

On uniqueness of KP soliton structures

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In this talk, we explore the Kadomtsev-Petviashvili II (KP), focusing on solutions of smooth data that are not necessarily in a Sobolev space, specifically those of "soliton type" described by a phase $\Theta(t, x, y)$ and a unidimensional profile F . We show that these solutions are characterized through a set of nonlinear differential equations and special functionals like Wronskian, Airy, and Heat types. These functional equations only depend on the new variables Θ and F . A distinct characteristic of this set of functionals is its special and rigid structure tailored to the considered soliton. By analyzing Θ and F , we establish the uniqueness of line-solitons, multi-solitons, and other degenerate solutions among a large class of KP solutions. Our results are also valid for other 2D dispersive models such as the quadratic and cubic Zakharov-Kuznetsov equations.

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