

Peer Review

Review of: "Multidimensional Soliton Systems: an Update"

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I reviewed the manuscript, "Multidimensional Soliton Systems: an Update".

However, there are several issues related to clarity, justification, and presentation that should be addressed to improve the quality of the work.

- **Limited Novelty Beyond the Previous Review**

The manuscript is positioned as an update; however, the extent of genuinely new physical insight beyond Ref. [1] is not always clearly articulated. Several sections largely summarize already known developments without sufficient critical comparison.

- **Lack of a Clear Structural Roadmap**

The paper would benefit from a short roadmap at the end of the introduction, clearly outlining how experimental updates, theoretical advances, and emerging directions are organized.

- **Insufficient Quantitative Discussion**

Many results are described qualitatively. Quantitative benchmarks (e.g., parameter ranges, stability thresholds, or scaling laws) are often missing, which limits reproducibility and deeper physical understanding.

- **Figures Are Descriptive but Not Analytically Supported**

While figures are visually informative, the manuscript lacks sufficient analytical or numerical interpretation accompanying them, especially regarding stability mechanisms and dynamical timescales.

- **Fractional Diffraction Section Needs More Physical Interpretation**

The discussion on fractional diffraction focuses heavily on formalism. The physical meaning of the Lévy index and its experimental relevance could be elaborated further.

- Stability Analysis Is Not Uniform Across Models**

Stability is emphasized in some models (e.g., dipolar QDs) but not consistently analyzed or discussed in others, such as fractional or neural-network-based soliton constructions.
- Neural Network-Based Studies Are Briefly Mentioned**

The application of PINNs is introduced only superficially. Given its importance, a clearer discussion of advantages, limitations, and validation against traditional solvers is needed.
- Limited Discussion on Experimental Feasibility**

Several theoretical predictions (e.g., high-charge vortices or artificial gravity models) lack discussion on experimental constraints, feasibility, or current technological limitations.
- Connection Between Optical and Matter-Wave Systems Is Weak**

Although both optics and BECs are covered, the manuscript does not sufficiently emphasize unifying mechanisms or transferable concepts between these two platforms.
- Over-Reliance on Author's Previous Works**

A significant portion of the cited literature consists of the author's own contributions. While relevant, broader inclusion of independent perspectives would strengthen objectivity.
- Notation Becomes Dense in Later Sections**

Some equations (e.g., GPEs with nonlocal kernels) are introduced with minimal explanation of symbols and scaling, which may reduce accessibility for non-specialist readers.
- Absence of Comparative Tables or Summaries**

The manuscript would benefit from summary tables comparing different soliton types, stabilizing mechanisms, dimensions, and physical settings.
- Minimal Discussion on Limitations and Open Problems**

The paper highlights successes but rarely addresses unresolved challenges, such as collapse control, robustness under noise, or finite-temperature effects.
- Conclusion Is Too General**

The concluding section restates the importance of the field but does not sufficiently synthesize key insights from the update or identify concrete future research directions.
- Title May Overstate the Scope of the Update**

While informative, the title suggests a comprehensive update, whereas the manuscript focuses on selected recent developments. A more specific title could better reflect the content.
- On solving nonlinear PDEs, some useful methods have been employed, and some recent results are useful to be cited as: [[Unraveling Symmetry, Bifurcation Dynamics, and Exotic Attractors Analysis to](#)

the (3+1)-D Modified KdV-Zakharov-Kuznetsov Model], [Lump–Breather Interactions and Inelastic Wave Dynamics in KdV Hierarchy Systems via the Bilinear Neural Network-Based Approach], [Symmetry Structures and Comprehensive Dynamical Analysis of a (3+1)-Dimensional Nonlinear Bubbly Liquid Model], [Invariant Formulation of Nonclassical Symmetries and Explicit Solutions of Rosenau-Hyman equation along with Bifurcation Analysis], [Multiscale soliton structures and dynamical analysis of nonlinear discrete electrical lattices modeled by the Salerno equation], [Coke price prediction approach based on dense GRU and opposition-based learning salp swarm algorithm], [Multi-scale systemic risk and spillover networks of commodity markets in the bullish and bearish regimes][Multiple and generic bifurcation analysis of a discrete Hindmarsh-Rose model][Dynamics and bifurcations of a discrete-time Lotka–Volterra model using nonstandard finite difference discretization method]

Declarations

Potential competing interests: No potential competing interests to declare.