Russian Academy of Sciences
Institute of Applied Physics

International Symposium

TOPICAL PROBLEMS OF NONLINEAR WAVE PHYSICS

22 – 28 July, 2017

Moscow – St. Petersburg, Russia

PROGRAM and ABSTRACTS

Nizhny Novgorod, 2017

NWP-1: Nonlinear Dynamics and Complexity

NWP-2: Lasers with High Peak and High Average Power

NWP-3: Nonlinear Phenomena in the Atmosphere and Ocean

***WORKSHOP*: Magnetic Fields in Laboratory High Energy Density Plasmas (LaB)**

***CREMLIN WORKSHOP*: Key Technological Issues in Construction and Exploitation of 100 Pw Lass Lasers**

Board of Chairs

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PROGRAM

Saturday, July 22

	NWP-1: Nonlinear Dynamics and Complexity	NWP-2: Lasers with High Peak and High Average Power	NWP-3: Nonlinear Phenomena in the Atmosphere and Ocean
Chairs:	**Albert Luo *(USA)*, Vladimir Nekorkin *(Russia)***	**Efim Khazanov *(Russia)*, Ken-ichi Ueda *(Japan)***	**Henrik Dijkstra *(The Netherlands)*, Alexander Feigin *(Russia)*, Juergen Kurths *(Germany)*, Evgeny Mareev *(Russia)*, Vladimir Rakov *(USA)***
	Workshop: Magnetic Fields in Laboratory High Energy Density Plasmas (LaB)	**Cremlin workshop: Key Technological Issues in Construction and Exploitation of 100 PW Class Lasers**	
Chairs:	**Julien Fuchs *(France)***	**Alexander Sergeev *(Russia)*, Catalin Miron *(Romania)***	
18:00-21:00	**Registration**		
19:30-20:30	**Dinner**		
21:30	**Departure from Moscow**		
21:30	**Welcome Party**		

Cruise map

Sunday, July 23

8:00-9:00	**Breakfast**		
	HALL A		
9:00-9:30	**Opening Session**		
9:30-10:20	**Henrik Dijkstra** (*The Netherlands*). The physics of El Niño **[Plenary talk 1]**		
10:20-11:10	**Antonio Politi** (*UK*). Characterization of collective chaos in mean-field models **[Plenary talk 2]**		
11:10-11:30	**Coffee break**		
Session	**NWP-1**	**NWP-2 & LaB**	**NWP-3**
	Neural networks – 1	**Key technological issues in construction and exploitation of 100 PW class lasers (Cremlin w/sh)**	**Climate dynamics – 1**
	HALL B	**HALL A**	**HALL C**
11:30-13:30	**11:30 V.I. Nekorkin** (*Russia*)**, O.V. Maslennikov, and D.S. Shchapin.** Emergent traffic in a hypernetwork generated by an adaptive neuron network [Invited]	**11:30 V. Yashin** (*Russia*)**, B. Lee, B. Jeong, J. Yang, E. Sall, S. Chizhov, and G.H. Kim.** High-peak and high-average power Yb-doped femtosecond lasers for various applications [Invited]	**11:30 A.M. Feigin** (*Russia*)**, D.N. Mukhin, E.M. Loskutov, A.S. Gavrilov, and A.F. Seleznev.** Empirical approach to modeling & prognosis of climate systems
	12:00 T. Asabuki, N. Hiratani, and T. Fukai (*Japan*)**.** Chunking by mutual supervision in reservoir computing [Invited]	**11:50 K.F. Burdonov** (*Russia*)**, I.B. Mukhin, and A.A. Soloviev.** Increasing of front-end system stability for parametric PetaWatt lasers	**12:00 D.N. Mukhin** (*Russia*)**, A.S. Gavrilov, E.M. Loskutov, and A.M. Feigin.** Extraction of leading nonlinear dynamical modes of climate from data
	12:30 Ll. Hernández-Navarro, S. Teller, E. Tibau, J.G. Orlandi, J. Casademunt, E Vives, and J. Soriano (*Spain*)**.** Experiments in neuronal cultures: connectivity, dynamics and complexity in a dish [Invited]	**12:05 Y. Kida** (*Japan*)**.** Deep UV monocycle laser for seeding of next generation XFEL [Invited]	**12:30 E.M. Loskutov** (*Russia*)**, D.N. Mukhin, A.S. Gavrilov, and A.M. Feigin.** Investigation of paleoclimate transitions with data-driven models
	13:00 A.E. Hramov (*Russia*)**, V.A. Maksimenko, V.V. Makarov, A. Luttjohann, M.V. Goremyko, A.A. Koronovskii, A.E. Runnova, G. van Luijtelaar, and S. Boccaletti.** Macroscopic and microscopic spectral properties of multilayer epileptic brain networks during local and global synchronization [Invited]	**12:25 I.L. Snetkov** (*Russia*)**, D. Zhou, A.I. Yakovlev, I.B. Mukhin, I.I. Kuznetsov, O.V. Palashov, and K.I. Ueda.** 200 W continuous wave disk-laser on Yb:LuAG ceramics	**13:00 A.S. Gavrilov** (*Russia*)**, A.F. Seleznev, D.N. Mukhin, E.M. Loskutov, and A.M. Feigin.** Reduced nonlinear data-driven prognostic climate model construction
		12:40 J. Shao (*China*)**, Zh. Wu, Sh. Liu, J. Chen, Yu. Zhao, and M. Huang.** Toward "Defect-Free" optics: where to start? [Invited]	
		13:00 S.Yu. Mironov (*Russia*)**, J. Wheeler, E.A. Khazanov, and G. Mourou.** Control of temporal intensity profile for PW laser pulses	
		13:15 E.A. Khazanov (*Russia*)**, O.V. Maslennikov, V.N. Ginzburg, A.A. Kochetkov, and V.I. Nekorkin.** Third-order-nonlinear effects in single crystals with arbitrary orientation and in ceramics	
13:30-15:00	**Lunch**		

Sunday, July 23 *(Afternoon)*

Session	NWP-1	NWP-2 & LaB	NWP-3
	Chaotic dynamics	**LaB – 1**	**Atmosphere and ocean dynamics – 1**
	HALL B	**HALL A**	**HALL C**
15:00-17:30	**15:00 Y. Guo and A.C.J. Luo** (*USA*)**.** On period-1 motions to chaos in a parametrically excited pendulum [Invited]	**15:00 A.V. Brantov** (*Russia*) **and V.Yu. Bychenkov.** Relativistically strong laser plasma interaction: energetic particles, gamma and THz radiation, magnetic fields [Invited]	**15:00 P. Berloff** (*UK*)**.** Dynamically consistent parameterization of mesoscale eddies [Invited]
	15: 30 A.S. Dmitriev (*Russia*)**, E.V. Efremova, M.Yu. Gerasimov, and V.V. Itskov.** Look at the world in a different light: radio illumination using microwave dynamic chaos [Invited]	**15:20 Yu. Fukuda** (*Japan*)**.** Laser-driven ion accelerations with submicron cluster targets: Contributions of magnetic vortexes [Invited]	**15:30 A.V. Glazunov and E.V. Mortikov** (*Russia*). LES and DNS modelling of stably stratified boundary layer turbulence
	16:00 S.P. Kuznetsov (*Russia*)**.** Design principles and illustrations of hyperbolic chaos in mechanical and electronic systems [Invited]	**15:40 K.V. Lezhnin** (*USA*)**, T.Zh. Esirkepov, and S.V. Bulanov.** Dynamics of relativistic electron vortices in collisionless plasmas [Invited]	**16:00 D.A. Sergeev** (*Russia*)**, Yu.I. Troitskaya, and G.N. Balandina.** Estimation of the CO_2 fluxes between the ocean and atmosphere for the hurricane wind forces using remote sensing data
	16:30 E. Volkov (*Russia*) **and E. Hellen.** Complex routes to unusual collective chaos in indirectly coupled identical ring oscillators [Invited]	**16:00 J. Fuchs** (*France*)**.** Ion interactions with dense plasmas in magnetized and unmagnetized configurations [Invited]	**16:30 I.V. Shevchenko** (*UK*) **and P.S. Berloff.** On large-scale low-frequency variability of the wind-driven midlatitude ocean gyres [Invited]
	17:00 E.P. Seleznev (*Russia*)**, O.V. Astakhov, and N.V. Stankevich.** Chaotic and quasiperiodic oscillations in the system of coupled self-generators and multi-contours self-generator [Invited]	**16:20 M. Nakatsutsumi** (*Germany*)**, Y. Sentoku, S.N. Chen, S. Buffechoux, A. Kon, A. Korzhimanov, L. Gremillet, B. Atherton, P. Audebert, M. Geissel, L. Hurd, M. Kimmel, P. Rambo, M. Schollmeier, J. Schwarz, M. Starodubtsev, R. Kodama, and J. Fuchs.** Magnetic inhibition of laser-driven, sheath-accelerated high-energy protons [Invited]	
		16:40 A. Yogo (*Japan*)**, M. Hata, A. Morace, N. Iwata, Y. Arikawa, T. Johzaki, S. Fujioka, Y. Sentoku, S. Tosaki, K. Koga, H. Nishimura, K. Mima, M. Nakai, R. Kodama, and H. Azechi.** Ion acceleration from the modulated electric and magnetic fields by bundled picosecond laser beams [Invited]	
		17:00 Zhe Zhang (*China*)**.** Generation and application of a laser driven magnetic field in Lab-Astrophysics researches [Invited]	
17:30-17:50	**Coffee break**		
17:50-19:30	**Poster Session**		
19:30-20:30	**Dinner**		
20:30-22:30	**UGLICH**	**Walking tour**	

	Poster Session
17:50-19:30	**[1]. G.M. Nkeumaleu, A.S. Tchakoutio Nguetcho, and J.-M. Bilbault** (*France*)**.** Modulated-wave solutions for an anharmonic lattice **[NWP-1]** **[2]. H.A. Mahamat, S. Jacquir, S. Binczak, and J.-M. Bilbault** (*France*). Electrocardiogram analysis using phase space reconstruction **[NWP-1]** **[3]. A.S. Karavaev** (*Russia*)**, J.M. Ishbulatov, A.R. Kiselev, V.I. Ponomarenko, and M.D. Prokhorov.** Model of human cardiovascular system **[NWP-1]** **[4]. S.Yu. Kirillov** (*Russia*) **and V.I. Nekorkin.** Selective properties of neurons with dynamic threshold of excitability **[NWP-1]** **[5]. E.V. Sidak** (*Russia*)**, D.A. Smirnov, and B.P. Bezruchko.** Detection of couplings between oscillators based on the phase dynamics analysis in case of hidden interactions **[NWP-1]** **[6]. N.V. Stankevich** (*Russia, Finland*) **and E. Mosekilde.** Coexistence between bursting and silent states in a beta-cell model **[NWP-1]** **[7]. A. Lylova** (*Russia*)**, J. Sheldakova, A. Kudryashov, V. Samarkin, and A. Rukosuev.** Formation of the laser beam with the help of different types of deformable mirrors **[NWP-2 & Cremlin w\sh]** **[8]. A.A. Kochetkov** (*Russia*)**, V.N. Ginzburg, M.S. Kuzmina, A.A. Shaykin, and E.A. Khazanov.** Experimental research of small-scale self-focusing in isotropic crystals **[NWP-2, Cremlin w/sh & LaB]** **[9]. A.P. Korobeynikova** (*Russia*)**, A.A. Shaykin, I.V. Koryukin, and E.A. Khazanov.** Mathematical model of an additional laser pulse generating process in a Q-switched generator **[NWP-2, Cremlin w\sh & LaB]** **[10]. M.A. Garasev, V.V. Kocharovsky, A.A. Nechaev** (*Russia*)**, and A. N. Stepanov.** Density bump formation at the front of a collisionless electrostatic shock wave in a laser ablated plasma **[NWP-2, Cremlin w\sh & LaB]** **[11]. A. Seleznev** (*Russia*)**, A. Gavrilov, E. Kocharovskaya, E. Loskutov, D. Mukhin, Vl. Kocharovsky, and A. Feigin.** Space-time empirical modes as an instrument for investigation of nonlinear phenomena in the superradiant lasers **[NWP-2 & LaB]** **[12]. A.S. Zuev** (*Russia*)**, A.A. Kochetkov, A.A. Shaykin, and I.V. Yakovlev.** Upgrade of the front-end of the PetaWatt laser complex PEARL **[NWP-2, Cremlin w\sh & LaB]** **[13]. G.E. Khazanov** (*Russia*) **and S.A. Ermakov.** Analysis of damping of surface waves on water with viscoelastic finite-thickness film **[NWP-3]** **[14]. M.Yu. Kulikov, A.A. Nechaev** (*Russia*)**, M.V. Belikovich, T.S. Ermakova, and A.M. Feigin.** Daytime photochemical equilibrium of OH, HO_2, and O_3 at the altitudes of the mesosphere: implication for MLS/Aura data validation **[NWP-3]** **[15]. P.A. Perezhogin** (*Russia*)**, A.V. Glazunov, and A.S. Gritsun.** Stochastic parametrization for 2-D turbulence simulation **[NWP-3]** **[16]. V.P. Reutov, G.V. Rybushkina, and S.V. Shagalov** (*Russia*)**.** On the dynamical chaos in barotropic zonal jets **[NWP-3]** **[17]. V.V. Toporovsky** (*Russia*)**, A.V. Kudryashov, J.V. Sheldakova, and I.V. Galaktionov.** Determination of optical properties of turbid media by Monte Carlo method **[NWP-3]**
19:30-20:30	**Dinner**
20:30-22:30	**UGLICH** **Walking tour**

Monday, July 24

7:30-8:30	**Breakfast**		
9:00-11:40	**MYSHKIN**	**walking tour**	
11:40-12:00	**Coffee break**		
	NWP-1	**NWP-2 & LaB**	**NWP-3**
	Stochastic dynamics	**LaB – 2**	**Atmosphere electrodynamics – 1**
	HALL B	**HALL A**	**HALL C**
12:00-13:30	**12:00 M. Hasler (Switzerland).** Dynamics of stochastically blinking systems [Invited]	**12:00 A.V. Ivanovsky** (*Russia*)**.** Study of physical processes at high energy densities with the use of explosive magnetic generators [Invited]	**12:00 V.A. Rakov** (*USA*)**.** A review of global and regional lightning locating systems with emphasis on testing their performance characteristics [Invited]
	12:30 A.A. Koronovskii (*Russia*)**.** Characteristics of noise-induced intermittency in bistable systems [Invited]	**12:20 Y. Kishimoto** (*Japan*)**, D. Kawahito, T. Okihara, H. Sakaguchi, K. Fukami, and Y. Fukuda.** Confinement of high energy density plasma produced by the interaction between high intensity laser and structured medium [Invited]	**12:30 A.P. Khain** (*Israel*) **and M. Pinsky.** Microphysical processes in clouds affecting charge separation [Invited]
	13:00 S. Yanchuk (*Germany*)**.** Noise-resistance of oscillatory neural networks with adaptive coupling [Invited]	**12:40 Guang-yue Hu** (*China*)**, Yi-han Liang, Hui-bo Tang, Yang Zuo, Yu-lin Wang, Bin Zhao, Ping Zhu, and Jian Zheng.** Laser plasma evolution in external 10 T magnetic field [Invited]	**13:00 Y. Du** (*Hong Kong*)**, M. Chen, and Yu. Yang.** Observation and testing platform for lightning to the 350 m-tall Shenzhen meteorological tower [Invited]
		13:00 C.K. Li (*USA*)**, F.H. Séguin, J.A. Frenje, R.D. Petrasso, P.-E. Masson-Labprde, S. Laffite, V. Tassin, P.A. Amendt, H.G. Rinderknecht, S.C. Wilks, N.M. Hoffman, A.B. Zylstra, S. Atzeni, R. Betti, M.J. Rosenberg, and T.C. Sangster.** Measurement of self-generated spontaneous fields and their effects on ICF ion kinetic dynamics [Invited]	
13:30-15:00	**Lunch**		
15:00-16:00	**Sponsor session**		
16:00-18:00	**KOPRINO**	**Riverside outings**	
	HALL A		
18:00-18:50	**Ken-ichi Ueda** (*Japan*)**.** Thermal-lens-free heat capacitive active mirror **[Plenary talk 3]**		
18:50-19:40	**Juergen Kurths** (*Germany*). Predictability of extreme climate events via a complex network approach **[Plenary talk 4]**		
19:40-20:40	**Dinner**		
21:00-22:00	**Concert**		

