Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Emergence of Coherence from Incoherence in Cavity-Coupled Arrays of Three-level Atoms[1] PEIRU HE, MURRAY HOLLAND, JILA, CU Boulder, ANA MARIA REY, JILA, NIST — We investigate the emergence of many-body synchronization in macroscopic arrays of V-type three-level atoms. The two optical transitions are separately coupled to two cavity modes in the bad cavity regime, meaning that for these modes the cavity decay rate is larger than all other relevant system frequencies. While synchronization and superradiance have been demonstrated in two-level arrays coupled to one bad cavity mode, the three-level case, possessing more degrees of freedom, is anticipated to exhibit richer physics. Using the cumulant expansion approach, we find both transitions can individually synchronize when the ground state is incoherently pumped to the two excited states. Of particular interest is the fact that the two-point correlation function between the excited states becomes nonzero and oscillates in time, indicating an emergent coherence between these two levels even in the absence of any external coherent drive. The oscillations are robust and only decay at the collective decay rate (the smallest frequency scale in the problem). We derive analytical expressions for the oscillation frequency and the associated linewidth. We further examine the phase diagrams to determine the parameter regime where the emergent coherence exists.

[1]NSF, NIST

Peiru He
JILA, Univ of Colorado - Boulder

Date submitted: 23 Jan 2017 Electronic form version 1.4