Conference programme

2nd International Conference on Integrable Systems and Nonlinear Dynamics
(ISND 2020)

The programme is schedule in **GMT+3 Moscow Time**

Monday 19.10.2020

09:00-09:50 Registration (6th floor) / Coffee (7th floor)
10:00-10:30 Opening (Tensor, Administration of YarSU)
10:30-11:00 V.V. Sokolov, "Non-abelian evolution systems with conservation laws and symmetries"
11:00-11:30 ***Coffee break***
11:30-12:00 S.V. Sokolov, "Dynamics of a cylinder and two point vortices in an ideal fluid"
12:00-12:30 D. Talalaev, "Graph combinatorics, statistical physics and cluster algebras"
12:30-13:00 G. Sharygin, "Symmetries of the full symmetric Toda system on real Lie algebras" **(online)**
13:00-14:00 ***Lunch break***
14:00-14:30 D. Millionshchikov, "The growth of characteristic Lie-Reinhart Algebras of hyperbolic PDE"
14:30-15:00 V. Sidorenko, "Retrograde coorbital motion of celestial bodies: the investigation of qualitative properties using Wisdom's "adiabatic approximation""
15:00-15:30 A. Rosaev, "On the limitation of backward integration method in case of resonance orbits"

ONLINE TALKS

15:30-16:00 M. Preobrazhenskaia, "Construction of cycles with a different number of bursts for each of the components in the ring of oscillators "
16:00-16:30 ***Coffee break***
16:30-17:00 V. Rubtsov, "Topological Invariants of Monge-Ampere Grassmannians"
17:00-17:30 D. Gurevich, "Quantum doubles and quantum vertex algebras"
17:30-18:00 A. Rassadin, "On electric potential of thin round lamella"
18:30 ***Welcome party***

Tuesday 20.10.2020

09:00-09:30 S.A. Kashenko, "Infinite-dimensional turing bifurcation in chains of connected van der Pol systems" **(in Russian)**
09:30-10:00 S. Glyzin, "Neimark–Sacker bifurcation and stability analysis for family of maps modelling delayed logistic equation" **(in Russian)**
10:00-10:30 V. Gishlarkaev, "Fourier transform method for some types of nonlinear partial differential equations" **(in Russian)**
10:30-11:00 D. Treschev, TBA **(online)**
11:00-11:30 ***Coffee break***
11:30-12:00 N. Nefedov, "Periodic and stationary solutions of nonlinear reaction-diffusion problems with singularly perturbed boundary conditions" **(online)**
12:00-12:30 A. Mikhailov, "Differential and difference equations on non-commutative algebras"
12:30-13:00 A.A. Kashchenko, "Relaxation modes in the ring of oscillators with delayed feedback"

13:00-14:00 ***Lunch break***
14:00-14:30 A. Sakharov, "Discriminant set of the restricted three-vortex problem on a plane"
14:30-15:00 A. Orlov, "Integrable systems and combinatorics"

ONLINE TALKS

15:00-15:30 A. Pogrebkov, "Multiplicative dynamical systems in terms of the induced dynamics"
15:30-16:00 M.C. Van der Weele, "Integrable Systems in Multidimensions"
16:00-16:30 ***Coffee break***
16:30-17:00 N. Hounkonnou, "Noncommutative Kepler Dynamics: symmetry groups and bi-Hamiltonian structures"
17:00-17:30 M. Pavlov, "A new class of integrable two-component systems of hydrodynamic type"
17:30-18:00 S. Anastassiou, "Complicated behaviour in some Henon-type maps"
18:00-19:00 **POSTERS**

- V. Golubenets, "Periodic relaxation solutions of certain generalization of logistic equation with state-dependent delay"
- D. Kosterin, "Stability of piecewise smooth solutions of a distributed dynamical system"
- A.N. Kulikov, D.A. Kulikov, "Spatially inhomogeneous equilibrium states of the Cahn-Hilliard equation"
- V.A. Kulikov, "Analysis of bifurcations of spatially inhomogeneous solutions of a nonlinear parabolic equation with the operator of rotation of the spatial argument and delay"
- A.A. Tovsultanov, "On a Dirichlet problem from an elliptic functional- differential equation with an affine argument transformation"

19:00 **Conference dinner**

Wendesday 21.10.2020

10:00-10:30 V. Kozlov, TBA **(online)**
10:30-11:00 V. Buchstaber, "Dynamical systems on 2-torus, model of Josephson junction and isomonodromic families of linear systems" **(online)**
11:00-11:30 ***Coffee break***
11:30-12:00 V. Volkov, "Asymptotic solution of coefficient inverse problems for interior layer Burgers type equations with modular nonlinearity" **(online)**
12:00-12:30 A. Tsiganov, "Reduction of divisors for the Kowalevski top"

ONLINE TALKS

12:30-13:00 A. Bountis, "Local and global dynamics in 1-d hamiltonian lattices: from physics to engineering"
13:00-14:00 ***Lunch break***
14:00-14:30 H. Skokos, "Chaotic wave packet propagation in disordered nonlinear lattices with one and two spatial dimensions"
14:30-15:00 M. Hillebrand, "Chaotic dynamics in a planar model of graphene"
15:00-15:30 V. Drakopoulos, "Univariable fractal interpolation functions"
15:30-16:00 R. Ivanov, "Fokas-Lenells equations on Hermitian symmetric spaces"
16:00 ***Excursion***

