BREAKING OF SYMMETRY IN A PT-SYMMETRIC OPEN CHAIN

Jacob L. Barnett (Yogesh N. Joglekar), Department of Physics, Indiana University – Purdue University Indianapolis (IUPUI), Indianapolis, IN 46202

The study of electromagnetic waves in engineering optical materials presents opportunities to manipulate light transmission through various optical media such as fiber optic cables. Recent experiments in this field have explored materials that have balanced gain and absorption that occur at different locations. We can model such a system as a chain with nearest neighbor hopping, and balanced, parity and time reversal symmetric (PT-symmetric) impurities, and it is represented by a non-Hermitian Hamiltonian matrix. The emergence of complex energy eigenvalues for such a matrix corresponds to the PT-symmetry breaking.

We numerically and analytically investigate the eigenvalues of such a non-Hermitian Hamiltonian for an open chain with N sites. We find that the critical impurity strength, when the PT-symmetry breaks, is determined by the hopping amplitude between the impurities t_b, and hopping amplitude outside the impurities t_o in a non-trivial way. As a consequence, we show that the PT-breaking in such an open chain can be dramatically tuned by changing the hopping amplitude. Our results suggest that small changes in such systems, created in optical waveguides, can lead to significant changes for wave propagation through them (Joglekar, Y. N.,& Barnett, J. L., (2011). Origin of maximal symmetry breaking in even PT-symmetric lattices, Physical Review A, 84, 024103.)

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