Tuesday, July 25

7:30-8:30	**Breakfast**		
Session	**NWP-1**	**NWP-2 & LaB**	**NWP-3**
	Complex dynamics	**Laser sources: extending limits**	**Climate dynamics – 2**
	HALL B	**HALL A**	**HALL C**
8:30-10:30	**8:30 X. Leoncini** (*France*)**.** Dynamics of systems with many degrees of freedom from long range-interactions to complex networks [Invited]	**8:30 I.E. Kozhevatov** (*Russia*)**, D.E. Silin, A.V. Pigasin, E.H. Kulikova, and S.B. Speransky.** Design and specifications of 630-mm phase shifting interferometer for the qualification of large aperture optics	**8:30 A.A. Tsonis** (*USA*) **and S. Kravtsov.** Insights into decadal climate variability from the synchronization of a network of major climate modes [Invited]
	9:00 I. Franović (*Serbia*) **and V.V. Klinshov.** Mean-field analysis of stability and slow rate fluctuations in a network of noisy neurons with coupling delay	**8:50 A. Kudryashov** (*Russia*)**, V. Samarkin, A. Aleksandrov, G. Borsoni, T. Jitsuno, and J. Sheldakova.** Large bimorph flexible mirror for Peta-Watt laser beam correction [Invited]	**9:00 N.A. Diansky** (*Russia*)**, I.V. Solomonova, A.V. Gusev, and T.Yu. Vyruchalkina.** Effects of the North Atlantic thermohaline circulation on climate variability and Arctic climate change projections based on the combined scenario [Invited]
	9:30 V.V. Klinshov (*Russia*)**, D.S. Shchapin, S. Yanchuk, and V.I. Nekorkin.** Multi-jittering regimes in networks with pulse delayed coupling	**9:10 E.A. Mironov** (*Russia*) **and O.V. Palashov.** Thermo-optical characteristics of uniaxial crystals	**9:30 A. Gritsun** (*Russia*) **and V. Lucarini.** Instability characteristics of blocking regimes in a simple quasi-geostrophic atmospheric model [Invited]
		9:25 V.Yu. Venediktov (*Russia*)**.** Holographic wavefront sensors and high-power lasers	
		9:45 V.N. Ginzburg (*Russia*)**, A.A. Kochetkov, and E.A. Khazanov.** Study of self-filtering and small-scale self-focusing suppression of high-intensity laser beams	
		10:00 Yu. Zhao (*China*)**, J. Shao, Sh. Liu, M. Zhu, J. Chen, and Zh. Wu.** Thermal-dynamical analysis of femtosecond laser damage of optical coatings	
		10:15 I. Shaikin (*Russia*)**, A. Kuzmin, and A. Shaykin.** Pump laser for multistage parametrical amplifier	
10:30-13:30	**GORITSY**	**Bus tour**	
13:30-15:00	**Lunch**		

	HALL A		
15:00-15:50	**Ashot Chilingarian** (*Armenia*). On the initiation of lightning in thunderclouds **[Plenary talk 5]**		
15:50-16:40	**Albert Diaz-Guilera** (*Spain*). Nonlinear dynamics on multiplex networks **[Plenary talk 6]**		
16:40-17:30	**Jean Claude Kieffer (*Canada*).** High peak power lasers at INRS and applications of laser-wakefield-based X-ray sources: from bio-medical to global food security **[Plenary talk 7]**		
17:30-17:50	**Coffee break**		
Session	**NWP-1**	**NWP-2 & LaB**	**NWP-3**
	Patterns	**LaB – 3**	**Climate dynamics – 3**
	HALL B	**HALL A**	**HALL C**
17:50-19:30	**17:50 J. Zhang** (*China*)**, Y. Liu, S. Cao, and W. Wang.** Studying pattern dynamics in aerodynamics using Lagrangian coherent structures [Invited]	**17:50 G.S. Bisnovatyi-Kogan** (*Russia*)**.** Mechanisms of astrophysical JET formation, and comparison with laboratory experiments [Invited]	**17:50 J. Tribbia** (*USA*)**.** Weather and climate predictability and its relation to predictive skill [Invited]
	18:30 A.A. Polezhaev (*Russia*) **and M.B. Kuznetsov.** Patterns formed before the onset of subcritical Turing bifurcation [Invited]	**18:10 D.V. Bisikalo** (*Russia*)**.** Modelling of accretion processes in magnetized binary stars [Invited]	**18:30 S.V. Kravtsov** (*USA*)**.** Pronounced differences between the observed and CMIP5 simulated climate variability in the twentieth century [Invited]
		18:30 G. Revet (*France*)**, S.N. Chen, R. Bonito, B. Khiar, E. Filipov, C. Argiroffi, D. P. Higginson, S. Orlando, J. Béard, M. Blecher, M. Borghesi, K. Burdonov, D. Khaghani, K. Naughton, H. Pépin, O. Portugall, R. Riquier, R. Rodriguez, S.N. Ryazantsev, I.Yu. Skobelev, A. Soloviev, O. Willi, S. Pikuz, A. Ciardi, and J. Fuchs.** Laboratory unravelling of matter accretion in young low-mass stars [Invited]	**19:00 D.Yu. Gushchina** (*Russia*) **and B. Dewitte.** The role of atmosphere intraseasonal variability in El Niño forcing [Invited]
		18:50 S.A. Pikuz (*Russia*)**, E.D. Filippov, S.N. Ryazantsev, I.Yu. Skobelev, G. Revet, D.P. Higginson, S.N. Chen, B. Albertazzi, A.A. Soloviev, J. Beard, B. Khiar, A. Ciardi, A.Ya. Faenov, H. Pepin, and J. Fuchs.** X-ray spectroscopy diagnostics to study complex supersonic plasma flows with astrophysical relevance in laser plasma [Invited]	
		19:10 F. Kroll (*Germany*)**, A. Pelka, B. Albertazzi, F. Brack, E. Brambrink, T. Cowan, P. Drake, E. Falize, E. Filipov, Y. Kuramitsu, C. Kuranz, D. Lamb, J. Levesque, C. Li, M. Manuel, T. Michel, T. Morita, N. Ozaki, S. Pikuz, G. Rigon, M. Rödel, Y. Sakawa, U. Schramm, H. Shimogawara, L. Van Box Som, and M. Koenig.** Experimental study of accretion processes in X-ray binary stars using an external B-field [Invited]	
19:30-20:30	**Dinner**		

Tuesday, July 25 *(Evening)*

Session	NWP-1	NWP-2 & LaB	NWP-3
		Laser-plasma sources and applications	**Climate dynamics – 4**
	HALL B	**HALL A**	**HALL C**
20:30-22:00		**20:30 T. Ebisuzaki** (*Japan*) **and S. Wada.** Deorbiting of space debris by laser ablation [Invited]	**20:30 D. Kondrashov** (*USA*)**.** Data-adaptive harmonic decomposition and multi-layer Stuart-Landau stochastic modelling [Invited]
		20:50 A.A. Golovanov (*Russia*)**, I.Yu. Kostyukov, J. Thomas, and A.M. Pukhov.** Analytic model for electromagnetic fields in the bubble regime of plasma wakefield	**21:00 G.S. Duane** (*USA*)**, M.-L. Shen, and N.S. Keenlyside.** Supermodeling the climate system to capture self-organized criticality [Invited]
		21:05 M. Chen (*China*)**, W. Luo, W.-Yu. Liu, T. Yuan, Ji-Ye Yu, F.-Yu Li, D. Del Sorbo, C.P. Ridgers, Zh.-M. Sheng.** QED cascade saturation and electron-positron jet formation from an ultrastrong laser-irradiated thin foil [Invited]	**21:30 D.A. Zappala, M. Barreiro, and C. Masoller** (*Spain*)**.** Hilbert analysis unveils inter-decadal changes in large-scale patterns of SAT variability
		21:25 D.A. Serebryakov (*Russia*)**, E.N. Nerush, and I.Yu. Kostyukov.** Model for hard X-ray generation and electron acceleration during grazing incidence of a laser pulse onto a planar target	
		21:40 O.E. Vais (*Russia*) **and V.Yu. Bychenkov.** Analysis of electrons accelerated from ultra-thin foils for evaluation of high-power ultrashort laser pulse intensity	

Wednesday, July 26

8:00-9:00	**Breakfast**		
9:00-11:00	**VYTEGRA**	**sightseeing**	
Session	**NWP-1**	**NWP-2 & LaB**	**NWP-3**
	Symmetries and Conservation Laws	**LaB – 4**	**Atmosphere electrodynamics – 2**
	HALL B	**HALL A**	**HALL C**
11:30-13:30	**11:30 M.L. Gandarias** (*Spain*). On conservation laws for some equations that admit compacton solutions [Invited]	**11:30 B. Qiao** (*China*)**, Z. Xu, W. P. Yao, and X.T. He.** Magnetic reconnection in the high-energy-density and relativistic regime [Invited]	**11:30 A. Chilingarian** (*Armenia*)**.** The runaway breakdown particles spectra obtained just before the lightning stroke [Invited]
	12:00 M.S. Bruzón (*Spain*) **and E. Recio.** Conservation laws and potential systems for a general family of thin film equations [Invited]	**11:50 S. Bolaños** (*France*)**, R. Smets, R. Riquier, A. Grisollet, and J. Fuchs.** Investigating guide field reconnection in HED plasmas [Invited]	**12:00 A.V. Agafonov, I.S. Baidin, A.V. Oginov** (*Russia*)**, A.A. Rodionov, and K.V. Shpakov.** Radiations in lightning-like atmospheric discharges
	12:30 M. Oberlack (*Germany*)**, V. Grebenev, and M. Waclawczyk.** Statistical symmetries in turbulence – recent results for 2D flows [Invited]	**12:10 J.Y. Zhong** (*China*)**.** Low-beta magnetic reconnection experiments driven by intense lasers [Invited]	**12:30 N.V. Ilin** (*Russia*)**, F.A. Kuterin, and C. Price.** Prediction of the lightning activity using radar data and machine learning technique
	13:00 C.M. Khalique (*South Africa*)**.** Lie group analysis and conservation laws of the Zoomeron equation [Invited]	**12:30 A. Maksimchuk** (*USA*)**, A. Raymond, C.F. Dong, A. McKelvey, C. Zulick, N. Alexander, A. Bhattachajee, P.T. Campbell, H. Chen, V. Chvykov, E. Del Rio, P. Fitzsimmons, W. Fox, B.X. Hou, C. Mileham, J. Nees, P.M. Nilson, C. Stoekl, A.G.R. Thomas, M.S. Wei, V. Yanovsky, L. Willingale, and K. Krushelnick.** Relativistic magnetic reconnection driven by high intensity lasers [Invited]	**13:00 A.A. Evtushenko** (*Russia*)**, A.V. Strikovskiy, M.E. Gushchin, and S.V. Korobkov.** Laboratory modeling of high-altitude discharges
13:30-15:00	**Lunch**		

Wednesday, July 26 *(Afternoon)*

	HALL A		
15:00-15:50	**Jean-Christophe Chanteloup** *(France)* XCAN, Ecole Polytechnique-Thales Coherent Beam Combination joint laser program **[Plenary talk 8]**		
15:50-16:40	**Eckehard Schöll** (*Germany*) Coherence resonance chimeras in dynamical networks **[Plenary talk 9]**		
16:40-17:00	**Coffee break**		
Session	**NWP-1**	**NWP-2 & LaB**	**NWP-3**
	Chimeras	**Key technological issues in construction and exploitation of 100 PW class lasers (Cremlin w/sh)**	**Atmosphere electrodynamics – 3**
	HALL B	**HALL A**	**HALL C**
17:00-19:30	**17:00 V.S. Anishchenko** (*Russia*)**, N.I. Semenova, and G.I. Strelkova.** Dynamical and statistical characteristics of different chimera structures in networks of nonlocally coupled oscillators [Invited]	**17:00 Ch. Simon-Boisson** (*France*)**.** TBA [Invited]	**17:00 E.A. Mareev** (*Russia*)**.** On the energy of lightning flashes and distribution of thunderstorm activity over the globe
	17:30 A. Gjurchinovski (*Macedonia*)**, E. Schöll, and A. Zakharova.** Amplitude death and chimera patterns in complex networks with time delays [Invited]	**17:20 Sh. Tokita** (*Japan*)**, K. Teramoto, T. Terao, Sh. Inoue, R. Yasuhara, T. Nagashima, M. Hashida, J. Kawanaka, N. Miyanaga, and Sh. Sakabe.** Generation of strong terahertz surface waves on metal wires by relativistic-intensity laser pulses [Invited]	**17:30 M. Chen** (*China*)**, M.K. Chan, S. Cai, and Y. Du.** Macroscopic physical models for lightning leaders and return strokes [Invited]
	18:00 Z.G. Nicolaou (*USA*)**, H. Riecke, and A.E. Motter.** Chimera states in continuous media [Invited]	**17:40 M. Nakatsutsumi** (*Germany*)**, T. Toncian, G. Priebe, K. Appel, C. Baehtz, B. Chen, S. Göde, Z. Konopkova, M. Makita, A. Schmidt, K. Sukharnikov, I. Thorpe, A. Pelka, M. Lederer, T. E. Cowan, and U. Zastrau.** Integrating the high-energy and high-intensity lasers for the HED instrument at the European XFEL [Invited]	**18:00 F.A. Kuterin** (*Russia*)**, A.A. Syssoev, and D.I. Iudin.** The main negative leader tip and space stems numerical modeling
	18:30 G.I. Strelkova (*Russia*)**, N.I. Semenova, and V.S. Anishchenko.** Effect of switchings between chimera states in an ensemble of coupled chaotic maps	**18:00 A. Yogo** (*Japan*)**, K. Mima, N. Iwata, S. Tosaki, A. Morace, Y. Arikawa, S. Fujioka, H. Nishimura, Y. Sentoku, T. Johzaki, K. Matsuo, N. Kamitsukasa, S. Kojima, H. Nagatomo, M. Nakai, H. Shiraga, M. Murakami, S. Tokita, J. Kawanaka, N. Miyanaga, K. Yamanoi, T. Norimatsu, A. Sagisaka, S.V. Bulanov, H. Sakagami, K. Kondo, and H. Azechi.** Laser-ion acceleration boosted by multi-picosecond pulses [Invited]	**18:30 A. Chilingarian** (*Armenia*)**.** Enhanced particle fluxes during the decay stage of Aragats thunderstorms
	19:00 A. Zakharova (*Germany*)**.** Chimera states in multiplex networks	**18:20 S. Ter-Avetisyan** (*Hungary*)**.** Perspectives of ion acceleration with PW-ultrashort laser pulse [Invited]	**19:00 A.A. Bulatov** (*Russia*)**, A.A. Syssoev, S.S. Davydenko, and D.I. Iudin.** Bidirectional leader development numerical simulation
		18:40 A. Soloviev (*Russia*)**, K. Burdonov, S.N. Chen, A. Eremeev, S. Pikuz, G.V. Pokrovskiy, T.A. Pikuz, G. Revet, A. Sladkov, V. Ginzburg, E. Khazanov, A. Kuzmin, D.K. Batheja, S. Mironov, R. Osmanov, I. Shaykin, A. Shaykin, I. Yakovlev, M. Starodubtsev, and J. Fuchs.** Laser driven ion acceleration at PEARL laser facility	
		18:55 J. Fuchs (*France*)**.** Horizons of science, driven by super-power lasers [Invited]	
19:30-20:30	**Dinner**		

