Optics and Optomechanics at Exceptional Points

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Waveguide-coupled optical resonators represent open physical systems due to optical losses originating from absorption, coupling and radiation. As such they are characterized by non-Hermitian Hamiltonians. By engineering their loss/gain profiles and coupling to other systems, such systems can be brought to a non-Hermitian degeneracy known as an exceptional point (EP), where complex eigenvalues and the corresponding eigenstates of the system coalesce. The presence of an EP affects the system significantly, leading to nontrivial physics with interesting features. In this talk, after briefly reviewing the related physics and the applications that we have developed in the past few years (e.g., loss-induced lasing and directional emission in whispering gallery resonators), I will present the progress in our experimental and theoretical studies towards a better understanding of optical processes and optomechanical interactions at EPs for realizing photonic and phononic devices with novel functionalities. I will also discuss challenges and future prospects in this emerging field of non-Hermitian photonics.