Thursday 22.10.2020

10:00-10:30 I. Kashchenko, "The dynamics of singular perturbed system of two delay differential equations"
10:30-11:00 Ian Marshall, TBA
11:00-11:30 ***Coffee break***
11:30-12:00 A. Anikin, "Non-standard Liouville tori and caustics in problem of long waves trapped by a shore"

ONLINE TALKS

12:00-12:30 B. Bychkov, "Star-triangle transformation of the Potts model partition function as a solution for the tetrahedron equation and related combinatorial topics"
12:30-13:00 I. Habibullin, "Generalized invariant manifolds and separation of the variables for integrable lattices"
13:00-14:00 ***Lunch break***
14:00-14:30 Z. Makridin, M. Pavlov, "A new class of integrable two-component systems of hydrodynamic type"
15:00-15:30 S. Wabnitz, "Spatiotemporal soliton bullet dynamics in multimode optical fibers"
15:30-16:00 V. Gergjikov, "Recursion operators and hierarchies of mKdV equations related to the Kac-Moody algebras a(1) and a(2)"
16:00-16:30 ***Coffee break***
16:30-17:00 P. Xenitidis, "Symmetries and integrability of difference equations"
17:00-17:30 N. Kallinikos, "Approximate quasisymmetry"

Friday 23.10.2020

10:00-10:30 D. Glazkov, "Local solutions of slow-fast delay optoelectronic model"
10:30-11:00 S. Igonin, "Yang–Baxter maps associated with Darboux transformations, Lie groups, and linear approximations of refactorisation problems"
11:00-11:30 ***Coffee break***

ONLINE TALKS

11:30-12:00 T. Kouloukas, "Cluster maps associated with the discrete KdV equation"
12:00-12:30 P. Kassotakis, "Integrable two-component systems of difference equations"
12:30-13:00 G. Grahovski, "Grassmann extensions of Yang–Baxter maps"
13:00-14:00 ***Lunch break***
14:00-14:30 P. Adamopoulou, "On a hierarchy of multi-component generalisation of mKdV type equations"
14:30-15:00 G. Papamikos, "From solutions of Yang--Baxter equations to higher dimensional integrable maps"
15:00-15:30 S. Sklaveniti, "Discretization of the NLS-type hierarchy"

Spatiotemporal soliton bullet dynamics in multimode optical fibers

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In recent years, nonlinear pulse propagation in multimode fibers (MMFs) is has experienced a dramatic resurgence of interest, because of their potential for optical communications and high-power lasers. However, from the fundamental viewpoint several aspects still remain to be fully understood. Here we experimentally and theoretically studied the dynamics of high-energy (up to reaching the fiber damage threshold) spatiotemporal solitons in MMFs with a graded-index (GRIN) core profile. Intra-pulse Raman scattering leads to the fission of the initial femtosecond pulse into different multimode solitons, which undergo Raman self-frequency shift (SSFS) [1-2]. In our experiments, we revealed the presence of a new nonlinear propagation regime in MMFs, where stable spatiotemporal solitons are created by the fission of the initial pulse. Remarkably, these solitons have different amplitudes and wavelengths, but nearly equal time duration [3].

Numerical simulations were conducted to reproduce the phenomenon of fission using an exact 3D+1 vector model, including higher-order dispersion, Kerr and Raman nonlinearities. We also included a phenomenological two-photon absorption (TPA) term, to model the presence of nonlinear losses.

The measured output spectrum shows that the Raman-induced SSFS tends to saturate for energies higher than 200 nJ. This is due to the presence of high nonlinear loss in the first few cm of MM fiber, owing to multi-photon absorption by fiber defects and doping [4]. Two distinct multimode soliton propagation regimes exist: in the first, only weak linear losses are present; in the second, the output energy remains clamped to a nearly constant value. Remarkably, in the nonlinear loss regime, nearly all of the transmitted energy is funneled into high-energy spatiotemporal soliton pulses with a bell-shaped, high-quality beam profile. These results are of significant interest for the development of new, high-power laser soliton sources in the mid-infrared domain of the spectrum.

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REFERENCES

1. *Grudinin A. B., et al.,* "Nonlinear mode coupling in multimode optical fiber; excitation of femtosecond-range stimulated-Raman scattering solitons," JETP Lett., **47**, 356–359 (1988).
2. *Renninger W. H., et al.* "Optical solitons in graded-index multimode fibres," Nature Communic., **4**, 1719 (2013).
3. *Zitelli M., et al.,* "High-energy soliton fission dynamics in multimode GRIN fibers," Optics Express, **28**, 20473–20488 (2020).
4. *Hansson T., et al.,* "Nonlinear beam self-imaging and self-focusing dynamics in a GRIN multimode optical fiber: theory and experiments," Optics Express, **28**, 24005–240219 (2020).