CLASSICALIZATION OF THE NON-LINEAR SCHRODINGER EQUATION

A. N. Njah
Department of Physics, Federal University of Agriculture, PMB 2240, Abeokuta, Ogun State, Nigeria

Abstract

The Non-linear Schrodinger Equation (NLSE), (in units of $\hbar = 1$ $i\frac{\partial \psi}{\partial t} + a\frac{\partial^2 \psi}{\partial x^2} + \beta|\psi|^{\rho}\psi = 0$ where $\rho = 1,2,3,...,\alpha$ is a positive real constant, and β is a real constant, E is the energy, is known to be integral for infinite X space. A Fourier analysis in a bounded interval $|X| \le L$, i.e. $u(x) = \sum_j u_j \exp(ik_j x)$ shows that the NLSE is a nonlinear Hamiltonian system of N degrees of freedom. The effect of truncating the degrees of freedom to a finite number N and the fact that L is finite are investigated for the case $\alpha = +1, \beta = 1$ and . $\rho = 2$ The results show that chaos sets in at certain value of the energy as the energy – increases for fixed N. Hence the NLSE is not integrable for finite N, and L. However, the integrability increases with increase in N implying that as N tends to infinity the NLSE becomes completely integrable as expected..