NWP-2025 Program

	NWP-1 **Nonlinear Dynamics and Machine Learning**	NWP-2 **High-Power Lasers and Applications**	NWP-3 **Nonlinear Phenomena in the Atmosphere and Ocean**
Chairs	**Stefano Boccaletti (Italy) Vladimir I. Nekorkin (Russia)**	**Efim Khazanov (Russia) Jianda Shao (China)**	**Evgeny Mareev (Russia)**
	IX Scientific School "Dynamics of Complex Networks and their Applications" (DCNA'2025) Russian-Chinese Workshop "Ultra Intense Laser Technology and Intense Field Physics"		
9:30-12:30	**Registration of participants**		
12:30	**Departure from Moscow**		
13:30-15:00	**Lunch**		
15:00	**Opening session**		
	Plenary session		
15:30-16:10	**Evgenii Kuznetsov** (Russia). Symmetry approach to the problem of the gas expansion into a vacuum		
16:10-16:50	**Jianda Shao** (China). Research progress and future prospect of AI+laser at SIOM		
16:50-17:30	**Alexander Khain** (Israel). Toroidal vortices: their effects on dynamics and microphysics of cumulus clouds		
17:30-18:00	**Coffee break**		
	NWP-1	NWP-2	NWP-3
	Complex dynamics of oscillatory systems	**Ultra-intense laser technology and intense field physics. Session 1**	**Climate. Session 1**
18:00-19:40	**V. Nekorkin.** Biologically inspired neural networks based on adaptive Kuramoto model with higher-order interactions (**Invited**, 30 min)	**M. Starodubtsev.** XCELS-100 Project (**Invited,** 30 min)	**S. Kravtsov.** Emulation and S2S probabilistic prediction of 2-M temperature and precipitation over the global domain using linear inverse modeling (**Invited**, 30 min)
	A. Kazakov. Robust chaos in the generalized Kuramoto model (**Invited**, 30 min)	**S. Liu.** Application of artificial intelligence in optical testing (**Invited,** 30 min)	**D. Kondrashov.** Advancing predictive understanding of summer Arctic Sea ice (**Invited**, 30 min)
	J. Zhu. Phase dynamics of noise-induced coherent oscillators (**Invited,** 30 min)	**A. Shaykin.** 3PW OPCPA PEARL facility (**Invited**, 30 min)	**N. Iakovlev.** The understanding of the Arctic Ocean hydro- and sea ice dynamics: Multiscale physics and numerical modeling (**Invited**, 30 min)
20:00-21:00	**Dinner**		
21:30	**Welcome party**		

8:00-9:00	Breakfast		
	NWP-1	**NWP-2**	**NWP-3**
	Novel approaches and applications in machine learning. Session 1	**Ultra-intense laser technology and intense field physics. Session 2**	**Ocean**
9:00-11:20	**I. Oseledets.** TBA (**Invited,** 30 min)	**E. Khazanov.** Impact of small-scale obscuration, surface roughness and reflectivity fluctuations of diffraction gratings on the temporal contrast of a femtosecond pulse (**Invited**, 30 min)	**S. Badulin.** Anisotropic weakly turbulent spectra of ocean swell: Analytical results and simulations (**Invited**, 30 min)
	V. Vanovskiy. AI technologies for modelling complex physical processes. Case of self-supervised computational graph coarsening (**Invited**, 30 min)	**Y. Jin.** Fabrication and application of surface relief gratings (**Invited,** 30 min)	**V. Geogjaev.** On anisotropic Kolmogorov spectra for deep water surface waves (**Invited**, 30 min)
	A. Ossadtchi. Interpreting brain activity with nonlinear and neural network based models (**Invited**, 30 min)	**S. Mironov.** Filtering spatial noise in a diffraction grating compressor to suppress small-scale self-focusing at post-compression stage (**Invited,** 30 min)	**V. Zhmur.** Behavior modes of a quasi-geostrophic ellipsoidal vortex in a horizontal flow with vertical shear (**Invited**, 30 min)
	M. Kiselev. Numeric model of spiking neural network CoLaNET learning process (**Invited,** 30 min)	**F. Wu.** Ultrahigh peak power femtosecond laser pulse compression methods (20 min)	
	A. Emelianova. A novel reservoir computing model: self-organized criticality, adaptivity and higher-order interactions (20 min)	**I. Yakovlev.** Ultrashort-pulse stretcher for XCELS laser complex prototype (20 min)	
11:30	Arrival at Uglich		
11:30-14:00	Excursion		
14:30	Departure from Uglich		
14:30-16:30	Lunch		
	Plenary session		
16:30-17:10	**Alexander Hramov** (Russia). AI and network theory approaches for studying and diagnosing brain disorders		
17:10-17:50	**Alexander Feigin** (Russia). The role of nonlinear processes in observed climate evolution		
17:50-18:10	Coffee break		
	NWP-1	**NWP-2**	**NWP-3**
	Novel approaches and applications in machine learning. Session 2	**Ultra-intense laser technology and intense field physics. Session 3**	**Climate. Session 2**
18:10-19:30	**S. Kurkin.** Analysis of simplicial complexes as an effective approach for detecting higher-order	**C. Wei.** Laser-based manufacturing technology for high UV-laser-damage-threshold fused silica	**A. Seleznev.** Revealing evolution of ENSO in a changing climate: Data-driven dynamical systems