Wednesday, July 26 *(Evening)*

Session	NWP-1	NWP-2 & LaB	NWP-3
		LaB – 5	
	HALL B	**HALL A**	**HALL C**
20:30-22:00		**20:30 <u>D. Kumar</u>** (*Czech Republic*)**, S. Singh, H. Ahmed, R. Dudzak, J. Dostal, T. Chodukowski, L. Giuffrida, P. Hadjisolomu, T. Hodge, J. Hrebicek, L. Juha, Z. Kalinowska, E. Krousky, M. Krus, P. Lutoslawski, M. De Marco, M. Pfeifer, J. Skala, J. Ullschmeid, T. Pisarczyk, M. Borghesi, and S. Kar.** Generation of sub-MG quasi-stationary magnetic field using cm scale capacitor-coil targets [Invited]	
		20:50 <u>M.P. Read</u> (*UK*)**, C.P. Ridgers, J.J. Bissell, and R.J. Kingham.** Beam self-focusing and electron transport effects in magnetised laser-plasmas [Invited]	
		21:20 <u>K.M. Schoeffler</u> (*Portugal*)**, N.F. Loureiro, and L.O. Silva.** Kinetic solution for the generation of magnetic fields via the Biermann battery [Invited]	
		21:30 A. Soloviev, K. Burdonov, S. N. Chen, A. Eremeev, G. Revet, S. Pikuz, E. Filippov, M. Cerchez, T. Gangly, A. Sladkov, A. Korzhimanov, V. Ginzburg, E. Khazanov, A. Kochetkov, A. Kuzmin, I. Shaykin, A. Shaykin, I. Yakovlev, <u>M. Starodubtsev</u> (*Russia*)**, and J. Fuchs.** Laboratory investigation of laser plasma expansion across the ambient magnetic field [Invited]	
22:00	**Concert**		

8:00-9:00	**Breakfast**		
	HALL A		
9:00-9:50	**C.C. Kuranz** (*USA*). Astrophysically relevant, magnetized high-energy-density physics experiments at the Unversity of Michigan **[Plenary talk 10]**		
9:50-10:40	**M. Hoshino** (*Japan*). Wakefield acceleration in relativistic shocks: origin of ultra-high-energy cosmic rays **[Plenary talk 11]**		
10:40-11:00	**Coffee break**		
Session	**NWP-1**	**NWP-2 & LaB**	**NWP-3**
	Neural networks – 2	**LaB – 6**	**Atmosphere and ocean dynamics – 2**
	HALL B	**HALL C**	**HALL C**
11:00-13:30	**11:00 M. Masoliver and C. Masoller** (*Spain*)**.** Subthreshold signal encoding and transmission in coupled FitzHugh-Nagumo neurons [Invited]	**11:00 L. Chen** (*UK*)**.** Magnetic field amplification and particle acceleration in laboratory astrophysics [Invited]	**11:00 F. Qiao** (*China*)**, Y. Yuan, C. Huang, D. Dai, J. Deng, and Z. Song.** Wave turbulence interaction induced vertical mixing and its effects in ocean and climate models [Invited]
	11:30 U. Feudel (*Germany*)**, G. Ansmann, and K. Lehnertz.** Self-induced switchings between multiple space–time patterns on complex networks of excitable units [Invited]	**11:20 A.A. Andreev** (*Russia*) **and Z. Lech.** Generation and detection of super-strong magnetic fields by ultra-intense laser pulses [Invited]	**11:30 C. Guan** (*China*) **and D. Zhu.** Numerical investigations of wave-induced mixing in upper ocean layer [Invited]
	S. Morfu, M. Bordet, M. Rossé, and J.M. Bilbault (*France*)**.** Impact of perturbations on neuron response [Invited]	**11:40 Ph. Korneev** (*Russia*)**, E.d'Humieres, V.Tikhonchuk, and T. Pisarczyk.** Laser-plasma magnetization for laboratory astrophysics [Invited]	**12:00 I. Kamenkovich** (*USA*)**, M. Rudko, and I. Rypina.** Dynamics and transport characteristics of zonally elongated transients in the ocean [Invited]
	12:30 M. Courbage (*France*)**, L. Mangin, and F. Rozi.** Respiratory neural network: activity, connectivity and synchronization [Invited]	**12:00 I.F. Shaikhislamov** (*Russia*)**, Yu.P. Zakharov, V.G. Posukh, A.V. Melekhov, and A.G. Ponomarenko.** Collisionless super-Alfvenic interaction and generation of large amplitude pre-shock magnetosonic wave in laser plasma experiment [Invited]	**12:30 J. Li** (*China*)**, A.L. Kohout, H.H. Shen, and C. Guan.** Effect of nonlinear wave-wave interaction on apparent wave attenuation in ice covered seas
	13:00 O.V. Maslennikov (*Russia*)**, I. Franović, and V.I. Nekorkin.** Mean-field model for a network of globally coupled stochastic map-based neurons	**12:20 S. Sakata** (*Japan*)**, S. Lee, H. Sawada, Y. Iwasa, H. Morita, K. Matsuo, K.F.F. Law, T. Johzaki, H. Nagatomo, Y. Sentoku, A. Sunahara, A. Yao, Y. Arikawa, M. Hata, S. Kojima, Y. Abe, H. Kishimoto, K. Kanbayashi, A. Yogo, A. Morace, H. Sakagami, T. Ozaki, K. Yamanoi, T. Norimatsu, T. Shimizu, Y. Nakata, J. Kawanaka, S. Tokita, N. Miyanaga, M. Murakami, M. Nakai, H. Shiraga, H. Nishimura, K. Mima, H. Azechi, and S. Fujioka.** First experimental demonstration of isochoric heating of a dense plasma core with assistance of external kilo-Tesla magnetic field [Invited]	**13:00 S.V. Shagalov** (*Russia*) **and G.V. Rybushkina.** Weakly supercritical dynamics of Rossby wave packets in barotropically unstable zonal JET flows
		12:40 Q. Moreno (*France*)**, M.E. Dieckmann, X. Ribeyre, S. Jequier, V.T Tikhonchuk, L. Gremillet, and E. d'Humières.** PIC simulations for the study of collisionless shocks formation in laboratory astrophysics context [Invited]	
		13:00 V.M. Gubchenko (*Russia*)**.** On kinetic approach to magnetic reconnection: from space to laser HED plasma [Invited]	

Thursday, July 27 ***(Afternoon, Evening)***

13:30-15:00		**Lunch**
15:00-19:30	**VALAAM**	**tour**
19:30-20:30		**Dinner**
20:30-21:30		**Closing session**
22:00		**Party, dancing**

Friday, July 28

8:00	**Arrival in St. Petersburg**
8:00-9:00	**Breakfast**
9:30-12:00	**Departure**

Personal Schedule

Time	22 July.	23 July.	24 July.	25 July.	26 July.	27 July.	28 July.
11:00-11:30							
11:30-12:00							
12:00-12:30							
12:30-13:00							
13:30-15:00	Lunch						
15:00-15:30							
15:30-16:00							
16:00-16:30							
16:30-17:00							
	Coffee break						
17:00-17:30							
17:30-18:00							
18:00-18:30							
18:30-19:00							
19:00-20:00	Dinner						
20:00-20:30							
20:30-21:00							
21:00-21:30							
21:30-22:00							
21:30-23:00	Evening program						

ABSTRACTS OF PLENARY TALKS

Sunday, July 23

9:30–10:20

H. A. Dijkstra (*the Netherlands*). **The physics of El Niño**

The El Niño variability in the equatorial Tropical Pacific is characterized by sea surface temperature anomalies and associated changes in the atmospheric circulation. Through an enormous observational effort over the last decades, the relevant time scales and spatial patterns of El Niño are now well-documented. In the meantime, a hierarchy of models has been developed to understand the physics of this phenomenon and to make predictions of future events.

10:20–11:10

A. Politi (*UK*). **Characterization of collective chaos in mean-field models**

Networks of dynamical systems are often characterized by a collective (macroscopic) irregular behavior. Mean-field (globally coupled) models provide the simplest setup where this regime can be accurately investigated. This is the case of unidimensional maps, but also of Stuart-Landau and phase oscillators. The connection between microscopic and macroscopic dynamics is discussed by making use of various indicators such as standard (microscopic) Lyapunov exponents, collective Lyapunov exponents, and monitoring the evolution of perturbations of finite amplitude. Robustness and generality of collective chaos will be also discussed, exploring the behavior of sparse networks, as well as one-dimensional systems with long-range interactions.

Monday, July 24

18:00–18:50

K. I. Ueda (*Japan*). **Thermal-lens-free heat capacitive active mirror**

A new concept for thermal-lens-free solid state lasers, Heat Capacitive Active Mirror (HCAM), is proposed according to the systematic calculation of temperature profile and thermal-induced phase shift on 0.25–5 mm thick active mirrors of 10-mm diameter with 5-mm area pumping. Three orders of magnitude of thermal-lens reduction under the efficient cooling condition is possible. This is the first proposal for the paradigm shifting technology of thermal-lens-free active mirror available for coherent beam combination.

18:50–19:40

Ju. Kurths (*Germany*). **Predictability of extreme climate events via a complex network approach**

We analyse climate dynamics from a complex network approach. This leads to an inverse problem: Is there a backbone-like structure underlying the climate system? For this we propose a method to reconstruct and analyze a complex network from data generated by a spatio-temporal dynamical system. This approach enables us to uncover relations to global circulation patterns in oceans and atmosphere.

Tuesday, July 25

15:00–15:50

A. Chilingarian (*Armenia*, *Russia*). **On the initiation of lightning in thunderclouds**

The relationship of lightning and elementary particle fluxes in the thunderclouds is not fully understood to date. Using the particle beams (the so-called Thunderstorm Ground Enhancements – TGE) as a probe we investigate the characteristics of the interrelated atmospheric processes. The well-known effect of the TGE dynamics is the abrupt termination of the particle flux by the lightning flash. With new precise electronics, we can see that particle flux decline occurred simultaneously with the rearranging of the charge centers in the cloud. The analysis of the TGE energy spectra before and after the lightning demonstrates that intense high-energy part of the TGE energy spectra disappeared just after lightning. The decline of particle flux coincides on millisecond time scale with first atmospheric discharges and we can conclude that Relativistic Runaway *Electron* Avalanches (RREA) in the thundercloud assist initiation of the negative cloud to ground lightning.

15:50–16:40

A. Diaz-Guilera (*Spain*). **Nonlinear dynamics in multiplex networks**

Complex networks have been investigated for two decades as a paradigm for the interaction pattern behind many complex systems. Nowadays, these networks are not complex enough and the interactions in complex systems are given by even more complex structures: multilayers, interdependent networks, time dependent networks,... We show here the analysis of some nonlinear phenomena on this new class of networks.

16:40–17:30

J. C. Kieffer (*Canada*), S. Fourmaux, and E. Hallin.

High peak power lasers at INRS and applications of laser-wakefield-based X-ray sources: from bio-medical to global food security

We upgraded over the past two years the INRS high peak power laser facility from 200 TW (5 J, 25 fs) to 600 TW (11 J, 18 fs). The experimental programs have been restarted at the beginning of 2017 in the continuity of our previous scientific directions, i.e. high intensity laser-matter interaction and ultrafast X-ray sources. In this talk we will present and discuss the first experiments realized with our new laser facility, with a particular emphasis on the generation of ultrafast bright hard X-rays.

Wednesday, July 26

15:00–15:50

J.-C. Chanteloup (France), A. Heilmann, J. Le Dortz, M. Antier, S. Bellanger, J. Bourderionnet, A. Brignon, L. Daniault, I. Fsaifes, E. Lallier, C. Larat, and C. Simon-Boisson.

XCAN, Ecole Polytechnique-Thales Coherent Beam Combination joint laser program

The XCAN project carried out by *Thales* and the *Ecole Polytechnique* is a laser system relying on the Coherent Addition of laser beams produced through a Network (CAN) of Large Mode Area (LMA) Yb doped amplifying optical fibers. This technique known as Coherent Beam Combination (CBC) offers an attractive approach to simultaneously achieve the high peak and high average powers required for various scientific, industrial, and societal applications. The coherent addition of 61 individual beams should allow us to obtain a single beam carrying a 3 mJ / 300 fs / 200 kHz pulse train; i.e. about half a kW average power.

15:50–16:40

E. Schöll (*Germany*). **Coherence resonance chimeras in dynamical networks**

We show that chimera patterns can be induced by noise in nonlocally coupled neural networks in the excitable regime. In contrast to classical chimeras, occurring in noise-free oscillatory networks, they have features of two phenomena: coherence resonance and chimera states. Therefore, we call them coherence-resonance chimeras. These patterns demonstrate the constructive role of noise and appear for intermediate values of noise intensity, which is a characteristic feature of coherence resonance. In the coherence-resonance chimera state a neural network of identical elements splits into two coexisting domains with different behavior: spatially coherent and spatially incoherent, a typical property of chimera states. Moreover, these noise-induced chimera states are characterized by alternating behavior: coherent and incoherent domains switch their location periodically. We show that this alternating switching can be explained by analyzing the coupling functions.

Thursday, July 27

9:00–9:50

C. C. Kuranz (*USA*), R. P. Young, M. J.-E. Manuel, A. M. Rasmus, J. Levesque, G. Fiksel, S. R. Klein, M. R. Trantham, P. Hartigan, A. Liao, C. K. Li, H. W. Sio, and J. M. Foster.

Astrophysically relevant, magnetized high-energy-density physics experiments at the University of Michigan

We summarize experiments performed by or in collaboration with, the University of Michigan regarding astrophysically relevant, magnetized high-energy-density (HED) plasmas. Magnetized plasmas are ubiquitous throughout our universe, but the study of these systems relies heavily on numerical simulations in limited parameter regimes and has had little guidance from controlled laboratory experiments to test underlying principles. Using high-energy lasers, we aim to create plasma conditions similar to those found in astrophysical systems.

