Poster

Dynamics of Localized structures in $F = 1$ Spinor Bose-Einstein Condensate: Effects of Spin-Orbit Coupling and Rabi Coupling

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We investigate the effects of two time-independent parameters, Spin-Orbit Coupling (SOC) and Rabi Coupling (Ω), on $F = 1$ spinor Bose-Einstein condensates governed by the three-component Gross-Pitaevskii (GP) equations. Using the Darboux transformation technique, we construct localized structures, including classical bright-dark solitons, breathers, and rogue waves. In the case of rogue waves, the inclusion of SOC and Rabi coupling induces rapid oscillations in amplitude and the formation of stripe-like patterns in the temporal direction. For breathers, Rabi coupling introduces temporal stripes with single and double-mode peaks near the origin, while the amplitude remains constant between maxima and minima under the influence of SOC. Additionally, the transition from dark to bright solitons can be achieved by incorporating the Rabi coupling parameter in classical dark-bright solitons. This study provides insights into the interplay of SOC and Rabi coupling in shaping the dynamics of localized structures in F = 1 spinor Bose-Einstein condensates.

References

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