

Line-soliton interactions in the Kadomtsev-Petviashvili equation

Gino Biondini¹

May 17, 2007

1. State University of New York at Buffalo, Department of Mathematics, Buffalo, NY 14260 - USA.

The Kadomtsev-Petviashvili (KP) equation is perhaps the prototypical (2+1)-dimensional integrable system, and it possesses exact solutions called line solitons. Recent studies have shown that the solitonic sector of the version of KP known as KP II is extremely rich. Here I will present a general class of line-soliton solutions of KP II, which describe an arbitrary number of incoming line solitons interacting to form another arbitrary number of outgoing solitons. I will then describe two special subclasses. One subclass is that of solutions which also satisfy the finite Toda lattice hierarchy. Such solutions describe resonant interactions creating a web-like structure. Another subclass is that of elastic N -soliton solutions, defined as those solutions for which the incoming line solitons coincide with the outgoing line solitons apart from translations. I will show how all elastic N -soliton solutions, which include nonresonant, partially resonant and fully resonant cases, can be classified in terms of the individual soliton parameters. Finally, I will briefly show how the existence of such solutions appears to be a rather general feature of (2+1)-dimensional integrable systems.

References

- [1] G. Biondini and Y. Kodama, “On a family of solutions of KP which also satisfy the Toda lattice hierarchy”, *J. Phys. A* **36**, 10519–10536 (2003)
- [2] Y. Kodama, “Young diagrams and N -soliton solutions of the KP equation”, *J. Phys. A* **37**, 11169 (2004).
- [3] G. Biondini and S. Chakravarty, “Soliton solutions of the KP II equation”, *J. Math. Phys.* **47**, 033514 (2006)
- [4] G. Biondini and S. Chakravarty, “Elastic and inelastic line-soliton solutions of the KP II equation”, *Math. Comp. Simul.* **74**, 237 (2007)