KP Reductions from the Lattice

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The Kadomtsev-Petviashvili (KP) equation is a nonlinear partial differential equation in 2+1 dimensions that describes the complex web-like patterns of waves that can appear on the surface of shallow water. The KP equation is the simplest nontrivial equation in the KP hierarchy, a system of equations with diverse applications in mathematics and theoretical physics. Many important nonlinear partial differential equations in 1+1 dimensions, such as the Burgers', Korteweg-de Vries, nonlinear Schrodinger and Boussinesq equations, all arise as symmetry reductions of the KP hierarchy.

Among the numerous special properties of KP (both the equation and the hierarchy) is the existence of a Backlund transformation (BT), a way to construct a new solution from a given one by solution of a simpler system. Backlund transformations commute, and this allows the construction of an associated lattice, in which the vertices are solutions of KP (equation or hierarchy), connected by an edge if they are related by a BT. In this talk we show new reductions of KP arise by imposing translational invariances on this lattice. The reductions obtained in this way appear to be, at least in some cases, the so-called Schwarzian versions of the classical symmetry reductions