9:50–10:40

M. Hoshino (*Japan*), M. Iwamoto, T. Amano, and Y. Matsumoto.

Wakefield acceleration in relativistic shocks: origin of ultra-high-energy cosmic rays

We investigate particle acceleration by using a newly developed PIC code in a relativistic shock by paying a special attention to large amplitude electromagnetic precursor waves generated in shock upstream, and discuss that the scheme of the wakefield acceleration, which is proposed in an ultra-intense laser pulse by Tajima and Dawson (197), can be applied for the origin of ultra-high-energy cosmic rays in the universe.

A B S T R A C T S

Sunday, July 23

NWP-1: Nonlinear Dynamics and Complexity	NWP-2: Lasers with High Peak and High Average Power	NWP-3: Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
Neural networks – 1	**Key technological issues in construction and exploitation of 100 PW class lasers (Cremlin workshop)**	**Climate dynamics – 1**
11:30 **V.I. Nekorkin** (*Russia*), O.V. Maslennikov, and D.S. Shchapin. **Emergent traffic in a hypernetwork generated by an adaptive neuron network** [Invited] We propose a model of an adaptive network of spiking neurons that gives rise to a hypernetwork of its dynamic states at the upper level of description. Left to itself, the network exhibits a sequence of transient clustering which relates to a traffic in the hypernetwork in the form of random switching between different states. Receiving inputs the system is able to generate reproducible sequences corresponding to stimulus-specific paths in the hypernetwork. We illustrate these basic notions by a simple network of discrete-time spiking neurons together with its FPGA realization and analyze their properties.	**11:30** **V. Yashin** (*Russia*), B. Lee, B. Jeong, J. Yang, E. Sall, S. Chizhov, and G.H. Kim. **High-peak and high-average power Yb-doped femtosecond lasers for various applications** [Invited] A diode-pumped, ultrafast Yb:KGW laser system utilizing chirped-pulse amplification (CPA) in a dual-slab regenerative amplifier (RA) with spectral shaping of seeding pulse from a master oscillator (MO) has been developed. A train of compressed pulses with pulse length of 181 fs, repetition rate up to 500 kHz, and average power exceeding 15 W after compression and pulse picker was achieved.	**11:30** **A.M. Feigin** (*Russia*)**,** D.N. Mukhin, E.M. Loskutov, A.S. Gavrilov, and A.F. Seleznev. **Empirical approach to modeling & prognosis of climate systems** The underlying objectives of the empirical (data-driven) approach are, first, derivation of as much as possible information about system function and, second, use this knowledge for prognosis of the system evolution. The talk focuses on the current problems posed by empirical modeling of climate.
12:00 T. Asabuki, N. Hiratani, and **T. Fukai** (*Japan*). **Chunking by mutual supervision in reservoir computing** [Invited] Many higher-order functions of the brain such as language acquisition and motor learning require sequence learning. Chunking enables the brain to generate compact representations of complex sequential events, and hence plays a pivotal role in the modeling of the external world by the brain and artificial intelligence. Several mechanisms have been proposed for chunking in the literature of computational neuroscience and computer science. However, the performance of the previous models was limited to relatively simple sequences, and the neural mechanisms underlying chunking in complex sequences remain elusive. Here, we propose a recurrent network model that is capable of learning chunks in such complex sequences.	**11:50** **K.F. Burdonov** (*Russia*)**,** I.B. Mukhin, and A.A. Soloviev. **Increasing of front-end system stability for parametric PetaWatt** lasers Here we present the results of upgrade of the FRONT END system for nanosecond pump laser of petawatt parametric facilities. A discharge lamp based pump of a single-mode Q-switched Nd:YLF master oscillator was replaced by a diode end-pumping system, which provides an opportunity to increase frequency from 1 Hz to more than 20 Hz and also to increase energy stability and control laser pulse shape. A new Nd:YLF laser at the wavelength of 1054 nm with duration 1 ns, energy 1 mJ, repetition rate more than 20 Hz and external synchronization with temporal jitter less than 100 ps was developed and optimized. A new FRONT END system will replace the existing one at the PEARL facility.	**12:00** **D.N. Mukhin** (*Russia*)**,** A.S. Gavrilov, E.M. Loskutov, and A.M. Feigin. **Extraction of leading nonlinear dynamical modes of climate from data** A new nonlinear expansion of climatic data accounting for external forcing of different nature is suggested. It is applied to analysis of sea surface temperature anomalies over the globe aiming to extract leading climate modes. The structure of the obtained modes and their response to external factors are discussed.

12:30

Ll. Hernández-Navarro, S. Teller, E. Tibau, J.G. Orlandi, J. Casademunt, E. Vives, and **J. Soriano** (*Spain*).

Experiments in neuronal cultures: connectivity, dynamics and complexity in a dish [Invited]

Neuronal cultures provide a versatile experimental platform to explore living neuronal networks, and model them through physico-mathematical toolboxes such as dynamical systems, network theory, or information theory. Here we present different examples on the use of neuronal cultures to address important questions in neuroscience, specifically spontaneous activity patterns, the importance of spatial embedding, and the resilience of circuits to damage. The studies combine experiments with numerical simulations.

13:00

A.E. Hramov (*Russia*), V.A. Maksimenko, V.V. Makarov, A. Luttjohann, M.V. Goremyko, A.A. Koronovskii, A.E. Runnova, G. van Luijtelaar, and S. Boccaletti.

Macroscopic and microscopic spectral properties of multilayer epileptic brain networks during local and global synchronization [Invited]

We introduce a practical and computationally undemanding technique for inferring interactions at various microscopic levels between the units of a complex network with adaptive links from the measurements and the processing of macroscopic signals. Our methodology is then applied for taking a look at the microscopic interactions occurring in a neurophysiological system, namely, in the thalamo-cortical neural network of an epileptic brain, where the group electrical activity is registered by means of EEG. We demonstrate that it is possible to infer the degree of interaction between the interconnected regions of the brain during different types of brain activities, and to estimate the regions' participation in the generation of the different levels of consciousness.

12:05

Y. Kida (*Japan*).

Deep UV monocycle laser for seeding of next generation XFEL [Invited]

In 2015, an approach was reported that potentially leads to free-electron lasers generating isolated X-ray pulses with durations orders of magnitude shorter than the state-of-the-art free-electron lasers. Called mono-cycle harmonic generation, it shortens X-ray pulses to their fundamental shortest limits of mono-cycle durations. The scheme requires stable mono-cycle seed laser pulses with high pulse energies for the density modulation of electrons in free-electron lasers. In this project, an approach is investigated to generate such a mono-cycle seed pulse in the deep-ultraviolet for the initiation of the mono-cycle harmonic generation scheme.

12:25

I.L. Snetkov (*Russia*), D. Zhou, A.I. Yakovlev, I.B. Mukhin, I.I. Kuznetsov, O.V. Palashov, and K.I. Ueda.

200 W continuous wave disk-laser on Yb:LuAG ceramics

The optical and laser properties of Yb:LuAG ceramic sample made by nanocrystalline pressure-less sintering in H_2 (NC-PLSH) were investigated. An active element of a disk laser was manufactured and continuous generation with maximum output power of 200 W and slope efficiency of 40% was demonstrated.

12:40

J. Shao (*China*), Zh. Wu, Sh. Liu, J. Chen, Yu. Zhao, and M. Huang.

Toward "Defect-Free" optics: where to start? [Invited]

To characterize the defects in optical materials is of great importance for high power laser applications. In this paper, recent progress in defect characterization of various optics is presented by using different imaging techniques, including photothermal microscopy and optical scattering microscopy. A multimodal microscopic technique was proposed for a more comprehensive evaluation of the defects over the surface of the large optics, so as to have a better understanding of the laser damage behaviors and to provide clues to eliminate defects during manufacturing process.

12:30

E.M. Loskutov (*Russia*), D.N. Mukhin, A.S. Gavrilov, and A.M. Feigin.

Investigation of paleoclimate transitions with data-driven models

In this work we propose a data-driven model for the investigation of critical transitions on paleo time scales. Namely, we investigated the mid-Pleistocene transition which led to a change of dominate cycles of glacial variability in Pleistocene. We demonstrate that our data-driven model is a good tool for analysing paleoclimate variability. In particular, we discuss the possibility of detecting, identifying and predicting the mid-Pleistocene transition by means of nonlinear empirical modeling using the paleoclimate record time series.

13:00

A.S. Gavrilov (*Russia*), A.F. Seleznev, D.N. Mukhin, E.M. Loskutov, and A.M. Feigin.

Reduced nonlinear data-driven prognostic climate model construction

A Bayesian approach to construction of evolution operator from high-dimensional climate data is presented. The method incorporates two key steps: (1) obtaining the time series of hidden variables by empirical reduction of observed data and (2) constructing an evolution operator for the hidden variables using the reduction of its time-embedded phase space. Both of these steps take into account the most significant spatial and temporal couplings which are crucial in climate system. Predictions of global SST field as well as particular climate indices (e.g. El Nino index) are demonstrated.

HALL B	HALL A	HALL C
	Key technological issues in construction and exploitation of 100 PW class lasers (Cremlin workshop)	
	13:00 **S.Yu. Mironov** (*Russia*), J. Wheeler, E.A. Khazanov, and G. Mourou. **Control of temporal intensity profile for PW laser pulses** A possibility of using self-phase modulation and cascaded quadratic nonlinearity effects for enhancement temporal parameters of PW laser pulses was demonstrated with the help of numerical simulations. Pulse duration can be shortened and intensity contrast ratio can be increased after a standard grating compressor. Implementation of the techniques to output radiation of TW and PW laser systems will multiply peak power in times.	
	13:15 **E.A. Khazanov** (*Russia*), O.V. Maslennikov, V.N. Ginzburg, A.A. Kochetkov, and V.I. Nekorkin. **Third-order-nonlinear effects in single crystals with arbitrary orientation and in ceramics** The influence of cubic crystal orientation on the generation of cross-polarization, self-phase modulation and laser beam self-focusing is investigated. The orientations at which these effects are maximal and minimal have been found. The qualitative and quantitative difference of these effects in ceramics from those in single crystals and glass has been determined. Random small-scale (of order grain size) spatial modulation of laser beam polarization and phase has been predicted. This effect has no analogs in glasses or in single crystals.	

Nonlinear Dynamics and Complexity	Lasers with High Peak and High Average Power	Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
Chaotic dynamics	**LaB - 1**	**Atmosphere and ocean dynamics – 1**
15:00 Y. Guo and **A.C.J. Luo** (*USA*). **On period-1 motions to chaos in a parametrically excited pendulum** [Invited] In this paper, bifurcation trees of period-1 motions to chaos in a parametrically excited pendulum are predicted semi-analytically. To construct discrete mapping structure of periodic motions, implicit discrete maps are developed from the discretized differential equation of such a parametric pendulum. The bifurcation tree of period-1 motions to chaos is presented via the complete bifurcation trees of period-1 to period-4 motions. The corresponding stability and bifurcation analysis are carried out through eigenvalue analysis. Finally, numerical simulations of various periodic motions are completed, and such simulations are illustrated over the analytically predicted trajectories for verifications.	**15:00** **A.V. Brantov** (*Russia*) and V.Yu. Bychenkov. **Relativistically strong laser plasma interaction: energetic particles, gamma and THz radiation, magnetic fields** [Invited] We review recent developments in LPI and CFAR research related to the production of energetic ions and electrons, generation of strong quasi-static magnetic fields, and emission of secondary electromagnetic radiation in the interaction of short relativistically intense laser pulses with different targets.We present theoretical models and 3D PIC simulations on optimization of charged particle acceleration from thin foils and low-dense targets and several schemes for generation of THz pulses, gamma radiation and quasi-static magnetic fields.	**15:00** **P. Berloff** (*UK*). **Dynamically consistent parameterization of mesoscale eddies** [Invited] Dynamically consistent, novel parameterization of oceanic mesoscale eddies is proposed, implemented and tested in the double-gyre ocean circulation model. The results are encouraging and providing the framework for further refinements of the parameterization.
15: 30 **A.S. Dmitriev** (*Russia*), E.V. Efremova, M.Yu. Gerasimov, and V.V. Itskov. **Look at the world in a different light: radio illumination using microwave dynamic chaos** [Invited] The problem of wideband illumination of objects and surfaces by radiation from artificial noncoherent microwave sources with the aim of subsequent observation by radiometric equipment is considered. The main problem in solving this task consists in creating efficient microwave generators analogous to available sources of lighting in the visible spectral range. We propose to use generators of ultrawideband chaotic oscillations as sources of noncoherent microwave radiation.	**15:20** **Yu. Fukuda** (*Japan*). **Laser-driven ion accelerations with submicron cluster targets: Contributions of magnetic vortexes** [Invited] An approach for accelerating ions due to the formation of a strong dipole vortex structure in subcritical density plasmas, with the use of a cluster-gas target, is presented. Ions with energy 10–20 MeV per nucleon having a small divergence (full angle) of 3.4 are generated in the forward direction with an ultrashort pulse laser of 150-mJ energy and 40-fs duration, corresponding to approximately tenfold increase in the ion energies compared to the TNSA experiments using thin foil targets.	**15:30** A.V. Glazunov and **E.V. Mortikov** (*Russia*). **LES and DNS modelling of stably stratified boundary layer turbulence** Large-eddy simulation (LES) and direct numerical simulation (DNS) approaches were used for modelling boundary layer turbulence under stable stratification. We describe results for different boundary layer type flows and review their relevance for developing parameterizations of turbulent processes in large-scale models of atmosphere and ocean.
16:00 **S.P. Kuznetsov** (*Russia*). **Design principles and illustrations of hyperbolic chaos in mechanical and electronic systems** [Invited] The report contains an overview of approaches to constructing systems of electronic and mechanical nature manifesting the hyperbolic chaos.	**15:40** **K.V. Lezhnin** (*USA*), T.Zh. Esirkepov, and S.V. Bulanov. **Dynamics of relativistic electron vortices in collisionless plasmas** [Invited] Vortex dynamics is an important topic of physics of continuous media and plasma physics. In comparison to hydrodynamical vortices, the vortices in collisionless relativistic plasmas exhibit new properties, as the displacement current, two-fluid and kinetic effects come into play. Using 2D PIC simulations, we demonstrate how these effects appear during the single or binary vortex evolution, playing a huge role in stability of the electron vortices and ion acceleration.	**16:00** **D.A. Sergeev** (*Russia*), Yu.I. Troitskaya, and G.N. Balandina. **Estimation of the CO_2 fluxes between the ocean and atmosphere for the hurricane wind forces using remote sensing data** CO_2 transfer between the hydrosphere and atmosphere in the boundary layer is an important part of the global cycle of the main greenhouse gas. Modern numerical models based on estimates of all components of the cycle, and taking into account the observed increase in concentration, often result an imbalance that varies over a wide range from year to year. It is comparable with estimates of the annual flux of carbon dioxide between the atmosphere and the ocean. It is customary to associate this imbalance with the problem of the flux correct estimation, since the error in its determination remains high in comparison with the other components of the global cycle. Direction and amplitude of continuous gases exchange in the boundary layer between the atmosphere and the hydrosphere, including carbon dioxide, vary greatly depending on geographical location, season, meteorological and hydrological conditions.

