Abstract

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"Integrable PDEs and Nonlinear Steepest Descent"

The asymptotic analysis of so-called completely integrable PDEs is often reducible to the asymptotic analysis of Riemann-Hilbert matrix factorization problems in the complex plane or a Riemann surface. This is achieved through a deformation method, initiated by Its, and made systematic and rigorous by Deift and Zhou. Although it is often known as the nonlinear steepest descent method, it is only recently that the term "steepest descent" has been justified, properly speaking steepest descent contours have been constructed, and the method has achieved it full power. In my talk I will illustrate this asymptotic method by considering the case of the semiclassical focusing NLS problem. I will explain how the nonlinear steepest descent method gives rise to a maxi-min variational problem for Green potentials with external field in an infinite sheeted Riemann surface and I will describe results on existence and regularity of solutions to this variational problem. The solutions are the steepest descent contours (S-curves; trajectories of quadratic differentials) together with their equilibrium measures.