# Particle-like Interactions of Two-Dimensional Solitary Waves in Continuous Media

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We show that interaction of solitary waves in continuous media (water, plasma, solids, etc.) which are described by two-dimensional models of Kadomtsev–Petviashvili type can be effectively considered as interaction of classical particles. The theoretical concept of such approach was developed in the works by Gorshkov & Ostrovsky [1–3] basically for one-dimensional systems. Here we develop this approach for two-dimensional wave models and show that the asymptotic solutions agree well with exact solutions in the cases when a wave model is completely integrable. Then, the asymptotic method is applied to nonintegrable models and provides non-trivial solutions describing interaction of two-dimensional solitary waves. Examples are given for plane soliton interactions in the infinitely deep stratified ocean governed by the 2D Benjamin–Ono equation and for plane soliton interactions in 2D discrete lattices of quadratic or triangle-hexagonal structures. We also present exact and numerical solutions describing the dynamics of fully localized solitary waves called lumps. Lumps can exist in nonlinear media with a positive dispersion. It is shown that lumps can form molecular-type patterns (multi-lumps) stationary moving in a certain direction on a plane. Various analytical and numerical solutions are presented. Elementary acts of lump interaction with each and with plane solitons are described in detail. Nontrivial interactions of lumps and multi-lumps with each other are illustrated through the numerical modelling. Interaction of periodic lump chains with plane solitons is also presented. Details of this study can be found in Refs. [4–6].

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