HALL B	HALL A	HALL C
Chaotic dynamics	**LaB - 1**	**Atmosphere and ocean dynamics – 1**
16:30 **E. Volkov** (*Russia*) and E. Hellen. **Complex routes to unusual collective chaos in indirectly coupled identical ring oscillators** [Invited] Synthetic genetic networks of identical ring oscillators with nonlinear conjugate coupling that simulates bacterial "quorum sensing" provide unusual examples of multistability between regular attractors, the appearance of symmetric chaos via period doubling of complex limit cycle or via torus destruction and uncommon spatially inhomogeneous collective chaos over very large parameter areas. A study of routes to the regions occupied by symmetric and asymmetric chaotic regimes demonstrates the presence of broad parts with coexisting regular and chaotic oscillations, which enhances the multistability of the coupled system.	**16:00** **J. Fuchs** (*France*). **Ion interactions with dense plasmas in magnetized and unmagnetized configurations** [Invited] I will present experimental work aimed at investigating the development of the streaming instability driven by the interaction of energetic ions -streaming along a magnetic field- with a background plasma, and its effects on the beam and background plasma. Beyond its interest as a fundamental phenomenon in plasma physics, the understanding of the streaming instability could be key to help explaining the observed anomalous ionization of dense clouds in the inter-stellar medium (ISM), which repercussion on star formation. Although numerical simulations underline the important role streaming instabilities play in space plasmas, the presence of a variety of growing and competitive modes, and the complex behaviour of such systems mean that our knowledge of it is still far from being complete. To experimentally study this instability, we have exploited and coupled several experimental configurations that are well-assessed by our group: the generation of fast ion beams driven by short-pulse lasers, the generation and characterization of well-controlled background plasma in which the ions are propagated, and strong external magnetization of this system. Results will be presented and discussed.	**16:30** **I.V. Shevchenko** (*UK*) and P.S. Berloff. **On large-scale low-frequency variability of the wind-driven midlatitude ocean gyres** [Invited] We discuss the large-scale low-frequency variability of the midlatitude ocean gyres and their western boundary currents simulated by the eddy-resolving quasi-geostrophic model. We applied EOF analysis to turbulent solutions and extracted robust large-scale decadal variability modes. To interpret these statistical modes dynamically, we linearized the quasi-geostrophic equations around the time-mean circulation and solved the corresponding full set of linear eigenmodes with their eigenfrequencies. We then projected the extracted variability on the eigenmodes and found that this variability is a multi-modal coherent-pattern phenomenon rather than a single mode or a combination of several modes as in flows preceding developed turbulence.
17:00 **E.P. Seleznev** (*Russia*), O.V. Astakhov, and N.V. Stankevich. **Chaotic and quasiperiodic oscillations in the system of coupled self-generators and multi-contours self-generator** [Invited] In the present paper, formation of multi-modes chaotic attractor, based on the multi-dimensional quasiperiodic torus observed in numerical and radiophysical experiments is reported. Characteristic phase portraits are shown.	**16:20** **M. Nakatsutsumi** (*Germany*), Y. Sentoku, S.N. Chen, S. Buffechoux, A. Kon, A. Korzhimanov, L. Gremillet, B. Atherton, P. Audebert, M. Geissel, L. Hurd, M. Kimmel, P. Rambo, M. Schollmeier, J. Schwarz, M. Starodubtsev, R. Kodama, and J. Fuchs. **Magnetic inhibition of laser-driven, sheath-accelerated high-energy protons** [Invited] Proton and ion beams accelerated in ultra-high-potential electron sheaths created on solid targets by ultrafast lasers have remarkable characteristics that have enabled unique applications. The current challenge is to increase the ion energy to 100 MeV and beyond, which is commonly thought to be possible by raising the on-target laser intensity. In this talk, we present experimental and numerical results demonstrating that magnetostatic fields self-generated on the target surface may pose a fundamental limit to acceleration for high enough laser intensities.	

16:40

A. Yogo (*Japan*), M. Hata, A. Morace, N. Iwata, Y. Arikawa, T. Johzaki, S. Fujioka, Y. Sentoku, S. Tosaki, K. Koga, H. Nishimura, K. Mima, M. Nakai, R. Kodama, and H. Azechi.

Ion acceleration from the modulated electric and magnetic fields by bundled picosecond laser beams [Invited]

We demonstrated the laser-ion acceleration by bundled picosecond laser beams experimentally. 50-MeV protons were achieved from a typical thin aluminum target with 1.2×10^{19} Wcm^{-2} as a total laser intensity of four bundled beams. This result can be attributed to the interference effects, which appear in multiple laser beams focused on the target with a small angle to each other. The modulated laser fields induce localized electric and magnetic fields also on the rear side, which make a beneficial effect for enhancing the ion energy owing to the high absorption efficiency due to the modulation.

17:00

Zhe Zhang (*China*).

Generation and application of a laser driven magnetic field in Lab-Astrophysics researches [Invited]

To generate a strong magnetic field by intense laser have been demonstrated. A hundreds to thousands Tesla level pulsed magnetic field can be produced. Besides the original design of a “capacitor-coil”, many other types of coils have been tested with fs-ps short pulse laser. With such a strong magnetic field, laboratory researches about many astro-phenomenon can be studied in a new regime and a more controllable way.

	Poster session
17:50 19:30	**[1]. G.M. Nkeumaleu, A.S. Tchakoutio Nguetcho, and J.M. Bilbault** (*France*). Modulated-wave solutions for an anharmonic lattice **[NWP-1]** Using the theory of bifurcations, we provide and find travelling wave dynamics, in a nonlinear Klein Gordon model with anharmonic, cubic and quartic interactions, immersed in a parameterized on-site substrate potential. The case of an anharmonic interactions and a deformable substrate potential allow theoretical adaptation of the model to various physical situations. Non-convex interactions in lattice systems lead to the existence of singular straight lines in phase space and thus, allow the appearance of a number of interesting phenomena that cannot be produced with linear coupling alone. By investigating the dynamical behavior and bifurcations of solutions of the planar dynamical systems, we derive a variety of exotic (peakons, compactons, bright and dark solitary waves, cups, different families of periodic solutions and others) solutions corresponding to the phase trajectories under different parameter conditions. Moreover, we demonstrate how and why travelling waves lose their smoothness and develop into solutions with compact support or breaking. **[2]. H.A. Mahamat, S. Jacquir, S. Binczak, and J.-M. Bilbault** (*France*). Electrocardiogram analysis using phase space reconstruction **[NWP-1]** Arrhythmias are a set of very common heart diseases that are a real challenge for science in general and physicians in particular. Some arrhythmias can reach the atria and cause, for example, fibrillation, which is manifested by an anarchic contraction of the atria and causes a rapid and irregular contraction of the ventricles. The spiral waves could be at the origin of the fibrillation and can disrupt the propagation of electric activity of the heart and lead to a chaotic state critical of the fibrillation. The behavior of a biological system depends on the variations of many parameters, which makes it almost unpredictable. Methods derived from the theory of chaos and nonlinear dynamics provide elements that allow understanding this type of behavior and establishing a qualitative link with bio-inspired or phenomenological mathematical models. In this work, we analyse the ECG resulting from WPW. **[3]. A.S. Karavaev** (*Russia*), **J.M. Ishbulatov, A.R. Kiselev, V.I. Ponomarenko, and M.D. Prokhorov**. Model of human cardiovascular system **[NWP-1]** We propose a model of human cardiovascular system which describes the main heart rhythm, the regulation of heart function and blood vessels by the autonomic nervous system, baroreflex, and the formation of arterial blood pressure. The proposed model demonstrates the phenomenon of synchronization of mean arterial pressure regulatory system by the signal of respiration with the basic period close to 10 s, which is observed in the physiological experiments. **[4]. S.Yu. Kirillov** (*Russia*) **and V.I. Nekorkin**. Selective properties of neurons with dynamic threshold of excitability **[NWP-1**] A model neuron with slow synaptic input demonstrates high variability of its excitability threshold properties. This allows the neuron to receive and transform fast external synaptic signals in a complicated nontrivial manner. The slow modulation of the threshold properties not only changes the number of spikes in the response, but also makes the number of spikes from the fast pulse amplitude nonmonotonic. **[5]. E.V. Sidak** (*Russia*), **D.A. Smirnov, and B.P. Bezruchko**. Detection of couplings between oscillators based on phase dynamics analysis in case of hidden interactions **[NWP-1]** We investigate the possibilities of the phase dynamics analysis-based method for detection of directional and time-delayed couplings between two oscillators from their time series (exhibiting multiple spectral peaks) in case of hidden third oscillator influencing both the observed ones. We have shown that application of the method of phase dynamics modeling to such a situation leads to false coupling detections. We have suggested a diagnostic criterion of possible errors and modified the technique of couplings detection. The effectiveness of the proposed modification is shown in numerical experiments. **[6]. N.V. Stankevich** (*Russia, Finland*) **and E. Mosekilde**. Coexistence between bursting and silent states in a beta-cell model **[NWP-1]** In the present paper a modified version of the well-known pancreatic cell model is suggested. The considered modification only produces minor changes of the model and thus allows for a stable state to arise and develop inside the bursting dynamics. In this way the model becomes an example of coexisting stable and bursting dynamics in a biophysical model. We present a series of numerical simulations with the model and describe some of the main scenarios associated with the observed form of multistability. **[7]. A. Lylova** (*Russia*), J. Sheldakova, A. Kudryashov, V. Samarkin, and A. Rukosuev. Formation of the laser beam with the help of different types of deformable mirrors **[NWP-2, Cremlin w/sh]** Adaptive optics allows transforming intensity distribution from Gaussian to flattop, doughnut etc. In this work, two types of the wavefront correctors for the beam shaping were used: bimorph deformable mirror and stacked-actuator deformable mirror. The flattop and doughnut beam formation results with the use of adaptive optics are also presented. **[8]. A.A. Kochetkov** (*Russia*), **V.N. Ginzburg, M.S. Kuzmina, A.A. Shaykin, and E.A. Khazanov**. Experimental research of small-scale self-focusing in isotropic crystals **[NWP-2, Cremlin w/sh & LaB**] Direct measurements of spatial noise gain in an intense wave propagating in [001]-oriented BaF2 were performed. Significant dependence of gain on the angle between the radiation polarization and the crystallographic axis predicted earlier was demonstrated. [**9]. A.P. Korobeynikova** (*Russia*), **A.A. Shaykin, I.V. Koryukin, and E.A. Khazanov**. Mathematical model of an additional laser pulse generating process in a Q-switched generator **[NWP-2, Cremlin w/sh & LaB]** In this work a mathematical model is presented, that describes the generation of a laser pulse in a Q-switched generator taking into account the possibility of generating other modes. The modeling implies the formation of two neighbor longitudal modes with different losses of free running pulses and time variation of the population inversion in different areas of the active element due to light intensity. It is shown that in the Q-switched regime a second so-called postpulse can be generated after generation of the main giant pulse.

[10]. M.A. Garasev, V.V. Kocharovsky, A.A. Nechaev (*Russia*), **and A. N. Stepanov**. Density bump formation at the front of a collisionless electrostatic shock wave in a laser ablated plasma **[NWP-2, Cremlin w/sh & LaB]**

The collisionless expansion of a dual-temperature plasmoid through a cold and tenuous plasma is studied numerically. It is found that a density bump is formed at the front of a collisionless electrostatic shock wave propagating at nearly ion-acoustic velocity. 1D3V and 2D3V PIC-simulations suggest that the bump emerges due to the presence of the ionized background and differs from an ion-acoustic soliton, being exposed to a continuous flow of high-energy particles of the dense plasmoid. Electrons' thermal anisotropy, arising behind the shock, leads to the growth of quasi-static Weibel magnetic fields up to a level of magnetization of ~10%.

[11]. A. Seleznev (*Russia*), **A. Gavrilov, E. Kocharovskaya, E. Loskutov, D. Mukhin, Vl. Kocharovsky, and A. Feigin.** Space-time empirical modes as an instrument for investigation of nonlinear phenomena in the superradiant lasers **[NWP-2 & LaB]**

The work is devoted to investigating spatial-temporal dynamics of the laser field in the low-Q cavities where photon lifetime is less than polarization relaxation time. We develop the spatialtemporal-dependent mode technique that takes into account strong coupling of standard cold or hot laser modes due to non-adiabatic and nonlinear effects. Its efficiency for the spectralcorrelation analysis of the laser field is demonstrated.

[12]. A.S. Zuev (*Russia*), A.A. Kochetkov, A.A. Shaykin, and I.V. Yakovlev. Upgrade of the front-end of the PetaWatt laser complex PEARL **[NWP-2, Cremlin w/sh & LaB]**

The front-end of the laser system PEARL is currently upgraded at IAP RAS. A femtosecond Ti:Sapphire oscillator and a new stretcher will be installed aimed at reducing output pulse duration and increasing stability and reliable operation of the laser system.

[13]. G.E. Khazanov (*Russia*) **and S.A. Ermakov**. Analysis of damping of surface waves on water with viscoelastic finite-thickness film **[NWP-3]**

The characteristics of surface waves on water covered with a viscoelastic finite-thickness film have been analyzed, and an analytical formula for gravity-capillary waves damping coefficient as a function of film thickness, viscosity and elasticity has been derived. The results are compared with the well-known case of monomolecular film in the context of remote observation and characterization of oil spills on sea surface.

[14]. M.Yu. Kulikov, A.A. Nechaev (Russia), **M.V. Belikovich, T.S. Ermakova, and A.M. Feigin**. Daytime photochemical equilibrium of OH, HO2, and O3 at the altitudes of the mesosphere: implication for MLS/Aura data validation **[NWP-3]**

The technique of statistic validation for simultaneous mesospheric measurements of OH, HO2 and O3 in the daytime has been developed. It implies meeting the photochemical equilibrium equation and takes into account measurement error. The presentation shows the first results of applying the technique to MLS/Aura data.

[15]. P.A. Perezhogin (*Russia*), **A.V. Glazunov, and A.S. Gritsun**. Stochastic parametrization for 2-D turbulence simulation **[NWP-3**]

Stochastic subgrid parametrizations designed for coarse-grid numerical simulations of two-dimensional turbulence were investigated. These parametrizations require a-priori analysis of high resolution simulation data and take into account the properties of numerical schemes. The proposed parametrizations were tested under the modeling of bidirectional energy-enstrophy cascade in isotropic homogeneous 2-D turbulence. The energy generation spectrum induced by subgrid processes was obtained using high-resolution computation. This spectrum was used for the evaluation of subgrid stochastic model parameters. It was shown that the proposed model improves the large-scale dynamics. In particular, it restores the inverse energy cascade for different numerical schemes and improves the sensitivity of the coarse-grid numerical models to external forcing.

[16]. V.P. Reutov, G.V. Rybushkina, and S.V. Shagalov (*Russia*). On the dynamical chaos in barotropic zonal jets **[NWP-3]**

The onset of dynamical chaos in the barotropic quasi-two-dimensional zonal flows is studied. The horizontal Bickley jet in a channel with rigid lateral walls is examined using numerical simulation. As soon as the flow velocity has exceeded the instability threshold, the mode alternation with hysteresis is revealed. It is found that the transition to the dynamical chaos occurs at fairly large supercriticality and may be regarded as the Ruelle-Takens scenario. The peculiarities of the transition due to modification of the flow velocity profile are elucidated.

