

含光格子势双/混合Lévy指标分数阶NLS方程的多峰隙孤子与稳定激发 (闫振亚)

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In this paper, we investigate the new two-Lévy-index fractional nonlinear Schrödinger (FNLS) equations with optical lattices, where two fractional derivative terms are introduced to control the diffractions. Especially, we explore the linear Bloch bandgaps and existence of gap solitons for the two-Lévyindex mixed FNLS equations with optical lattices. We analyse the effects of different coefficients of normal and abnormal diffraction terms on bandgap structures. Families of single-, double-, triple-, as well as quadruple-peak solitons are found in the first gap with the defocusing nonlinearity while such solitons can be found in the semi-infinite gap when it turns to the focusing regime. Meanwhile, we find that the above-obtained gap solitons can be roughly divided into two types, one of which branches out from the band edge, and another one cannot branch out from the band edge. Moreover, the stability of gap solitons is discussed via the linear stability analysis, and then their dynamical behaviours are verified by means of direct simulations. And stable multi-peak solitons can be obtained via analysing the phase structure. Meanwhile, we find the stable excitations of gap solitons via excitations of system parameters. The stable gap solitons are also verified to appear in the two-Lévy-index FNLS equation. These results may pave the way for the study of linear and nonlinear phenomena of two-Lévy-index and mixed FNLS equations or other mixed fractional physical models in optical lattices and the related physical experimental designs.

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