	interactions in complex networks: Application examples (**Invited**, 30 min)	optics (**Invited**, 30 min)	approach (**Invited**, 30 min)
	K. Stoyanova. Machine learning in the assessment of the nomological organization of traits (**Invited,** 30 min)	**D. Silin.** Problems of high-precision measurements of wide-aperture aspherical optics (20 min)	**A. Kozlov.** Evaluation of regional climate simulations over the Northern Eurasia using a new land surface model (20 min)
	A. Kuc. Application of machine learning and long-range temporal correlations in EEG for the diagnosis of focal epilepsy (20 min)	**Q. Lu.** Problems of high-precision measurements of wide-aperture aspherical optics (20 min)	
19:30-20:30	**Dinner**		
21:00-22:00	**Concert**		

8:00-9:00	Breakfast		
	NWP-1	**NWP-2**	**NWP-3**
	Complex dynamical networks. Session 1	**Ultra-intense laser technology and intense field physics. Session 4**	**Climate. Session 3**
9:00-10:30	**S. Kashchenko.** Dynamics of chains of coupled systems with a large number of elements (**Invited**, 30 min)	**Y. Wang.** Research on broadband high damage threshold ultrafast laser coatings (**Invited,** 30 min)	**D. Mukhin.** data-driven methods for studying nonlinear climate phenomena (**Invited,** 30 min)
	D. Goldobin. Macroscopic self-organization of recurrent synaptic networks beyond the diffusion approximation (**Invited**, 30 min)	**I. Mukhin.** High aperture active mirror disk laser head for 10 J and 10 Hz laser amplifier (**Invited,** 30 min)	**E. Loskutov.** Improving the predictability of the climatic dynamics of the characteristics of the tropical basin of the Pacific and Indian Oceans using joint empirical models (**Invited,** 30 min)
	L. Smirnov. Dynamics of large oscillator ensembles with random interactions (**Invited**, 30 min)	**M. Sun.** New configurations on high efficiency and ultra-broadband optical parametric amplification (20 min)	**R. Samoilov** Identification of Seasonally Dependent Atmospheric Circulation Regimes with Non-Homogeneous Hidden Markov Model (20 min)
10:30	Arrival at Goritsy		
10:30-13:20	Excursion		
13:30	Departure from Goritsy		
13:30-15:00	Lunch		
	NWP-1	**NWP-2**	**NWP-3**
	Complex dynamical networks. Session 2	**Ultra-intense laser technology and intense field physics. Session 5**	**Atmosphere. Session 1**
15:00-17:30	**G. Strelkova.** Beneficial role of noise in the dynamics of complex networks: chimera resonance (**Invited**, 30 min)	**A. Soloviev.** Dipole focusing of exawatt laser radiation: An experimental way to the theoretical limit (**Invited,** 30 min)	**O. Ckhheteani.** Wave-vortex interactions in geophysical flows (**Invited,** 30 min)
	T. Vadivasova. Effects of coupling and noise in networks of excitable FitzHugh–Nagumo neurons (**Invited**, 30 min)	**Yue Cheng.** Design, fabrication and performance study of the all-solid anti-resonant fiber (20 min)	**E. Malinovskaia.** Convective and electrostatic structures in dust aerosol emission (20 min)
	V. Ponomarenko. Image recognition using a small spiking neural network (**Invited**, 30 min)	**I. Kuzhetsov.** High-power multichannel Yb:YAG laser with coherent beam combining (20 min)	**N. Vazaeva.** On the universality of squall statistics: self-similarity and turbulent features (20 min)
	V. Semenov. Control of deterministic and stochastic wavefront propagation for networks of bistable oscillators (**Invited**, 30 min)	**Xin Li.** Luminescence behavior and structural relationship of bismuth doped silica glasses and fibers (20 min)	**A. Khain.** Are the mechanisms responsible for the formation of cumulus cloud fields well understood? (**Invited,** 30 min)
	N. Semenova. The impact of internal noise on deep and spiking neural networks (**Invited**, 30 min)	**K. Burdonov.** Recent progress in development of a low-power multi-beam coherent combining system prototype for the XCELS project (20 min)	**K. Rubinstein** Nonlinear response of the atmospheric transport model to meteorological forecast uncertainties (10 min)