[17]. V.V. Toporovsky (*Russia*), **A.V. Kudryashov, J.V. Sheldakova, and I.V. Galaktionov**. Determination of optical properties of turbid media by Monte Carlo method **[NWP-3]**

The distribution of radiation in the turbid media and simulation of optical properties of the media are the most common tasks for description of interaction of incident radiation with scattering centers. Therefore, for description of the path of photons in the media different simulation methods are used: Kubelka-Munk method, diffusion approximation, Monte Carlo method. Among them the most optimal one is the Monte Carlo method, because it gives the most accurate and valid information about the distribution of the radiation inside the media.

Nonlinear Dynamics and Complexity	Lasers with High Peak and High Average Power	Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
Stochastic dynamics	**LaB – 2**	**Atmosphere electrodynamics – 1**
12:00 **M. Hasler** (*Switzerland*). **Dynamics of stochastically blinking systems** [Invited]	**12:00** **A.V. Ivanovsky** (*Russia*). **Study of physical processes at high energy densities with the use of explosive magnetic generators** [Invited] One of the methods to produce high energy density during modeling of physical processes and studies of material properties is to convert the kinetic energy of a high-speed shell or a liner. The paper will present these methods, will evaluate maximum attainable velocities and pressures, will compare the possibilities of providing symmetry and effect controlling, as well as recovery of the explored samples for subsequent analysis.	**12:00** **V.A. Rakov** (*USA*). **A review of global and regional lightning locating systems with emphasis on testing their performance characteristics** [Invited] Both cloud-to-ground and cloud lightning discharges involve a number of processes that produce characteristic electromagnetic field signatures. In general, any observable electromagnetic signal from a lightning source can be used to detect and locate the lightning process that produced it. An overview of the various radio-frequency lightning locating techniques, including magnetic direction finding and time-of-arrival technique, is given. Lightning locating system performance characteristics are discussed. Both cloud and cloud-to-ground flashes are considered. Representative examples of modern lightning locating systems are reviewed. Besides general characterization of each system, the available information on its performance characteristics is given.
12:30 **A.A. Koronovskii** (*Russia*). **Characteristics of noise-induced intermittency in bistable systems** [Invited] The aim of this talk is to develop a quantitative theory of noise-induced intermittency in a system with two coexisting regimes, and prove it with several different systems, from the point of view of the proposed theory comparing the statistical characteristics of the behavior of these systems with the theoretical predictions. We consider several systems where the noise-induced intermittency is observed, namely, the bistable energy model, erbium-doped fiber laser and the brain dynamics in perception of ambiguous images.	**12:20** **Y. Kishimoto** (*Japan*), D. Kawahito, T. Okihara, H. Sakaguchi, K. Fukami, and Y. Fukuda. **Confinement of high energy density plasma produced by the interaction between high intensity laser and structured medium** [Invited] We study a high energy density plasma produced by the interaction between high intensity short pulse laser and matter. Such a plasma is highly non-stationary and non-equilibrium regulated by multiply charged high-*Z* ions, high energy relativistic electrons, quasi-static and/or low frequency electromagnetic fields, and X-rays. Therefore, the plasma opens up many innovative applications including the study of astrophysics utilizing the nature of such an extreme state. However, the difficulty is the time scale that the plasma is sustained, i.e. the life time, which is very short and is determined by the inertia. Here, we try to confine such a high energy density plasma exceeding the inertia time. For this purpose, we introduce a target having structures with sub-micro scale incorporating with an externally applied magnetic field.	**12:30** **A.P. Khain** (*Israel*) and M. Pinsky. **Microphysical processes in clouds affecting charge separation** [Invited] We discuss microphysical processes in clouds such as effects of aerosols on formation of supercooled droplets, formation of crystals, graupel and hail at high levels. Possible role of breakup of snow by ice-ice collisions is considered. The state-of the art situation in cloud modeling is discussed.

13:00
S. Yanchuk (*Germany*).
Noise-resistance of oscillatory neural networks with adaptive coupling [Invited]
In my presentation, I will review the results obtained in publications. They show that oscillatory neural populations with adaptive synaptic weights governed by spike timing-dependent plasticity (STDP) exhibit a natural resistance to noise. With the increase of the noise intensity, we observe a dramatic increase of the mean synaptic coupling. These findings suggest that there is an optimal noise level, where the amount of synaptic coupling is maximal. In addition to the numerical and statistical analysis of large systems of Hodgkin-Huxley neurons and phase oscillators, we study theoretically the influence of noise for a minimal model by considering just two coupled neurons. It is shown how a strong bidirectional coupling, which is not present in the noise-free situation, can be stabilized by the noise.

12:40
Guang-yue Hu (*China*), Yi-han Liang, Hui-bo Tang, Yang Zuo, Yu-lin Wang, Bin Zhao, Ping Zhu, and Jian Zheng.
Laser plasma evolution in external 10 T magnetic field [Invited]
A Magnetized Laser Plasma Facility was built at USTC, which is composed of a nanosecond heating laser beam (6 J / 527 nm / 7 ns), a femtosecond detecting laser beam (2 mJ/800 nm/50 fs), and a 7–30T pulsed magnetic field generator. A series of laser plasma evolution experiments were performed at USTC.

13:00
Y. Du (*Hong Kong*), M. Chen, and Yu. Yang.
Observation and testing platform for lightning to the 350 m-tall Shenzhen meteorological tower [Invited]
A 360m-tall meteorological gradient observation tower has been constructed in Shenzhen, China. As the tall tower is subject to lightning strikes, it has been considered to be a perfect site for measuring lightning-related parameters and carrying out field tests for lightning protection. A series of observation systems have been installed at the site for measuring natural lightning currents, electromagnetic fields, lightning electromagnetic impulses, lightning optical phenomena. It is expected that the results obtained from measurement and observation at the site will further enhance the research on lightning discharge characteristics, lightning effects on electronic/electrical systems, bonding and grounding for lightning protection.

13:00
C.K. Li (*USA*), F.H. Séguin, J.A. Frenje, R.D. Petrasso, P.-E. Masson-Labprde, S. Laffite, V. Tassin, P.A. Amendt, H.G. Rinderknecht, S.C. Wilks, N.M. Hoffman, A.B. Zylstra, S. Atzeni, R. Betti, M.J. Rosenberg, and T.C. Sangster.
Measurement of self-generated spontaneous fields and their effects on ICF ion kinetic dynamics [Invited]
The plasma kinetic effects, which have been overlooked in the conventional single-spices-averaged hydrodynamic codes for inertial-confinement fusion (ICF), are attracting increasing attention. It has been realized that such effects are largely responsible for some disagreements between the experimental results and numerical simulations. Kinetic effects play an important role in the early ICF implosion phase and can potentially affect the dynamics in the later implosions. In particular, coupled with ion-kinetic processes, self-generated fields would have important effects on aspects of ion kinetic dynamics. For example, experiments at the OMEGA laser have shown that the interface between ICF hohlraum fill gas and Au wall blowoff is kinetically unstable, leading to formation of a diffusion layer and development of an ambipolar electric (E) field in the hohlraum radial direction. Such a field would enhance interpenetration and mixing between the Au blowoff and the gas plasma, changing hohlraum drive dynamics and then capsule implosions. We have recently conducted a series of indirect-drive and direct-drive ICF experiments on OMEGA. The experimental data, helped by the simulations, provide a new insight into the effects of self-generated fields on the interface structure in various ICF targets and ion kinetic dynamics.

Nonlinear Dynamics and Complexity	Lasers with High Peak and High Average Power	Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
Complex dynamics	**Laser sources: extending limits**	**Climate dynamics – 2**
8:30 **X. Leoncini** (*France*). **Dynamics of systems with many degrees of freedom from long range-interactions to complex networks** [Invited] In this talk I will discuss the dynamics of systems with many degrees of freedom. We first will consider some results obtained in the case of long-range interacting systems with Hamiltonian dynamics. Starting from these we shall see how some of the properties can be transferred to the dynamics on networks, either on regular lattices or more complex networks.	**8:30** **I.E. Kozhevatov** (*Russia*), D.E. Silin, A.V. Pigasin, E.H. Kulikova, and S.B. Speransky. **Design and specifications of 630-mm phase shifting interferometer for the qualification of large aperture optics** A specialized phase shifting interferometer for qualification of large optics for extremely high-power laser systems has been designed and tested at IAP RAS. The interferometer will be used to assess homogeneity of blank material as well as in-process inspection information and final inspection qualification data. The 630 mm system is one of the largest Fizeau phase shifting interferometers ever manufactured in Russia. The interferometer has a high lateral resolution, but the most notable feature of this device is its high absolute precission. In this presentation we consider vibration and distortion control of interferometer optical elements and optical transfer function optimization. We also address the effects in the test cavity arising from measuring transmitted and reflected wavefronts of optics mounted at various angles, including the Brewster's angles.	**8:30** **A.A. Tsonis** (*USA*) and S. Kravtsov. **Insights into decadal climate variability from the synchronization of a network of major climate modes** [Invited] We apply ideas from the theory of synchronized chaos to analyze a network of a few major climate indices and show evidence of major climate regime shifts that accompany, and perhaps even define, the observed and simulated decadal climate variability. We also detect differences in the dynamical structure of this variability between the models and observations, which can eventually help understand the current limitations of climate models and guide their further development.
9:00 **I. Franović** (*Serbia*) and V.V. Klinshov. **Mean-field analysis of stability and slow rate fluctuations in a network of noisy neurons with coupling delay** We analyze the emergence of slow rate fluctuations and rate oscillations in random neuronal networks influenced by external and internal noise, as well as coupling delay. The second-order stochastic mean-field model is derived to examine (i) network's stability and bifurcations in the thermodynamic limit and (ii) fluctuations associated to finite-size effects. Regarding (i), external and internal noise are found to affect macroscopic dynamics in a fundamentally different fashion. Considering (ii), we demonstrate that slow rate fluctuations between two quasi-stationary states may be understood as noise-driven transitions in a double-well potential, whereas delay-noise interplay can yield fluctuations involving two oscillatory regimes.	**8:50** **A. Kudryashov** (*Russia*), V. Samarkin, A. Aleksandrov, G. Borsoni, T. Jitsuno, and J. Sheldakova. **Large bimorph flexible mirror for Peta-Watt laser beam correction** [Invited] Two types of large bimorph deformable mirrors with the size of 410×468 mm and 320 mm were developed and tested. The results of the measurements of the response functions of all the actuators and of the surface shape of the deformable mirror are presented in this paper. The possibility of correction of the aberrations in high power lasers was demonstrated experimentally (to get Strehl number up to 0.7) and numerically.	**9:00** **N.A. Diansky** (*Russia*), I.V. Solomonova, A.V. Gusev, and T.Yu. Vyruchalkina. **Effects of the North Atlantic thermohaline circulation on climate variability and Arctic climate change projections based on the combined scenario** [Invited] The combined scenario of climate change assessment is proposed based on the composition of "greenhouse" and "cyclic" effects. The forecast of atmospheric characteristics was made for 2010–2071 using the CORE datasets for 1948–2009. The prognostic run was made with the OGCM INMOM on reproducing thermohaline circulation and sea ice in the Atlantic and Arctic Oceans for 1948–2071. The interconnections were investigated amongst climate processes of the North Atlantic and Arctic.
9:30 **V.V. Klinshov** (*Russia*), D.S. Shchapin, S. Yanchuk, and V.I. Nekorkin. **Multi-jittering regimes in networks with pulse delayed coupling** We report a novel type of the dynamics in oscillatory networks with pulse delayed coupling. In such networks the regular low-periodic oscillations may destabilize giving birth to the higher-	**9:10** **E.A. Mironov** (*Russia*) and O.V. Palashov. **Thermo-optical characteristics of uniaxial crystals** Thermally induced distortions of laser radiation caused by the photoelastic effect during high-power beam propagation through optical elements cut along the optical axis of uniaxial crystals have been investigated. The optical anisotropy parameter ξ and thermo-	**9:30** **A. Gritsun** (*Russia*) and V. Lucarini. **Instability characteristics of blocking regimes in a simple quasi-geostrophic atmospheric model** [Invited] In this paper we study statistics and instability characteristics of blocking events in the three layer quasi-geostrophic model of atmosphere by Marshall and Molteni. It is shown that the model is

periodic ones, the so-called "jittering" regimes. The period of the emergent regimes is proportional to the value of the coupling delay. Another characteristic feature is high multistability of these regimes. At the bifurcation point, the low-periodic regime destabilizes, and a bunch of higher-periodic ones appear at once. The number of the coexisting "jittering" regimes grows exponentially with the coupling delay.	optical constants Q and P specifying the magnitude of thermally induced depolarization and thermal lens, respectively, have been defined for uniaxial crystals of all three syngony types. The introduced thermo-optical characteristics may be used as applicability criteria of various uniaxial crystals for work with high-power laser radiation.	able to produce reasonable longitudinal distribution of blocking events as well as simulate blocking events with lifetime of up to 40 days. Using covariant Lyapunov exponents we analyze predictability of onset, duration and decay of blockings. It is shown that on the average blockings are less predictable than the system trajectory with the blocking onset and decay being the most unstable. We verify our findings by looking at unstable periodic orbits (UPOs) of the system representing blocking and nonblocking events. It was found that blocking UPOs have 20% more positive (unstable) Lyapunov exponents than the system trajectory, and 50% larger leading exponent.
	9:25 **V.Yu. Venediktov** (*Russia*). **Holographic wavefront sensors and high-power lasers** Holographic wavefront sensors provide a fast and computations-free tool for measurement of the wavefront distortions. We consider the basic schemes of such devices, the recent progress in their development, related first of all to the use of Fourier holography, and special features of such devices, which make them especially interesting for application in various laser systems, including the high-power laser systems.	
	9:45 **V.N. Ginzburg** (*Russia*), A.A. Kochetkov, and E.A. Khazanov. **Study of self-filtering and small-scale self-focusing suppression of high-intensity laser beams** Free space propagation of laser radiation with intensities over several hundred GW/cm^2 can act as a filter for spatial noise harmonics in an instability band of small-scale self-focusing (SSSF). Here we report on the results of experimental study of intense radiation self-filtering and SSSF suppression based on direct and indirect measurements of spatial noise gain of intense radiation propagating in a glass plate.	
	10:00 **Yu. Zhao** (*China*), J. Shao, Sh. Liu, M. Zhu, J. Chen, and Zh. Wu. **Thermal-dynamical analysis of femtosecond laser damage of optical coatings** Laser-induced damage behaviors of the HR coatings and chirped mirrors (CMs) are studied by 800nm-38fs lasers. Interestingly, a circular blister feature appears in the CMs at a wide range of laser fluence. The damage threshold was simulated by multi-wavelength ionization, and an adiabatic expansion model of ideal gas is adopted to illustrate the formation dynamics of blisters. The evolution of blisters can be explained by partial evaporation of the film and a subsequent gas expansion, driving the bulging of the film stack up to the stress limit, where the blister fractures. According to this model, the energy absorption ratio of blisters increases monotonously with increasing laser fluence.	

