Level Spacing Distributions and Quantum Chaos in Hermitian and non-Hermitian Systems

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Abstract *The correspondence between quantum level spacing distributions and classical motion of 1-D PT symmetric non-Hermitian systems is investigated using two PT symmetric complex potentials: complex rational power potential* $V_1(x) = (ix)^{(2n+1)/m}$ *and general polynomial potential* $V_2(x) = x^{2M} + ib_1x^{2M-1} + b_2x^{2M-2} + \cdots + ib_{2M-1}x$. *The level spacing distribution of* V_1 *has two forms. When* $2n+1-2m$ *is positive, the level spacing distribution of real eigen values assumes a decreasing power function, while it behaves as an increasing power function when* $2n+1-2m$ *is negative. The PT symmetry of this system is spontaneously broken as* $2n+1-2m$ *becomes negative. This change manifests itself in classical mechanics as it is found by Bender et al. However, it was found that the change in the form of level spacing distribution mentioned above is not due to the spontaneous breaking down of PT symmetry. Level spacing distribution of* V_2 *assumes an increasing power function when order of the polynomial is greater than two.*

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