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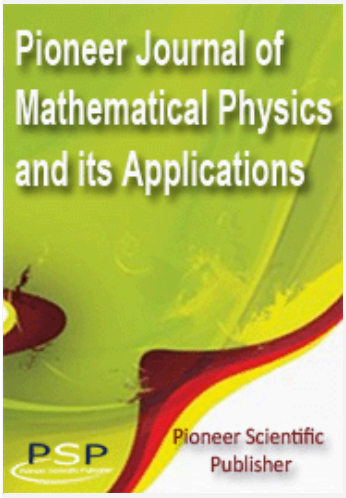

THE CLASSICAL SCHRÖDINGER EQUATION

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Abstract

Using a simple geometrical construction based upon the linear action of the Heisenberg-Weyl group we deduce a new nonlinear Schrödinger equation that provides an exact dynamic and energetic model of any classical system whatsoever, be it integrable, nonintegrable or chaotic. Within our model classical phase space points are represented by equivalence classes of wavefunctions that have identical position and momentum expectation values. Transport of these equivalence classes without dispersion leads to a system of wavefunction dynamics such that the expectation values track classical trajectories precisely for arbitrarily long times. Interestingly, the value of $\hbar$ proves immaterial for the purpose of constructing this alternative representation of classical point mechanics. The new feature which $\hbar$ does mediate concerns a simple embedding of the quantum geometric phase within classical mechanics. We discuss problems of physical interpretation and discover a simple route to recover the ordinary linear Schrödinger equation.

Keywords and phrases: quantum mechanics, classical mechanics, nonlinearity.