

SOLITONS AND NONLINEAR WAVES IN PERIODIC COMPLEX STRUCTURES (SYSN)

gemeinsam veranstaltet von den Fachverbänden
Quantenoptik und Photonik (Q) und
Dynamik und statistische Physik (DY)

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Spatial structures like solitons and vortices appearing in nonlinear media are a key for the understanding of complex effects in physics and related fields in science. In recent years fully new experimental systems in optics and atomic physics (e.g. BEC) as well as new theoretical approaches led to a much deeper understanding of the underlying physics of nonlinear media in general. This paves the way towards a fascinating area of fundamental physics and important applications in future. The goal of this symposium is to bring together scientists from different areas, mainly nonlinear optics and quantum optics and to show up similarities and differences of nonlinear phenomena like solitons and vortices in these branches.

ÜBERSICHT DER HAUPTVORTRÄGE UND FACHSITZUNGEN

(Hörsaal HU Audimax)

Hauptvorträge

SYSN 1.1	Fr	14:00	(HU Audimax)	Optical Fiber Solitons: Perturbations and Interactions , Fedor Mitschke
SYSN 1.2	Fr	14:30	(HU Audimax)	Solitons and nonlinear waves in photonic lattices , Mordechai Segev
SYSN 1.3	Fr	15:00	(HU Audimax)	Dissipative Optical Solitons , Ulf Peschel
SYSN 1.4	Fr	15:30	(HU Audimax)	Nonlinear lattice breathers and solitons: concepts and applications , Sergej Flach
SYSN 2.1	Fr	16:30	(HU Audimax)	Bose-Einstein Condensates in fast rotation , Jean Dalibard
SYSN 2.2	Fr	17:00	(HU Audimax)	Matter Wave Soliton Train from a Bose-Einstein Condensate , Randall G. Hulet
SYSN 2.3	Fr	17:30	(HU Audimax)	Towards controlling matter wave lattice solitons , Anna Sanpera
SYSN 2.4	Fr	18:00	(HU Audimax)	Non-spreading wave packets of interacting matter waves: Gap-Solitons and nonlinear self trapping , Markus Oberthaler

Fachsitzungen

SYSN 1	SYSN I	Fr 14:00–16:00	HU Audimax	SYSN 1.1–1.4
SYSN 2	SYSN II	Fr 16:30–18:30	HU Audimax	SYSN 2.1–2.4

Fachsitzungen

– Hauptvorträge –

SYSN 1 SYSN I

Zeit: Freitag 14:00–16:00

Raum: HU Audimax

Hauptvortrag SYSN 1.1 Fr 14:00 HU Audimax
Optical Fiber Solitons: Perturbations and Interactions —
 •FEDOR MITSCHKE — Institut für Physik, Universität Rostock, 18051
 Rostock

Solitons are the natural bits for information transfer via optical fiber. The particle-like properties of solitons include their interaction forces, and a remarkable resilience to perturbations. Solitons both bright and dark, survive strong perturbations in dispersion-managed fiber. In feedback loops, ensembles of solitons are shaped by mutual interaction. The talk also addresses the possibility of compound solitons, or *soliton molecules*.

Hauptvortrag SYSN 1.2 Fr 14:30 HU Audimax
Solitons and nonlinear waves in photonic lattices — •MORDECHAI
 SEGEV — Physics Department, Technion, Haifa 32000, Israel

Solitons in lattices are a universal phenomenon, common to all nonlinear periodic structures in nature, from optical waves and matter-waves to vibrational waves and spin waves. The past few years have witnessed several breakthroughs in this area, especially with nonlinear optical systems. I will review this recent progress with an emphasis on the universality of the underlying physics.

Hauptvortrag SYSN 1.3 Fr 15:00 HU Audimax
Dissipative Optical Solitons — •ULF PESCHEL — Institute of Solid
 State Physics and Optics, Friedrich-Schiller-University Jena, Max-Wien-
 Platz 1, 07743 Jena, Germany

Losses due to absorption or scattering are always present in real-world optical systems. The active compensation of energy dissipation is therefore vital for any kind of application. It also leads to the formation of new and surprisingly robust localized structures, which exchange energy with their environment. The aim of the talk is to discuss the properties of these so-called dissipative optical solitons for both the spatial and the temporal domain.

Hauptvortrag SYSN 1.4 Fr 15:30 HU Audimax
Nonlinear lattice breathers and solitons: concepts and applications — •SERGEJ FLACH — MPI für Physik komplexer Systeme,
 Noethnitzer Straße 38, 01187 Dresden

I will introduce mathematical concepts for obtaining localized excitations in nonlinear lattices, review the rich variety of experimental realizations, and discuss recent applications with particular focus on systems of interacting Josephson junctions and nonlinear optical waveguides.

SYSN 2 SYSN II

Zeit: Freitag 16:30–18:30

Raum: HU Audimax

Hauptvortrag SYSN 2.1 Fr 16:30 HU Audimax
Bose-Einstein Condensates in fast rotation — •JEAN DALIBARD
 — Laboratoire Kastler Brossel, 24 rue Lhomond, 75005 Paris, France

I will discuss some aspects of the physics of fast rotating Bose gases, both from theoretical and experimental perspectives. Using an approach based on the Landau Level structure of the spectrum, I will discuss the vortex pattern as well as the BEC transition temperature. I will also describe recent experiments performed in our laboratory, aiming to create a system of layered rotating superfluids.

Hauptvortrag SYSN 2.2 Fr 17:00 HU Audimax
Matter Wave Soliton Train from a Bose-Einstein Condensate —
 •RANDALL G. HULET — Department of Physics and Astronomy, Rice
 University, P.O. Box 1892, Houston, TX 77251-1892, USA

We have created a train of bright matter wave solitons from a Bose-Einstein condensate of lithium. Up to ten solitons form by modulational instability when the interatomic interactions are tuned from repulsive to attractive. The solitons propagate in a one-dimensional potential formed from a focused laser beam. Adjacent solitons are observed to strongly repel one another due to destructive wave interference.

Hauptvortrag SYSN 2.3 Fr 17:30 HU Audimax
Towards controlling matter wave lattice solitons — •ANNA SAN-
 PERA — Department of Physics, ICREA, Universitat Autònoma de
 Barcelona

The field of Bose-Einstein Condensation has stimulated a renewed interest in solitonic models, starting from the first experimental demonstration of continuous dark and bright solitons in condensates. The possibility, nowadays, to load the condensate in an optical lattice or to change its scattering length opens the path towards a control of such structures hardly achievable in other areas of physics.

Hauptvortrag SYSN 2.4 Fr 18:00 HU Audimax
Non-spreading wave packets of interacting matter waves: Gap-Solitons and nonlinear self trapping — •MARKUS OBERTHALER
 — Kirchhoff Institut für Physik, University of Heidelberg, Im Neuen-
 heimer Feld 227, D-69120 Heidelberg

One of the intriguing properties of nonlinear wave dynamics is the existence of stationary localized wave packets. In this talk the nonlinear wave dynamics of interacting matter waves realized with a Bose-Einstein condensate in one-dimensional periodic potentials will be discussed. In the case of weak periodic potentials Gap-solitons i.e. bright solitons for repulsive interaction, have been experimentally realized. In the deep periodic potential limit a totally different localization mechanism leads (discrete system) to non-spreading wave packets * nonlinear self trapping, which recently has been experimentally confirmed.