	NWP-1	NWP-2	NWP-3
		Xiao Liang. Recent research progress on the ultra-broadband and high efficiency OPCPA technology for high energy few-cycle laser (20 min)	
		M. Zolotavin. Subwavelength fiber probes for scanning the stable electric field structure in counterpropagating laser beams (20 min)	
17:30-17:50	**Coffee break**		
-	**Poster Session**		
	NWP-1	**NWP-2**	**NWP-3**
17:50:19:30	**A.S. Butorova, A.P. Sergeev.** Multi-algorithmic software for visual-to-auditory sensory substitution	**M. Dorozhkina.** Wakefield acceleration with the XCELS laser driver in plasma with a longitudinal density gradient	**A.A. Dolinin, N.V. Ilin, F.G. Sarafanov.** Experimental installation for the creation and maintenance of hypomagnetic conditions
	O.A. Goryunov, M.V. Kiselev, V.V. Klinshov. Dynamics of training a simplified network model CoLaNET on a simple classification task	**K.A. Glushkov, I.B. Mukhin.** Amplification of CEP-stabilized few cycle pulses in the 2-μm spectral range	**K.G. Rubinstein, P.A. Konyaev, A.A. Kiselev, M.M. Kurbatova.** Nonlinear response of the atmospheric transport model to meteorological forecast uncertainties
	N.V.Gromov, T.A.Levanova, L.A. Smirnov. On some properties of output matrices in reservoir computings	**I. Ivonin.** Self-consistent turbulence in the two-dimensional nonlinear Schrödinger equation with a repulsive potential	**S.E. Safonov**, **A.S. Gavrilov**, **D.N. Mukhin**, **R.S. Samoilov**. Application of recurrent neural networks to the analysis of mid-latitude atmospheric dynamics regimes
	Yu.M. Ishbulatov, A.M. Vakhlaeva, E.S. Dubinkina, B.P. Bezruchko, A.S. Karavaev. Using neural networks to detect coupling between van der Pol oscillators from noisy and short time series	**A.S. Kuratov**, **A.V. Brantov**, **V.Yu. Bychenkov.** Electrodynamic coupling of relativistic electrons and guided THz radiation in ultrafast laser-plasma interactions	**M. Shatalina**, F.G. Sarafanov, A.V. Volkova. Modeling of Schumann resonances excited by real sources and comparison with observational results
	E. Karatetskaia. Hyperchaotic dynamics in economic model of oligopoly market	**E. Lipkova, J.W. Wang**, S.G. Rykovanov. Attosecond coherent synchrotron emission broadening in plasma target	
	R.A. Kononov, O.V. Maslennikov, V.I. Nekorkin. How population coding shapes recurrent neural network dynamics in continuous signal processing	**M.P. Malakhov**, **A.M. Fedotov**, and **S.G. Rykovanov.** Thomson scattering spectrum in interacting laser and electron beams.	
20:00-21:30	**N.D. Kulagin, A.V. Andreev, A.A. Koronovskii, O.I. Moskalenko, A.A. Badarin, A.E. Hramov.** Intermittency in forecasting stochastic system behavior using reservoir computing	**S E. Perevalov** and **A.A. Soloviev.** Refocusing high-power fs-pulses using cone-shaped curved channels.	

	A.A. Panyushev, N.V. Stankevich. Machine learning model ability to reconstruct complex attractors	
	R. Paunova, D. Stoyanov, S. Kandilarova, F. Kherif. Toward a data-driven neuroscience: premises and tools of the computational turn	
	I.R. Ramazanov, A.V. Bukh, I.A. Shepelev. Features of synchronization of the ensemble of FitzHugh-Nagumo neurons with Lévy noise	
	P.A. Shcherbakov, G.V. Osipov. A new type of chimera state in an ensemble of active particles	
	N.S. Smirnov, S.A. Kurkin, E. Hramov. Topological signatures of functional brain networks in major depressive disorder using persistent homology	
20:00-21:30	**I.A. Soloviev, O.A. Gorunov, P.S. Smelov, A.V. Kovalchuk, A.A. Bulkin, V.V. Klinshov.** Pose estimation approach in vertebrae recognition	
	A. Todeva-Radneva, B. Valkov, R. Paunova, D. Stoyanov, S. Kandilarova. Altered connectivity of the salience, sensorimotor, visuo-occipital, and cerebellar networks may delineate valuable insights in the pathophysiology of the depressive syndrome	
	A. Todeva-Radneva, B. Valkov, R. Paunova, D. Stoyanov, S.Kandilarova. Altered connectivity between the right lingual gyrus and right anterior insula may differentiate unipolar from bipolar depression	
	V. Trifonov, A. Rudikov, O. Iliev, Yu.M. Laevsky, I. Oseledets, E. Muravleva. Efficient preconditioning for iterative methods with graph neural networks	
	V. Zaykova, F. Popova, R. Paunova, S. Kandilarova, D. Stoyanov. Increased connectivity of default mode and salience network hubs in auditory verbal hallucinations	
19:30-20:30	**Dinner**	
21:00-22:00	**Concert**	

