Abstract Submitted
for the DAMOP20 Meeting of
The American Physical Society

Steady-state phase diagram of a weakly driven chiral-coupled atomic chain[1] HSIANG-HUA JEN, Institute of Physics, Academia Sinica — A chiral-coupled atomic chain of two-level quantum emitters allows strong resonant dipole-dipole interactions, which enables significant collective couplings between every other emitters. This chiral-coupled system can be made of an atom-nanofiber or atom-waveguide interface, where nonreciprocal decay channels emerge. We theoretically study distinct interaction-driven quantum phases of matter with chiral couplings and infinite-range dipole-dipole interactions mediated by one-dimensional nanophotonics systems. The steady-state phase diagram in the low saturation limit involves states with extended distributions, crystalline orders, bi-edge/hole excitations, and a region of chiral-flow dichotomy. We distinguish these phases and regions by participation ratios and structure factors, and find two critical points which relate to decoherence-free subradiant sectors of the system. We further investigate the transport of excitations and emergence of crystalline orders under spatially-varying excitation detunings, and present non-ergodic butterfly-like system dynamics in the phase of extended hole excitations with a signature of persistent subharmonic oscillations. Our results pave the way toward simulations of many-body states in nonreciprocal quantum optical systems.

[1]Ministry of Science and Technology (MOST), Taiwan.

Hsiang-Hua Jen
Institute of Physics, Academia Sinica

Date submitted: 29 Dec 2019 Electronic form version 1.4