

# Joint CQSE and CASTS Seminar

2020

Mar. 6, Friday

TIME Mar. 6, 2020, 2:30~3:30pm  
TITLE Subradiance dynamics and steady-state phase diagram of a  
chirally coupled atomic chain  
SPEAKER Dr. Hsiang-Hua Jen  
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PLACE Rm716, CCMS & New Physics Building, NTU

## Abstract

A chirally coupled system can be made of an atom-nanofiber or atom-waveguide interface, where nonreciprocal decay channels emerge and time-reversal symmetry of light-matter couplings is broken. A collective radiation of super- or sub-radiance can be initiated depending on the interatomic spacing in a uniformly distributed atomic chain. This noncascaded scheme also allows sequential radiations from the ordered atoms, which form a series of excitation plateaus. We further study the effect of atomic local disorder, and find occurrence of plateaus on the decay curve dependent on the defect locations, as well as persistent disorder-induced localized excitations. This suggests dynamical dimer-like state components spontaneously emerged from the system via dissipation.

We also present distinct interaction-driven quantum phases of matter in this 1D nanophotonics systems. The unique phase diagram involves states with extended distributions, crystalline orders, bi-edge/hole excitations (BEE/BHE), and of chiral-flow dichotomy. Two critical points can be identified as well, which show critically slow dynamics and relate to the decoherence-free modes supported by the system. Finally, in the phases of BEE and BHE, non-ergodic signatures of subharmonic oscillations emerge, where a butterfly-like system dynamics is presented as a far-from-equilibrium phenomenon.

