



Universidad  
Carlos III de Madrid

# Seminario del Instituto Gregorio Millán

## Steepest-descent method for integrable systems (Part 1 of 2)

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### Abstract

We examine integrable nonlinear systems, in particular KdV (the Korteweg-de Vries equation) and NLS (the focusing nonlinear Schrödinger equation). The equations display their dispersive character particularly well in a scaling of small dispersion often referred to as the semiclassical scaling. The initial profile breaks into fully nonlinear modulated oscillations that are often multi-phase.

We will describe recent methods for solving the initial value problem in this scaling, using rigorous asymptotics. Conceptually, the process is analogous to linear PDE, where one can derive the geometrical optics approximation by applying the steepest descent method to the calculation of the integral that expresses the field. In the nonlinear case the object on which steepest descent is applied is not an integral. It is a Riemann-Hilbert problem that relates to the scattering theory of a linear operator. This operator is associated to the nonlinear problem and effects the solution of the nonlinear problem.

We will start with numerical results on the emergence of oscillations and we will give an outline of the basic ideas behind the the method of solution of integrable systems and of the asymptotic calculation.

- **DÍA Y HORA: viernes 12 de noviembre de 2010 a las 12:30**
- **LUGAR: Edificio Sabatini. Aula 2.1.D04**