8:00-9:00	Breakfast		
	NWP-1	**NWP-2**	**NWP-3**
	Novel approaches and applications in machine learning	**Theoretical investigations on high-power laser and plasma interaction**	**Atmospheric electricity. Lightnings**
9:00-12:00	**A. Kadurin.** AI for drug discovery (**Invited**, 30 min)	**V. Bychenkov.** Solitons in high-field relativistic optics and particle acceleration. Applications. (**Invited**, 30 min)	**E. Mareev.** Lightning return stroke: Modeling problems (**Invited**, 40 min)
	A. Kovalev. Agents with memory for partially observable Markov decision (**Invited**, 30 min)	**I. Kostyukov.** Photon statistics and radiative losses of relativistic electrons in strong em fields (**Invited**, 30 min)	**N. Ilin.** Large-scale parameterization of global lightning activity (**Invited**, 30 min)
	M. Khramova. Neurotechnologies in education: personalization of learning through a recommendation service (**Invited,** 30 min)	**A. Brantov.** Low-frequency radiation of laser accelerated electrons leaving metal/plasma targets (20 min)	**A. Evtushenko.** Analysis of global sprite distribution based on WWLLN data (20 min)
	A. Sergeev. Application of machine learning and evaluation of model performance in environmental forecasting tasks (**Invited**, 30 min)	**A. Samsonov.** Production of electron-positron plasma and strong magnetic fields in interaction of an extremely intense laser radiation with a structured solid target (20 min)	
	A. Badarin. Representation and classification of fMRI data using reservoir computing and spatial patterns (**Invited**, 30 min)	**O. Vais.** Efficient generation of synchrotron radiation in the relativistic self-trapping regime (20 min)	
	A. Andreev. Reservoir computing as an effective tool for predicting the behavior of stochastic systems (**Invited**, 30 min)	**E. Dmitriev.** Orbital angular momentum gain by charged particles in a spatially structured intense linearly polarized laser beam (20 min)	
		I. Aleksandrov. Positron generation in laser plasma and intensity determination (**Invited**, 30 min))	
12:20-12:40	Coffee break		
	Plenary session		
12:40-13:20	**Sergey Rykovanov** (Russia). How can nonlinearity help future Compton gamma sources?		
13:20-14:00	**Pavel Berloff** (Russia-UK). Challenge and mystery of the oceanic synoptic eddies		
14:00-15:30	Lunch		
16:00	Arrival at Kizhi		
16:00-18:40	Excursion		
19:00	Departure from Kizhi		
19:00-20:00	Dinner		

