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Ultrashort pulse laser, Ultrafast spectroscopy, & Quantum Information Experiments

We work on development and application of femtosecond pulse laser in the Electrophysics Dept., NCTU.

Our three major research interests:

(a) **Ultrashort pulse laser development:** We have developed ultrashort visible pulse laser with duration of sub-10fs. The ultrashort pulse duration can time-resolve the real-time modulation affected by molecular vibration, which could never been done by other light source. The observed dynamics of molecular vibration frequency visualizes the real-time change of molecular structure during chemical reactions.

(b) **Application for ultrafast spectroscopy:** We have developed fast-scan femtosecond spectroscopy system suitable for study of photofragile materials. Utilizing the system, we elucidate initial process of various chemical reactions including photovoltaic materials for solar cells, light sensor proteins in eyes (Fig. 1), and heme proteins like hemoglobin.

(c) **Quantum Information Experiments:** Quantum communication performed by entangled photon pair can transfer information securely. We have proposed various new methods to produce the entangled photon pairs with higher efficiency and/or simpler (Fig. 2).

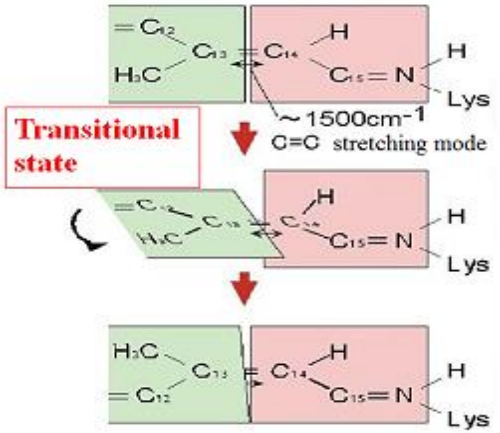

Fig. 1 Ultrafast structure change in light sensor protein

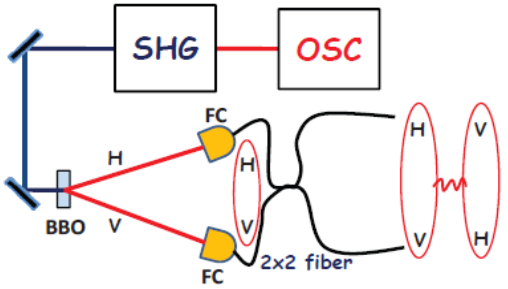

Fig. 2 Scheme to entangle photo pair beams