Demonstration of Dark Soliton Solutions Found by Inverse Scattering Transform

LI Cun, YANG Bai-Feng, CAI Hao, and HUANG Nian-Ning

Department of Physics, Wuhan University, Wuhan 430072, China

Abstract: One of the basic problems about the inverse scattering transform for solving a completely integrable nonlinear evolutions equation is to demonstrate that the Jost solutions obtained from the inverse scattering equations of Cauchy integral satisfy the Lax equations. Such a basic problem still exists in the procedure of deriving the dark soliton solutions of the NLS equation in normal dispersion with non-vanishing boundary conditions through the inverse scattering transform. In this paper, a pair of Jost solutions with same analytic properties are composed to be a 2×2 matrix and then another pair are introduced to be its right inverse confirmed by the Liouville theorem. As they are both 2×2 matrices, the right inverse should be the left inverse too, based upon which it is not difficult to show that these Jost solutions satisfy both the first and second Lax equations. As a result of compatibility condition, the dark soliton solutions definitely satisfy the NLS equation in normal dispersion with non-vanishing boundary conditions.

[Full text: PDF]

Close