NUMERICAL STUDY OF OF THE TWO-DIMENSIONAL CUBIC NLS EQUATION WITH A LINE DEFECT

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In this work, we numerically study the solutions of the cubic Nonlinear Schrödinger equation (NLS) in the two-dimensional spatial case, including a defect term located on a line $x = 0$:

$$\begin{aligned} & i\frac{\partial u}{\partial t} + \Delta u + Zu\delta_\Sigma + |u|^2 u = 0, && (x,y) \in \mathbb{R}^2,\ t \geq 0, \\ & u(0,x,y) = u_0(x,y), && x \in \mathbb{R}^2, \end{aligned} \tag{1}$$

where $u = u(t,x,y) \in \mathbb{C}, \Sigma = \{(x,y) \in \mathbb{R}^2 : x = 0\}$ and where Z is the defect amplitude.
Our aim is to investigate how the defect can affect the behavior of two well-know classes of solutions of the unperturbed equation: traveling solutions and explosive solutions. The numerical algorithm that is used involves a Crank-Nicolson scheme in the time and finite difference method in space. Our simulations have shown that the defect line has a splitting effect as already observed on simulations performed in one-dimensional space for the critical quintic case (see [1]) and can drastically change the dynamics of the solution.

Références

[1] L. Di Menza, O. Goubet, E. Hamraoui, *Numerical study of quintic NLS equation with defect*, Accepted in North Western European Journal of Mathematics.

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