

## **New Physics in “Energy-balanced” Zero-index Medium**

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The speaker introduces an unique type of “energy-balanced” zero-index media, whose effective permittivity and permeability are both purely imaginary, but with opposite signs, indicating the coexistence and balance of loss and gain. The speaker shows that such an “energy-balanced” zero-index medium can support “propagation” with the “wavelength” determined by the magnitudes of loss and gain. An interesting physical phenomenon manifested in the medium is that it leads to coherent perfect absorption (CPA) or lasing when proper interference is introduced. In particular, when the loss and gain share the same magnitude, the so-called “CPA lasing”, which was previously proposed in parity-time (PT) symmetric systems, can be realized. The functionality can be tuned from CPA to lasing by tuning the phase of the incident wave. The speaker and his group propose a route to realize such an “energy-balanced” zero-index medium by using a photonic core-shell structure composed of lossy cores coated by shells made of gain media. The unique functionality as a CPA lasing device is confirmed by numerical simulations. Their work reveals unique and intriguing physics which is induced by balanced gain and loss in different parameters of a homogeneous medium.