

Mathematical Physics

Polynomial algebras and exact solutions of general quantum non-linear optical models I: Two-mode boson systems

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We introduce higher order polynomial deformations of A_1 Lie algebra. We construct their unitary representations and the corresponding single-variable differential operator realizations. We then use the results to obtain exact (Bethe ansatz) solutions to a class of 2-mode boson systems, including the Boson-Einstein Condensate models as special cases. Up to an overall factor, the eigenfunctions of the 2-mode boson systems are given by polynomials whose roots are solutions of the associated Bethe ansatz equations. The corresponding eigenvalues are expressed in terms of these roots. We also establish the spectral equivalence between the BEC models and certain quasi-exactly solvable Schrödinger potentials.

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