

# CQSE Weekly Seminar

2018  
Sep. 14, Friday

TIME Sep. 14, 2018, 14:30 ~ 15:30  
TITLE Cooperative light scattering and spectrally entangled biphoton state  
SPEAKER Dr. Hsiang-Hua Jen  
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PLACE Rm716, CCMS & New Physics Building, NTU

## Abstract

Here I will talk about two relevant subjects recently investigated in our research group. One is that we theoretically investigate the light scattering of super- and subradiant states of an atomic ring prepared by single excitation with a photon which carries an orbital angular momentum (OAM). The superradiant modes predominantly scatter photons in the forward-backward direction, while the subradiant modes preferentially scatter photons in the transversal directions. When rings are stacked concentrically and on a plane, crossover from sub- to superradiance is observed. The super- and subradiant states are thus detectable through measuring the far-field radiation patterns, which further allow quantum storage and detection of a single photon with an OAM.

Second subject is that we theoretically investigate the spectral property of biphoton state from the cascade emissions from a Doppler-broadened atomic ensemble. This biphoton state is spontaneously created in the four-wave-mixing process. We obtain the spectral property in terms of superradiant decay rates of the lower transition, excitation pulse durations, and temperature of the medium. We quantify their frequency entanglement by Schmidt decomposition and find that more entangled source can be generated with longer excitation pulses, enhanced decay rates, and significant Doppler broadening. This allows spectral shaping of continuous frequency entanglement, which is useful in multimode long-distance quantum communication.

