

# Joint CQSE and CASTS Seminar

Weekly Seminar  
Mar. 10, 2017 (Friday)

TIME Mar. 10, 2017, 14:30 ~ 15:30  
TITLE Large cross-phase modulations at the few-photon levels  
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PLACE Rm716, CCMS & New Physics Building, NTU

## Abstract

The realization of large cross-phase modulations (XPM) at low-light intensities, ultimately at the single-photon level, is an important but challenging task in quantum information science. To reach this goal, one often requires high-finesse cavities to enhance nonlinear interactions between photons. However, cavity-based experiments require many compromises such as balancing cavity bandwidth and light-matter coupling strength, which remain technical difficulties. In this talk, I will introduce an efficient XPM based on a closed-loop double- $\Lambda$  system. The property of the double- $\Lambda$  medium can be controlled by changing the phases of the applied optical fields. This phase-dependent XPM scheme can achieve large phase modulations at low-light intensities without requiring cavities or tightly focusing laser beams. With this scheme, we observe a  $\pi$ -level phase shift with two pulses, both consisting of eight photons in cold rubidium atoms. Such a novel scheme provides a simple route to generate strong interactions between photons and may have potential applications in all-optical quantum signal processing.

