Principle and application of collective oscillation in photonic crystal slabs

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Collective oscillation refers to a cluster of individual resonances collectively oscillating as a whole but showing distinctively different behaviors than the single ones. Here, we focus on guided resonances in photonic crystal slabs, showing that the inter-mode-couplings occurred in the momentum space can arise collective oscillations in the real space. Accordingly, exotic near and far field distribution are created by controlling the geometry of photonic crystal and the dispersion of guided resonances. Consequently, we successfully demonstrate exceptional chiral emission without well-defined optical paths, verified by optical pumped single-mode lasing that emit as an unusual phase vortex beam. Our work reveals new possibilities for manipulate light in sophisticated photonic structures via collective behavior, which would shed light in understanding photonic phenomena from a many-body physics view, and thus fascinate many applications ranging from optical sensing and manipulating to large-volume optical communication.

Short Bio:

Chao Peng received his BS degree from the Department of Physics, Peking University in 2004, and his Ph.D. degree from the Department of Electronics, Peking University in 2009. He worked at the Department of EE, Kyoto University from 2009 to 2011 as a JSPS Fellow. Prof Peng joined Peking University in 2012, now he is a full professor in the State Key Laboratory of Photonics and Communications, School of Electronics, Peking University. His research interests include topological photonics, non-Hermitian photonics, and photonic integration. He had published over 100 peer-reviewed research articles on the Science, Nature, Phys. Rev. Lett. and other journals.