Time	NWP-1	NWP-2	NWP-3
8:00-9:00	**Breakfast**		
9:00-10:40	**Plenary session**		
9:00-9:40	**Drozdstroy Stoyanov** (Bulgaria). Machine learning for solutions of the mind brain problem in psychiatry		
9:40-10:20	**Alexander Sergeev** (Russia). Physics at the frontier of time: From solar clocks to atomic pulses		
10:20-10:40	**Coffee break**		
	NWP-1	**NWP-2**	**NWP-3**
	Nonlinear dynamics of complex systems	**Experimental investigations on laser-plasma interaction and applications. Session 1**	**Ionosphere and upper atmosphere**
10:40-12:20	**B. Bezruchko.** Application of the method for analyzing the coupling between oscillators by modeling their phase dynamics, relying on the spectral properties of the EEG (**Invited**, 30 min)	**A. Savel'ev.** Secondary sources with high reprate laser accelerated electron sources (**Invited,** 30 min)	**V. Skalyga.** Experimental facilities for laboratory modeling of electromagnetic radiation generation in planetary magnetospheres at IAP RAS (**Invited**, 30 min)
	A. Karavaev. Using the models of photoplethysmogram and electrocardiogram signals to adjust the method for detection of the synchronization between biological systems (**Invited**, 30 min)	**E. Starodubtseva.** Second harmonic generation from plasma channel sheath for laser-plasma electron acceleration diagnostics (20 min)	**M. Gushchin.** Generation of ultra-wide-band electromagnetic pulses by long spark discharges: New effects in lightning physics (**Invited**, 30 min)
	E. Borovkova. Methods for monitoring mental fatigue based on biosignal analysis (20 min)	**R. Zemskov.** Instabilities and magnetic structuring of plasma jets induced by intense PEARL laser (20 min)	**A. Nikolenko.** Development of flute instabilities during the expansion of plasma flows in a magnetic field in space plasma simulation experiments at Krot plasma device (20 min)
	E. Efremova. Application of ultra-wideband chaotic signals for indoor wireless distance measurement and positioning (20 min)	**N.Vrublevskaya.** Nonlinear response of diluted gases to an ultraviolet femtosecond pulse: quantum mechanical description (20 min)	**N. Blagoveshchenskaya.** Nonlinear phenomena in the ionospheric F-region induced by HF pumping under high effective radiated power (20 min)
12:30-14:00	**Lunch**		
14:00	**Arrival at Svir'stroy**		
14:00-17:30	**Excursion**		
18:00	**Departure from Svir'stroy**		
	NWP-1	**NWP-2**	**NWP-3**
	Nonlinear dynamics of complex systems. Session 2	**Experimental investigations on laser-plasma interaction and applications. Session 2**	**Atmosphere. Session 2**
18:00-19:30	**A. Kamchatnov.** Hamiltonian dynamics of ring dark solitons (**Invited**, 30 min)	**N. Andreev.** Efficient sources of ultra-relativistic	**A. Gritsun.** Instability, chaotic behavior and

		particles and hard radiation based on direct laser acceleration of electrons in foam targets (**Invited,** 30 min)	response properties of atmospheric models (**Invited**, 30 min)
	A. Dmitriev. Multiscale of life and intelligence (**Invited**, 30 min)	**C. Qin.** Study of laser-driven proton acceleration in SULF facility (20 min)	**E. Mortikov.** Numerical Simulation of turbulence in urban environment with idealized and realistic surface morphologies (**Invited**, 30 min)
	R. Banerjee. A hybrid framework for optimized and diversified stock portfolio construction using clustering, causal inferencing and reservoir computing: evidence from NIFTY 50 (**Invited**, 30 min)	**E. Nikolaev.** Application of nano- and femtosecond lasers for visualization of surfaces of solid materials and biological tissues (**Invited**, 30 min)	**V. Zhmur.** Composite vortex model of Jupiter's Great Red Spot (20 min)
19:30-20:30	Dinner		
20:30-21:30	Sponsor session		
21:30-22:30	Concert		

8:00	Arrival at Valaam		
8:00-9:00	Breakfast		
9:00-14:00	Excursion		
14:00-15:30	Lunch		
	NWP-1	**NWP-2**	**NWP-3**
	Nonlinear dynamics of complex systems. Session 3	**High power and high energy lasers**	**Art projects**
15:30-17:30	**V. Klinshov.** Dynamic convolution for image matching (20 min)	**Zhu Ping.** Advanced direct drive laser facility in national laboratory on high power laser and physics (20 min)	**E. Strelkov.** Volga-media art: memory, research, forecast
	O. Maslennikov. Unveiling the learning process: dynamic representations in RL-driven recurrent neural networks (20 min)	**Yu. Klimachev.** THz NH3 laser emission at pumping by CO2 laser (**Invited**, 30 min)	
	D. Kasatkin. Hierarchical formation of synchronization patterns in adaptive network with high-order interaction (20 min)	**E. Gacheva.** Population lensing in a disk multipass amplifier with A-cut YB:KGW active element (20 min)	
	A. Dmitrichev. Dynamics of a multi-machine power grid with a common load and its stability to connection and disconnection of generators (20 min)	**A. Sagitova.** Possibility of explosive detection by terahertz NH3 laser (20 min)	
	M. Bolotov. Chimera travel caused by kinks in a system of particles with an internal degree of freedom (20 min)	**Hua Lin.** High-power, high-energy 2um Ho:YLF composite thin disk laser (**Invited**, 30 min)	
	A. Bukh. Effect of interlayer communication delay in the FitzHugh–Nagumo network on its learning performance (20 min)		
17:30-17:50	Coffee break		
18:00-19:00	Closing session		
19:30	Dinner Party		

7:00-8:00	Breakfast
8:00-9:00	Arrival in St.Petersburg Departure