

Nonreciprocity and Non-Hermitian Skin Effect Induced by Losses

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Abstract— Nonreciprocity is important in both optical information processing and topological photonics studies. In this talk, we will present our recent study of generating nonreciprocity by taking advantage of energy loss, which is usually regarded as harmful. The loss in a resonance mode induces a phase lag, which is independent of the energy transmission direction. When multichannel lossy resonance modes are combined, the resulting interference gives rise to nonreciprocity, with different coupling strengths for the forward and backward directions, and unidirectional energy transmission [1]. By optimizing the interference mechanism, perfect nonreciprocity that allows lossless unidirectional transmission can also be realized [2]. Extending the study to a periodic dissipative-coherent coupling structure, we also propose a new mechanism for realizing non-Hermitian skin effect (NHSE) via dissipative couplings [3]. Moreover, we show that the non-Hermiticity induced by dissipative couplings can be fully transformed into nonreciprocity-type non-Hermiticity without bringing extra gain-loss-type non-Hermiticity. Thus, this mechanism enables unidirectional energy transmission without introducing additional insertion loss. Our work opens a new avenue for the design of nonreciprocal devices with high performance and the study of non-Hermitian topological effects.

REFERENCES

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