Solitons and soliton interactions in the complex coupled short-pulse equation

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Abstract

The complex coupled short pulse equation (ccSPE) describes the propagation of ultra-short optical pulses in nonlinear birefringent fibers. The system admits a variety of vector soliton solutions: fundamental solitons, fundamental breathers, composite breathers (generic or non-generic), as well as so-called self-symmetric composite solitons.

In this talk, we will discuss interactions of ccSPE solitons. The investigation relies on the dressing method and the Darboux matrices corresponding to the various types of solitons, and it combines refactorization problems on generators of certain rational loop groups, and long-time asymptotics of these generators, as well as the main refactorization theorem for the dressing factors which leads to the Yang-Baxter property for the refactorization map and the vector soliton interactions. In particular, we derive explicit formulas for the polarization shift of fundamental solitons which are the analog of the well-known formulas for the interaction of vector solitons in the Manakov system. Our study also reveals that upon interacting with a fundamental breather, a fundamental soliton becomes a fundamental breather and, conversely, that the interaction of two fundamental breathers generically yields two fundamental breathers with a polarization shifts, but may also result into a fundamental soliton and a fundamental breather. Explicit formulas for the coefficients that characterize the fundamental breathers, as well as for their polarization vectors are obtained. New Yang-Baxter maps are obtained in the process.

References

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