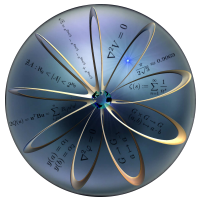

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soliton

Canonical name	Soliton
Date of creation	2013-03-22 17:47:50
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Owner	invisiblerhino (19637)
Last modified by	invisiblerhino (19637)
Numerical id	10
Author	invisiblerhino (19637)
Entry type	Definition
Classification	msc 35Q51
Classification	msc 37K40
Synonym	solitary wave

A soliton is a non-linear object which moves through space without dispersion at constant speed. They occur naturally as solutions to the Korteweg - de Vries equation. They were first observed by John Scott Russell in the 19th century and then by Martin Kruskal and Norman Zabusky (who coined the term soliton) in a famous computer simulation in 1965. Insight into solitons can be obtained by noting that the Korteweg - de Vries equation satisfies D'Alembert's solution:

$$u(x,t) = f(x - ct) + g(x + ct)$$

We see at once that this satisfies two important criteria: it has a constant velocity c, and it can also be shown that the two functions f and g can collide without altering shape. Solitons also occur in non-linear optics and as solutions to field equations in quantum field theory.