

Séminaire CEMPI

'SOLITONS'

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Abstract

In this presentation, I will give an overview of the history of the ideas related to solitons, from John Scott Russell's serendipitous empirical discovery in 1834, through Zabusky and Kruskal's numerical re-discovery in 1965 and Lax's insight of 1968 towards the all-enveloping ideas of Zakharov-Shabat and Ablowitz-Kaup-Newell-Segur emerged in 1972-73. Whenever possible, I will try to establish links between the formal theory of integrable partial differential equations and familiar objects of Quantum Mechanics and Laser Physics. In this spirit, I'll first review a relatively well-known connection between the Korteweg-de Vries solitons and the Poeschl-Teller potential ($\text{sech}^2(x)$ well). I'll further proceed to introduce an entirely unrecognized bridge between the sine-Gordon and Nonlinear Schroedinger solitons and two-level atom under a $\text{sech}(t)$ laser pulse. Both examples can be used to visualize the defining property of the solitons, their mutual transparency. If time permits, I'll briefly review our recent results on two completely mutually unrelated connections between the solitons and the supersymmetric quantum mechanics (SUSY-QM).