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## The generation of lumps and their interaction phenomena within the Kadomtsev–Petviashvili equation

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The stationary multi-lump solution of the (2 + 1)-dimensional Kadomtsev–Petviashvili I (KPI) equation is presented by making use of Hirota bilinear transform method. The dependence of the stationary multi-lump structures on free parameters is discussed. Then, the interactions of multi-lumps within the KPI equation are studied numerically. The interactions of single lumps with each other and with a more complex objects such as bi-lumps, as well as the interactions of bi-lumps with each other are studied in details. The main result is that in the process of interaction the multi-lumps usually disintegrate into a number of single lumps, and the multi-lump interactions resemble the cascade processes in the interaction of elementary particles. It is amazing that the concentrated wave fields in the form of lumps demonstrate the particle-like behavior. Finally, the generation of symmetric and asymmetric lumps by a straight or oblique three-dimensional bottom topography is numerically investigated in term of the forced KPI equation. The wave structures and propagation properties are studied for several forcings, such as the different orientation and volume of the bottom topographies.

Key words: Kadomtsev-Petviashvili Equation; Hirota transformation; Lump interaction; Bottom topography