

Peer Review

Review of: "Multidimensional Soliton Systems: an Update"

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This manuscript is a concise and focused “update” commentary that supplements and extends a recently published review on multidimensional soliton systems. The author systematically summarizes the latest experimental and theoretical advances in multidimensional solitons and related modes in nonlinear optics and Bose–Einstein condensates (BECs) since the appearance of the original review. Key topics include quantum droplets, solitons in fractional diffraction systems, three-dimensional vortex solitons under long-range interactions, and other emerging directions. The article is well-structured, clearly written, and effectively supported by figures. It demonstrates strong timeliness and review value, making it suitable for publication in a relevant scholarly journal.

Main Strengths:

High Timeliness: The text cites numerous recent (2024–2025) publications, including notable results in *Phys. Rev. Lett.* and other leading journals, promptly reflecting rapid progress in the field.

Comprehensive Coverage: The update encompasses both experimental developments (e.g., creation of multiple quantum droplets, observation of toroidal optical structures) and theoretical breakthroughs (e.g., 2D solitons with fractional diffraction, stability of anisotropic vortex solitons, applications of physics-informed neural networks), illustrating the breadth of current research.

Clear Organization: The presentation proceeds logically from experiments to theory, optics to BEC, and linear to nonlinear structures, with a clear emphasis on key results.

Effective Use of Figures: Schematic diagrams (e.g., quantum droplet splitting, toroidal optical modes, vortex configurations) are intuitive and aid in understanding complex physical phenomena.

Significant Scholarly Value: The article provides researchers with an accessible overview of recent advances and will help stimulate further studies in the field.

Suggestions for Improvement:

The title and abstract could be slightly expanded to more explicitly define the scope and core contributions of this “update.”

While the mathematical presentation of certain theoretical models (e.g., fractional diffraction systems, GPE with long-range interactions) is appropriate, adding brief explanatory remarks in the introduction or conclusion regarding the physical mechanisms could improve readability for a broader audience.

Although several directions are covered, a short mention of emerging interdisciplinary connections (e.g., with topological photonics, quantum simulation) might enhance the forward-looking perspective.

The references are generally well-formatted; however, consistency in citation style (some citations use bracketed numbers, others superscript) should be ensured, and the completeness of a few entries verified.

Conclusion:

This is a high-quality and timely research update. It presents novel content in a well-organized manner, supported by up-to-date references, and contributes positively to the field of multidimensional solitons. I recommend acceptance after minor revisions addressing the points above.

Declarations

Potential competing interests: No potential competing interests to declare.