HALL B	HALL A	HALL C
	Laser sources: extending limits	
	10:15 **I. Shaikin** (*Russia*), A. Kuzmin, and A. Shaykin. **Pump laser for multistage parametrical amplifier** This work is devoted to the PEARL-X setup pumping laser and improvements of the laser made in the last few years. A few problems are discussed: compactification of the scheme by using short spatial filters, pumping pulse energy increase by increasing beam aperture, efficient use of the energy stored in amplifiers due to the injection of an additional pulse into the pump pulse amplification system, ways to reduce the spatial and temporal inhomogeneity of the pump pulse. The optical and laser properties of Yb:LuAG ceramic sample made by nanocrystalline pressure-less sintering in H_2 (NC-PLSH) were investigated. An active element of a disk laser was manufactured and continuous generation with maximum output power of 200 W and slope efficiency of 40% was demonstrated.	

Nonlinear Dynamics and Complexity	Lasers with High Peak and High Average Power	Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
Patterns	**LaB – 3**	**Climate dynamics – 3**
17:50 **J. Zhang** (*China*), Y. Liu, S. Cao, and W. Wang. **Studying pattern dynamics in aerodynamics using Lagrangian coherent structures** [Invited] For the flow around a body in aerospace engineering, there exists a rich variety of nonlinear phenomena. For example, the breaking of a separation bubble is the main route to vortex shedding, which is a complex unsteady flow. Moreover, it has an important influence on the aerodynamic performance of airfoil near stall. Recently, experiments show that some kind of separation bubbles and their breakings, which are induced by some unsteady perturbations or excitations, can lead to the improvement of the aerodynamic performance in a sense. In other words, such improvement is relevant to the generating, developing and breaking of the separation bubble. However, the nature for such phenomenon is still unclear, and hence it is necessary to study the evolution of the bubble breaking in depth.	**17:50** **G.S. Bisnovatyi-Kogan** (*Russia*). **Mechanisms of astrophysical JET formation, and comparison with laboratory experiments** [Invited] Jets are observed in young stellar objects, X-ray sources, and active galactic nuclei (AGN). The mechanisms of jet formation may be divided into regular, acting continuously for a long time, and explosive ones. Continuous mechanisms are related to electrodynamics and radiation pressure acceleration, hydro-dynamical acceleration in the nozzle inside a thick disk, acceleration by relativistic beam of particles. Explosive jet formation is connected with supernovae, gamma ray bursts and explosive events in galactic nuclei. Mechanisms of jet collimation may be connected with magnetic confinement or pressure of external gas. Explosive formation of jets in laboratory is modeled in the experiments with powerful laser beam, and plasma focus.	**17:50** **J. Tribbia** (*USA*). **Weather and climate predictability and its relation to predictive skill** [Invited] Traditional model twin predictability experiments lead to a straightforward method of estimating the predictability of both weather and climate variability on time scales of days to decades. Ensemble forecasts correspond to such identical model twin experiments and enable one to calibrate the reliability of predictions and permit the estimate of dynamically and predictability relevant quantities like local Lyapunov exponents and vectors. Predictability estimates for weather and climate variability and their comparison to forecast skill will be given using the NCAR CESM1. As is invariably the case such predictability estimates are useful estimates of predictive reliability only for a short time consistent with linear error and the ensemble estimates become inconsistent at longer forecast times. The nonlinear aspects of uncertainty growth that lead to such behavior will be examined and discussed.
18:30 **A.A. Polezhaev** (*Russia*) and M.B. Kuznetsov. **Patterns formed before the onset of subcritical Turing bifurcation** [Invited] We investigate numerically the behavior of a two-component reaction-diffusion system of FitzHugh-Nagumo type before the onset of subcritical Turing bifurcation in response to local rigid perturbation. In a large region of parameters, initial perturbation evolves into a localized structure. In a part of that region, closer to the bifurcation line, this structure turns out to be unstable and undergoes self-completion covering all the available space in the course of time. Depending on the parameter values in two-dimensional space this process happens either through generation and evolution of new structures or through the elongation, deformation and rupture of initial structure, leading to space-filling non-branching snake-like patterns.	**18:10** **D.V. Bisikalo** (*Russia*). **Modelling of accretion processes in magnetized binary stars** [Invited] We present a review of physical processes occurring due the mass transfer between the components of close binary stars. To study the main properties of accretion disks and envelopes in various types of binaries we use results of three-dimensional HD and MHD numerical simulations. Special attention is paid to the description of the magnetic field influence on accretion processes. The main observational manifestations of the numerically found flow structure elements are also presented.	**18:30** **S.V. Kravtsov** (*USA*). **Pronounced differences between the observed and CMIP5 simulated climate variability in the twentieth century** [Invited] Identification and dynamical attribution of multidecadal climate undulations to either variations in external forcings or to internal sources is one of the most important topics of modern climate science, especially in conjunction with the issue of human induced global warming. Here we utilize ensembles of the 20^{th} century climate simulations to isolate forced signal and residual internal variability in a network of observed and modeled climate indices. The observed internal variability so estimated exhibits a pronounced multidecadal mode with a distinctive spatiotemporal signature, which is altogether absent in model simulations. This single mode explains a major fraction of model–data differences over the entire climate-index network considered; it may reflect either biases in the models' forced response or models' lack of requisite internal dynamics, or a combination of both.

HALL B	HALL A	HALL C
	LaB – 3	**Climate dynamics – 3**
	18:30 **G. Revet** (*France*), S.N. Chen, R. Bonito, B. Khiar, E. Filipov, C. Argiroffi, D. P. Higginson, S. Orlando, J. Béard, M. Blecher, M. Borghesi, K. Burdonov, D. Khaghani, K. Naughton, H. Pépin, O. Portugall, R. Riquier, R. Rodriguez, S.N. Ryazantsev, I.Yu. Skobelev, A. Soloviev, O. Willi, S. Pikuz, A. Ciardi, and J. Fuchs. **Laboratory unravelling of matter accretion in young low-mass stars** [Invited] Through scaled laboratory experiments of collimated plasma accretion onto a solid in the presence of a magnetic field, we open the first experimental window on this phenomenon by tracking, with spatial and temporal resolution, the dynamics of the system and simultaneously measuring multiband emissions. This is performed using a laser-created thermal plasma embedded in an external 20T pulsed magnetic field.	**19:00** **D.Yu. Gushchina** (*Russia*) and B. Dewitte. **The role of atmosphere intraseasonal variability in El Niño forcing** [Invited] The atmosphere disturbances of intraseasonal timescale (ITV) – Madden-Julian Oscillation (MJO) and equatorially Rossby waves (ER) were shown to participate in El Niño triggering with distinct contribution to conventional and Modoki El Niño. The ENSO/ITV relationship demonstrates a drastic seasonal dependence and is sensitive to the state of the tropical Pacific, particularly it is strongly correlated to the PDO and IPO index. This may have implication for ENSO seasonal forecasts.
	18:50 **S.A. Pikuz** (*Russia*)**,** E.D. Filippov, S.N. Ryazantsev, I.Yu. Skobelev, G. Revet, D.P. Higginson, S.N. Chen, B. Albertazzi, A.A. Soloviev, J. Beard, B. Khiar, A. Ciardi, A.Ya. Faenov, H. Pepin, and J. Fuchs. **X-ray spectroscopy diagnostics to study complex supersonic plasma flows with astrophysical relevance in laser plasma** [Invited] Remarkable plasma hydrodynamic phenomena such as supersonic jets have been observed to emerge from a wide variety of astrophysical systems, however the questions on their formation mechanisms and morphology are still open. Laboratory experiments employing the plasma produced by high power lasers can be scaled to astrophysical systems by matching dimensionless scaling parameters and thus providing the studies of astrophysical phenomena in controllable conditions. Particularly, laser produced jets are fully scalable to that one from young star objects, and the application of external magnetic field to plasma flows allows to investigate stable, large aspect ratio plasma jets.	
	19:10 **F. Kroll** (*Germany*), A. Pelka, B. Albertazzi, F. Brack, E. Brambrink, T. Cowan, P. Drake, E. Falize, E. Filipov, Y. Kuramitsu, C. Kuranz, D. Lamb, J. Levesque, C. Li, M. Manuel, T. Michel, T. Morita, N. Ozaki, S. Pikuz, G. Rigon, M. Rödel, Y. Sakawa, U. Schramm, H. Shimogawara, L. Van Box Som, and M. Koenig. **Experimental study of accretion processes in X-ray binary stars using an external B-field** [Invited] Here we report on recent results from experiments carried out at LULI2000 using the nanosecond beam to generate a high-density plasma flow by laser-driven rear-side shock breakout. The sample was positioned inside a pulsed coil generating a magnet field of ~15 T in order to study the influence of the magnetic field on the plasma flow. In addition, an obstacle was placed behind the sample to investigate the formation of a return shock. As diagnostics we used laser-driven X-ray point projection radioscopy driven by the pico2000 beam and optical Schlieren Imaging, shadowgraphy, and Streaked Optical Pyrometry from two sides.	

Nonlinear Dynamics and Complexity	Lasers with High Peak and High Average Power & LaB	Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
	Laser-plasma sources and applications	**Climate dynamics – 4**
	20:30 **T. Ebisuzaki** (*Japan*) and S. Wada. **Deorbiting of space debris by laser ablation** [Invited] Recent years deorbiting by the laser ablation attracts increasing attentions as an almost unique effective method to remediate cm-sized space debris. According to Ebisuzaki et al. 2014, the deorbiting operation is divided into three steps. First, a super-wide field telescope detects the reflection signal of the solar light by space debris and roughly determines its position and moving direction. Second, laser beams are ejected to the directions of the debris to determine the position and velocity precisely as well as its distance. Finally, a high intensity laser beam is focused onto the debris surface to induce laser ablation on the surface. The reaction force of the ablation leads the debris to the deorbiting to the Earth's atmosphere. In this talk, we will discuss the technical challenges to achieve the mission and propose the step-by-step approach for the technical demonstration of the mission.	**20:30** **D. Kondrashov** (*USA*). **Data-adaptive harmonic decomposition and multi-layer Stuart-Landau stochastic modelling** [Invited] Novel signal processing data-adaptive decomposition technique will be presented that estimates power and phase spectra of mutivariate datasets in geosciences and elsewhere. The key numerical features of the Data-adaptive Harmonic decomposition (DAH) method rely on the construction of covariance matrix that exploits time-lagged cross-correlations. Eigenmodes associated with DAH covariance matrix form an orthogonal set of oscillating data-adaptive harmonic modes (DAHMs) that come in pairs and in exact phase quadrature for a given temporal Fourier frequency. Data-driven inverse modeling is greatly simplified by using DAHM basis.
	20:50 **A.A. Golovanov** (*Russia*), I.Yu. Kostyukov, J. Thomas, and A.M. Pukhov. **Analytic model for electromagnetic fields in the bubble regime of plasma wakefield** We consider a model of a strongly nonlinear plasma wakefield (a bubble) excited by an intense laser pulse or a relativistic electron bunch propagating in plasma with transverse inhomogeneity. Assuming the general shape of the electron sheath on the border of the bubble, we obtain a second-order ordinary differential equation for the boundary of the bubble. We find approximations when this equation is significantly simplified. We develop a lowest-order perturbation theory for the components of electromagnetic fields inside and outside the bubble. The results are verified with 3D particle-in-cell simulations.	**21:00** **G.S. Duane** (*USA*), M.-L. Shen, and N.S. Keenlyside. **Supermodeling the climate system to capture self-organized criticality** [Invited] Differences in climate projections among state-of-the-art models can be resolved by connecting the models in run times. Even when the models err on the same side of truth, a supermodel formed from state-of-the-art climate models can compensate for the error, seemingly by learning to connect the constituent models (with positive connections) so as to mimic realistic *critical* behavior, as in blocked-zonal regime vacillation or the El Niño cycle.

HALL B	HALL A	HALL C
	Laser-plasma sources and applications	**Climate dynamics – 4**
	21:05 **M. Chen** (*China*), W. Luo, W.-Yu. Liu, T. Yuan, Ji-Ye Yu, F.-Yu Li, D. Del Sorbo, C.P. Ridgers, Zh.-M. Sheng. **QED cascade saturation and electron-positron jet formation from an ultrastrong laser-irradiated thin foil** [Invited] QED cascade saturation and relativistic electron-positron (e^-e^+) jet formation in a thin foil irradiated by two counter-propagating ultraintense laser pulses are studied. A scaling of QED cascade growth with laser intensity is found, which shows clear cascade saturation above threshold intensity of ~ 10^{24}W/cm^2. This saturation enables the production of high-yield ($\gtrsim 10^{13}$) ultradense (10^{24} cm^{-3}) e^-e^+ pair plasma and significant laser energy depletion. In the same intensity regime, the formed pair plasma is found to be further squeezed toward the initial thin-foil location, where finally relativistic e^-e^+ jets are formed and ejected transversely along the laser electric field directions.	**21:30** D.A. Zappala, M. Barreiro, and **C. Masoller** (*Spain*). **Hilbert analysis unveils inter-decadal changes in large-scale patterns of SAT variability** Climate change is a topic of great importance, and a lot of work is focused on quantifying significant variations in the properties of climatological variables, in particular, of surface air temperature (SAT). Although changes in local seasonal cycles (such as the amplitude and the phase lag to the insolation) have been investigated, changes in large-scale patterns of faster SAT variability (on a daily time-scale) remain poorly understood. Here we perform a Hilbert analysis of daily SAT reanalysis data covering the Earth's surface, and identify the geographical regions where inter-decadal changes are more pronounced.
	21:25 **D.A. Serebryakov** (*Russia*), E.N. Nerush, and I.Yu. Kostyukov. **Model for hard X-ray generation and electron acceleration during grazing incidence of a laser pulse onto a planar target** When a laser pulse with dimensionless amplitude $a_0 \sim 2$–8 is incident onto a solid-density planar target under small angles to the surface (~5–15 degrees), the superposition of the incident and the reflected waves results in appearance of strong longitudinal force at a certain distance from the target. The electrons (coming from, for example, a preplasma) can accelerate in the presence of this force up to tens of MeVs. PIC simulations also reveal that this effect is even enhanced if a reaches 30–50 because of nonlinear alteration of the target surface. As a result, the electrons produce hard X-ray or even gamma-ray flash in the direction of their propagation. We study this process by means of both theoretical model and numerical simulations and determine the optimal parameters for the most efficient electron acceleration x-ray generation.	
	21:40 **O.E. Vais** (*Russia*) and V.Yu. Bychenkov. **Analysis of electrons accelerated from ultra-thin foils for evaluation of high-power ultrashort laser pulse intensity** In the present work we suggest a new method of diagnostics of relativistically strong ultrashort laser pulses that is based on the analysis of angular spectral distributions of electrons gaining their energy in the process of direct vacuum acceleration by the laser field. To describe laser fields near the diffraction limit we use Stratton-Chu integrals to model a laser beam with different spatial profiles sharply focused by an off-axis parabolic mirror.	

