Title:	PT -symmetry and supersymmetry: interconnection of broken and unbroken phases
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Abstract:	The broken and unbroken phases of PT and supersymmetry in optical systems are explored for a complex refractive index profile in the form of a Scarf potential, under the framework of supersymmetric quantum mechanics. The transition from unbroken to the broken phases of PT-symmetry, with the merger of eigenfunctions near the exceptional point is found to arise from two distinct realizations of the potential, originating from the underlying supersymmetry. Interestingly, in PT-symmetric phase, spontaneous breaking of supersymmetry occurs in a parametric domain, possessing non-trivial shape invariances, under reparametrization to yield the corresponding energy spectra. One also observes a parametric bifurcation behaviour in this domain. Unlike the real Scraf potential, in PT-symmetric phase, a connection between complex isospecrtal superpotentials and modified Korteweg-de Vries equation occurs, only with certain restrictive parametric conditions. In the broken PT-symmetry phase, supersymmetry is found to be intact in the entire parameter domain yielding the complex energy spectra, with zero-width resonance occurring at integral values of a potential parameter.
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