# Physics Of Solitons

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**Yuan Shen, PhD Physics**
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The theoretical advances from this project will lead to a clearer and more effective understanding of highly nonlinear phenomena in physics, such as solitons, gravitational singularities in general ...

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Richard Clayton has a first degree in Applied Physics and Electronics from the University of Durham, and a PhD in Medical Physics from the University in Newcastle upon Tyne. After completing his PhD, ...

**Professor Richard Clayton**
Hawrylak, P.B. Corkum and M.Y. Ivanov, “High harmonic generation and level bifurcation in strongly driven quantum wells,” Laser Physics 13 ... “Watching dark solitons decay into vortex rings in a Bose ...

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This textbook gives an instructive view of solitons and their applications for advanced students of physics.

A discussion of the soliton, focusing on the properties that make it physically ubiquitous and the soliton equation mathematically miraculous.

Topological solitons occur in many nonlinear classical field theories. They are stable, particle-like objects, with finite mass and a smooth structure. Examples are monopoles and Skyrmions, Ginzburg-Landau vortices and sigma-model lumps, and Yang-Mills instantons. This book is a comprehensive survey of static topological solitons and their dynamical interactions. Particular emphasis is placed on the solitons which satisfy first-order Bogomolny equations. For these, the soliton dynamics can be investigated by finding the geodesics on the moduli space of static multi-soliton solutions. Remarkable scattering processes can be understood this way. The book starts with an introduction to classical field theory, and a survey of several mathematical techniques useful for understanding many types of topological soliton. Subsequent chapters explore key examples of solitons in one, two, three and four dimensions. The final chapter discusses the unstable sphaleron solutions which exist in several field theories.

This volume is devoted to the exciting topic of dissipative solitons, i.e. pulses or spatially localised waves in systems exhibiting gain and loss. Examples are laser systems, nonlinear resonators and optical transmission lines. The physical principles and mathematical concepts are explained in a clear and concise way, suitable for students and young researchers. The similarities and differences in the notion of a soliton between dissipative systems and Hamiltonian and integrable systems are discussed, and many examples are given. The contributions are written by the world's leading experts in the field, making it a unique exposition of this emerging topic.

This 2001 book explains the construction of exact soliton solutions to Einstein's theory of gravity.

This textbook is an introduction to the theory of solitons in the physical sciences.

The second edition of a highly successful book on nonlinear waves, solitons and chaos.

This book provides an introduction to localised excitations in spatially discrete systems, from the experimental, numerical and mathematical points of view. Also known as discrete breathers, nonlinear lattice excitations and intrinsic localised modes, these are spatially localised time periodic motions in networks of dynamical units. Examples of such networks are molecular crystals, biomolecules, and arrays of Josephson superconducting junctions. The book also addresses the formation of discrete breathers and their potential role in energy transfer in such systems. Contents:Computational Studies of Discrete BreathersVibrational Spectroscopy and Quantum LocalizationSlow ManifoldsLocalized Excitations in Josephson ArraysProtein Functional Dynamics: Computational ApproachesNonlinear Vibrational Spectroscopy: A Method to Study Vibrational Self-TrappingBreathers in Biomolecules?Statistical Physics of Localized VibrationsLocalization and Targeted Transfer of Atomic-Scale Nonlinear Excitations: Perspectives for Applications Readership: Advanced graduate students and postdoctoral researchers in nonlinear dynamics. Keywords:Energy Localisation;Transfer;Breathers;Quantum Localisation;Spectroscopy;Josephson Junctions;Protein Dynamics;Statistical Physics;Nonlinear Physics;Hamiltonian Dynamics

With contributions by numerous experts

The dissipative soliton concept is a fundamental extension of the concept of solitons in conservative and integrable systems. It includes ideas from three major sources, namely standard soliton theory developed since the 1960s; nonlinear dynamics theory; and Prigogine's ideas of systems far from equilibrium. These three sources also correspond to the three component parts of this novel paradigm. This book explains the above principles in detail and gives the reader various examples.