Several Quantum-Optical Analogies in Coupled Nanoantenna, Waveguide and Metasurface

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In this talk, we will present our recent studies on classical optical wave phenomena that are analogous to several different quantum effects. More specifically, we show that Bloch oscillation, Fano resonance, and electromagnetically-induced transparency (EIT) are sustainable and controllable in judiciously designed nanoantenna, waveguide and metasurface, leading to interesting far-field and near-field properties. These quantum-optical analogies originate from coherent optical mode interactions that can be well described by the coupled mode theory (CMT). In the end, PT-symmetry mediated wave transportation in 3D coupled waveguide arrays is discussed. Both full wave calculation and CMT results are shown.