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(G*) Solitonish Wave Functions

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The time-dependent Schrödinger equation in one-dimension has a remarkable class of shape-preserving solutions that are not widely appreciated. Important examples are the 1954 Senitzky coherent states, harmonic oscillator solutions that offset the stationary states by classical harmonic motion. Another solution is the Airy beam, found by Berry and Balazs in 1979. It has accelerating features in the absence of an external force. Although these solutions are very different, we show that they share many important properties. Furthermore, we show that these belong to a more general class of form preserving (solitonish) wave functions. We conclude with an analysis of their dynamics in phase space with their Wigner functions.

Keyword-1

quantum

Keyword-2

wave function

Keyword-3

soliton

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