Dark Solitons and Vortices, Double Wells, Ghost States and Nonlinear PT-phase transitions in Defocusing PT-symmetric Media

Conference by professor
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Abstract:

This talk concerns a theoretical analysis of some aspects of a theme that has received particular attention recently, namely parity-time (PT) symmetric media. In particular, we consider such media with an even real confining potential, an odd imaginary potential and a defocusing nonlinearity and observe a series of interesting phenomena such as:
(a) a destabilizing seemingly-pitchfork bifurcation of dark solitons;
(b) a nonlinear analog of the PT-phase transition where nonlinear eigenstates pairwise collide and disappear in saddle-center bifurcations;
(c) the spontaneous emission of solitary waves past the latter critical point;
(d) the direct generalization of each of the above features in higher dimensional settings.
Yet various open ended questions still remain including the nature of the daughter states of the pitchfork bifurcation.
We analyze the so-called ghost states which provide an answer to this question and illustrate their role in the observed dynamics. Importantly, we also derive connections of this problem with the classical Ptsymmetric dimer (or coupler) that has been recently investigated experimentally. The role of ghost states and of so-called analytically continued states in the latter model can be elucidated even in a fully analytical fashion, as we demonstrate.