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Parity-Time Symmetric Nonlocal Metamaterials for Focusing and Image Processing FRANCESCO MONTICONE, The University of Texas at Austin, CONSTANTINOS VALAGIANNOPOULOS, Aalto University, Finland, SILVIO SAVOIA, University of Sannio, Italy, ROMAIN FLEURY, ANDREA ALU, The University of Texas at Austin — Parity-Time (PT) symmetry refers to the invariance of a physical system upon reflection of space and time. An intriguing property of PT-symmetric quantum systems is the fact that they can have entirely real eigenvalue spectra, despite being non-Hermitian. Although the application of these concepts in quantum mechanics remains speculative, in classical optics non-Hermitian PT-symmetric systems can be readily realized with spatially balanced gain and loss. These systems have been shown to exhibit exotic responses, e.g., unidirectional invisibility, or anomalous scattering. Recently, negative refraction and planar focusing have been achieved by pairing a perfectly coherent absorbing metasurface with its time-reversed counterpart, i.e., a coherently lasing metasurface. Here, we generalize this idea to any pair of PT-symmetric structures, characterized by their scattering matrix, to put forward a realistic venue to PT-symmetric metamaterials for imaging. This approach allows us to design realistic structures based, e.g., on multilayered slabs, which implement the necessary nonlocality and spatial dispersion to achieve ideal all-angle negative refraction and planar focusing. We will also discuss how these concepts may realize arbitrary magnifying, focusing and image processing systems.

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