1), constructed a two-photon absorption measurement system, and evaluated the relationship between solution concentration and quantum entangled two-photon absorption cross sections for various dye molecular solutions.
Keywords : Entangled photon; Two-photon absorption; Dye molecules

二光子励起光源として、古典光であるパルスレーザー光を用いる場合には、集光して光子密度を高める必要がある。しかし、高密度光は熱過程や高次の多光子過程を同時に誘起するため、測定対象が損傷する可能性がある。他方、二光子励起光源として、量子相関に起因する潜在的な同時性を有する量子もつれ光子対(シグナル光とアイドラー光)を用いる場合には、光子密度が低くても二光子励起が可能であると理論的に予測されている[1]。しかし、これまで実験的に報告された量子もつれ二光子吸収断面積の値は、報文毎に異なっており[2-4]、濃度や集光条件が影響する可能性がある。本研究では同一励起光照射条件下における濃度依存性の評価を目的に、自発的パラメトリック下方変換(Figure1)により量子もつれ光子対を発生させ、二光子吸収測定系を構築し、種々の色素分子溶液における溶液濃度と量子もつれ二光子吸収断面積の関係を評価した。

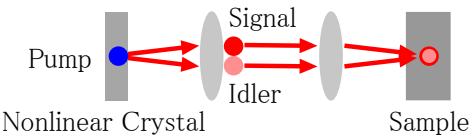

Figure 1. Two-photon absorption induced by the entangled photon pairs generated by spontaneous parametric downward conversion

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