Nonlinear Dynamics and Complexity	Lasers with High Peak and High Average Power & LaB	Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
Symmetries and Conservation Laws	**LaB – 4**	**Atmosphere electrodynamics – 2**
11:30 **M.L. Gandarias** (*Spain*)**.** **On conservation laws for some equations that admit compacton solutions** [Invited] We consider a generalized equation admitting compacton solutions induced by a non-convex convection. A complete classification of low-order conservation laws is obtained for this equation.	**11:30** **B. Qiao** (*China*), Z. Xu, W.P. Yao, and X.T. He. **Magnetic reconnection in the high-energy-density and relativistic regime** [Invited] Magnetic reconnection (MR), breaking and reorganizing the topology of magnetic field dramatically, is a fundamental process observed in many space, laboratory and astrophysical plasmas. In this talk, I report recent theoretical investigations on MR in the high-energy-density and relativistic regime for high-β (β > 1) and relativistic plasmas.	**11:30** **A. Chilingarian** (*Armenia*). **The runaway breakdown particles spectra obtained just before the lightning stroke** [Invited] The new emerging field of high- energy physics in the atmosphere involves measuring as many parameters as possible, such as particle fluxes, electric-field disturbances, radio emissions from the thunderclouds, and meteorological environments. The intensity of the Thunderstorm Ground Enhancement (TGE) analyzed in the present study was observed by 3 cm thick scintillators with a sensitive area of 1 m. sq. operated in the particle counter mode. The energy release spectra of gamma ray and electron content of avalanches unleashed in the cloud was measured by the 60 cm thick plastic scintillator equipped with veto system for charged particles. We estimate the height of cloud and compare the estimated maximal energy of electrons and gamma rays with simulated ones. It is the first measurements of Runaway Breakdown (RB) particles spectra obtained just before the lightning stroke.
12:00 **M.S. Bruzón** (*Spain*) and E. Recio. **Conservation laws and potential systems for a general family of thin film equations** [Invited] We derive and investigate the first-level and second-level potential systems of a family of thin film equations. From the first-level system, we obtain a new nonlocal conservation law.	**11:50** **S. Bolaños** (*France*), R. Smets, R. Riquier, A. Grisollet, and J. Fuchs. **Investigating guide field reconnection in HED plasmas** [Invited] Magnetic reconnection (MR) is a process which occurs in many astrophysical plasmas, e.g. in solar flares, in coronal mass ejecta, or at the outer boundary of the Earth magnetosphere. However, as of now, the fundamental microphysics implied in this process is far from being well understood. Most of the investigations on this long standing issue come from numerical studies and space observations. Laboratory modelling of plasmas, including those that can be generated by high-power lasers, offer now new perspectives to investigate MR and the processes governing it.	**12:00** A.V. Agafonov, I.S. Baidin, **A.V. Oginov** (*Russia*), A.A. Rodionov, and K.V. Shpakov. **Radiations in lightning-like atmospheric discharges** The recent results of investigation of a laboratory high-voltage discharge in air are presented. X-ray and neutron emission detection is specially emphasized. Data were obtained with a combination of plastic scintillation detectors and Helium-3-filled counters of thermal neutrons. Strong dependence of the hard X-ray and neutron radiation appearance on the field strength near electrodes was found. Complicated temporal structure of the neutron bursts observed during discharge was revealed. Anisotropy of bremsstrahlung X-rays was analyzed.

HALL B	HALL A	HALL C
Symmetries and Conservation Laws	**LaB – 4**	
12:30 **M. Oberlack** (*Germany*), V. Grebenev, and M. Waclawczyk. **Statistical symmetries in turbulence – recent results for 2D flows** [Invited] Turbulence is inherently statistical in nature. Further, from large-scale direct numerical simulations we have an overwhelming evidence, that the Navier-Stokes equations are an excellent model to describe turbulence. Independent of this, from a group theoretical point of view the Navier-Stokes equations admit the classical Galilean symmetry group extended by a scaling group, which gives a deep understanding on the physical properties together with the link to the underlying conservation laws.	**12:10** **J.Y. Zhong** (*China*). **Low-beta magnetic reconnection experiments driven by intense lasers** [Invited] The Sun is not so quiet as it looks. Solar flares, coronal mass ejections and solar wind strongly influence interplanetary and terrestrial space by virtue of shock waves, hard electromagnetic radiation and accelerated particles. It is very important to understand space weather and develop effective tools for space weather simulation and prediction to protect the performance and reliability of space borne and ground-based technological systems. It is believed that the coupling between the solar wind and the magnetosphere is mediated and controlled by the magnetic fields in the solar wind through the process of magnetic reconnection, which is considered to be an important mechanism of explosively transferring energy from magnetic fields to plasma flows and heat. In addition to (expensive) spacecraft, we show that the plasma reconnection process can also be studied by appropriately scaled lab experiments, in which large-scale space plasmas are scaled to (relatively low cost) small lab plasmas; these experiments also offer significant and flexible control over the conditions of reconnection.	
13:00 **C.M. Khalique** (*South Africa*). **Lie group analysis and conservation laws of the Zoomeron equation** [Invited] In this talk, we study the (2 + 1)-dimensional Zoomeron equation which is an extension of the well-known (1 + 1)-dimensional Zoomeron equation that has been studied extensively in the literature. We determine the classical Lie point symmetries admitted by the equation and compute an optimal system of one-dimensional subalgebras. Based on this optimal system, we obtain symmetry reductions and new group-invariant solutions. Furthermore we construct the conservation laws of the underlying equation using the multiplier method**.**	**12:30** **A. Maksimchuk** (*USA*), A. Raymond, C.F. Dong, A. McKelvey, C. Zulick, N. Alexander, A. Bhattachajee, P.T. Campbell, H. Chen, V. Chvykov, E. Del Rio, P. Fitzsimmons, W. Fox, B.X. Hou, C. Mileham, J. Nees, P.M. Nilson, C. Stoekl, A.G.R. Thomas, M.S. Wei, V. Yanovsky, L. Willingale, and K. Krushelnick. **Relativistic magnetic reconnection driven by high intensity lasers** [Invited] Magnetic reconnection is a fundamental plasma process involving a conversion of magnetic energy into plasma kinetic energy and plasma heating through changes in the magnetic field topology. Such events are widespread in astrophysics, space and laboratory plasmas. Here we present experimental studies using the OMEGA EP laser at the Laboratory for Laser Energetics and the HERCULES laser at the University of Michigan as well as numerical modeling which indicate that relativistic magnetic reconnection can be driven by two short-pulse, high-intensity laser pulses that produce relativistic plasma along with very strong magnetic fields. Evidence of magnetic reconnection in midplane diffusion region was identified by the plasma's X-ray emission patterns, changes to the electron energy spectrum, and by measuring the time over which reconnection occurs.	

HALL A

Nonlinear Dynamics and Complexity	**Lasers with High Peak and High Average Power & LaB**	Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
Chimeras	**Applications for ultimate lasers**	**Atmosphere electrodynamics – 3**
17:00 **V.S. Anishchenko** (*Russia*), N.I. Semenova, and G.I. Strelkova. **Dynamical and statistical characteristics of different chimera structures in networks of nonlocally coupled oscillators** [Invited] We explore the bifurcation transition from coherence to incoherence in ensembles of nonlocally coupled chaotic systems. It is firstly shown that two types of chimera states, namely, amplitude and phase chimeras, can be found in a network of coupled logistic maps. We reveal a bifurcation mechanism by analyzing the evolution of space-time profiles and the coupling function with varying coupling coefficient and formulate the necessary and sufficient conditions for realizing the chimera states in the ensemble. The regularities are established for the evolution of cross-correlations of oscillations in the network elements at the bifurcations related to the coupling strength variation. We reveal the distinctive features of cross-correlations for phase and amplitude chimera states.	**17:00** **Ch. Simon-Boisson** (*France*). **TBA** [Invited]	**17:00** **E.A. Mareev** (*Russia*). **On the energy of lightning flashes and distribution of thunderstorm activity over the globe** The talk is devoted to the unsolved issues of lightning energy and parametrization of thunderstorm activity in weather and climate models. The main attention is paid to the physical processes and mechanisms that determine the statistical distributions of lightning flashes in current and energy, as well as the distribution of lightning activity over the globe. The problem of lightning with extreme parameters and their connection with the most intense meteorological phenomena and forest fires is also considered.
17:30 **A. Gjurchinovski** (*Macedonia*), E. Schöll, and A. Zakharova. **Amplitude death and chimera patterns in complex networks with time delays** [Invited] We study the conditions of amplitude death in a network of delay-coupled limit cycle oscillators with time-varying delay coupling. By generalizing the master stability function formalism, we analyze the amplitude death regimes in a ring and a multiplex network of Stuart-Landau oscillators. We further investigate the influence of time delay (constant, time-varying, or distributed) on the dynamical regimes and the lifetime of amplitude chimera states in the case when coupling breaks the rotational S^1 symmetry. We demonstrate that the lifetime of amplitude chimeras and related incoherent states can be deliberately reduced or increased, depending upon the type of coupling delay.	**17:20** **Sh. Tokita** (*Japan*)**,** K. Teramoto, T. Terao, Sh. Inoue, R. Yasuhara, T. Nagashima, M. Hashida, J. Kawanaka, N. Miyanaga, and Sh. Sakabe. **Generation of strong terahertz surface waves on metal wires by relativistic-intensity laser pulses** [Invited] We report an efficient method for strong terahertz surface wave generation by relativistic-intensity ($>10^{18}$ W/cm^2) laser pulses. Ultrafast field propagation along a metal wire driven by a femtosecond laser pulse with a relativistic intensity is characterized by femtosecond electron deflectometry and electro-optic sampling. We found that the field propagating at the speed of light is a half-cycle transverse-magnetic surface wave excited on the wire and a considerable portion of the kinetic energy of laser-produced fast electrons can be transferred to the surface wave.	**17:30** **M. Chen** (*China*), M.K. Chan, S. Cai, and Y. Du. **Macroscopic physical models for lightning leaders and return strokes** [Invited] Cloud-to-ground lightning includes downward flashes and upward flash. A downward flash usually starts in clouds with a downward-going leader followed by a return stroke. An upward flash usually starts from a tall grounded structure with an upward-going leader followed by one or more downward leader/return stroke processes. It is the leader process that determines the path of the return stroke. In the following, we firstly present a macroscopic physical model for upward leaders from tall grounded structures and then a leader-return stroke coupled model for return stroke current and electromagnetic field calculations.

HALL B	HALL A	HALL C
Chimeras	**Applications for ultimate lasers**	**Atmosphere electrodynamics – 3**
18:00 **Z.G. Nicolaou** (*USA*), H. Riecke, and A.E. Motter. **Chimera states in continuous media** [Invited] The defining property of chimera states is the coexistence of coherent and incoherent domains in symmetric coupled systems. The recent realization that such states might be common in oscillator networks raises the question of whether an analogous phenomenon can occur in continuous media. Using the complex Ginzburg-Landau equation as a model system, we characterize continuous chimera states consisting of a coherent domain of a frozen spiral structure and an incoherent domain of amplitude turbulence. In contrast with discrete network systems, fluctuations in the local coupling field here play a crucial role in limiting the coherent regions.	**17:40** **M. Nakatsutsumi** (*Germany*), T. Toncian, G. Priebe, K. Appel, C. Baehtz, B. Chen, S. Göde, Z. Konopkova, M. Makita, A. Schmidt, K. Sukharnikov, I. Thorpe, A. Pelka, M. Lederer, T.E. Cowan, and U. Zastrau. **Integrating the high-energy and high-intensity lasers for the HED instrument at the European XFEL** [Invited] The High Energy Density Science (HED) instrument at the European X-ray Free-Electron Laser Facility is dedicated to the investigation of a wide range of materials at extreme conditions of pressure, temperature, ionization or electro-magnetic field. Several separate optical laser systems (~5 J / 25 fs, ~100 J / ns, ~2 mJ / 15 fs and ~45 mJ / 1 ps) will be available for warm- to hot-dense-matter creation, dynamic compression, relativistic laser-plasma interaction and more.	**18:00** **F.A. Kuterin** (*Russia*), A.A. Syssoev, and D.I. Iudin. **The main negative leader tip and space stems numerical modeling** Due to vigorous streamer development, various regions along the negative streamer tracks are heated and retain excess positive space charge. These regions are called space stems. The appearances of the stems in both laboratory discharge and lightning are successfully documented, but its origin remains still enigmatic. We consider the space stems appearance as a nonequilibrium kinetic transition provided by an external driving, the intensity of which is controlled by leader current.
18:30 **G.I. Strelkova** (*Russia*), N.I. Semenova, and V.S. Anishchenko. **Effect of switchings between chimera states in an ensemble of coupled chaotic maps** We study numerically the dynamics of a network of nonlocally coupled Henon maps. Temporal random switchings between amplitude and phase chimera states were investigated for the first time. It is shown that in the autonomous ensemble, a nonstationary switching process has a finite lifetime and is a transient towards the stationary regime of phase chimera. By applying short-term noise perturbations the lifetime of the switching regime can be increased to infinity.	**18:00** **A. Yogo** (*Japan*), K. Mima, N. Iwata, S. Tosaki, A. Morace, Y. Arikawa, S. Fujioka, H. Nishimura, Y. Sentoku, T. Johzaki, K. Matsuo, N. Kamitsukasa, S. Kojima, H. Nagatomo, M. Nakai, H. Shiraga, M. Murakami, S. Tokita, J. Kawanaka, N. Miyanaga, K. Yamanoi, T. Norimatsu, A. Sagisaka, S.V. Bulanov, H. Sakagami, K. Kondo, and H. Azechi. **Laser-ion acceleration boosted by multi-picosecond pulses** [Invited] We demonstrate that high-contrast multi-picosecond pulses are advantageous for proton acceleration. By extending the pulse duration from 1.5 to 6 ps with fixed laser intensity of 10^{18} Wcm^{-2}, the maximum proton energy is improved more than twice (from 13 to 33 MeV). The proton energies observed are discussed using a plasma expansion model newly developed that takes the electron temperature evolution beyond the ponderomotive energy in the over picoseconds interaction into account.	**18:30** **A. Chilingarian** *(Armenia)*. **Enhanced particle fluxes during the decay stage of Aragats thunderstorms** The bulk information on particle fluxes correlated with thunderstorm can be used to better understand the electrical structure of thunderclouds. The only very specific electric configuration of the lower part of the cloud can support the sustainable acceleration of the electrons. Our analysis is based on the thunderstorm data from the Aragats Mountain in Armenia, 3200 m above sea level Varieties of particle detectors located at Aragats Space Environmental Center are registering neutral and charged particle fluxes correlated with thunderstorms, so-called Thunderstorm Ground Enhancements (TGEs). In the present paper, we relate particle fluxes to the electrical structure of thunderclouds, namely, to an end-of- storm oscillation (EOSO) during the storm's decay phase.
19:00 **A. Zakharova** (*Germany*). **Chimera states in multiplex networks** We investigate the occurrence of coherence-incoherence patterns in multiplex networks where the nodes are distributed in different layers according to the type of the relation they share. For instance, in the case of a neuronal network the neurons can form different layers depending on their connectivity through a chemical link or by an ionic channel. The prime objective of multiplex networks is to study multiple levels of interactions where functions of one layer get affected by the properties of other layers. In the present work we particularly aim to understand the interplay of multiplexity and communication delay on emergence of chimera state in which the system splits into coexisting domains of spatially coherent	**18:20** **S. Ter-Avetisyan** (*Hungary*). **Perspectives of ion acceleration with PW-ultrashort laser pulse** [Invited] This presentation will discuss the ion acceleration obtained on 1.5 PW laser and different issuers connected with ion source and beam properties. The newly found scenario of ion acceleration offers more favorable proton energy scaling with laser intensity than it is known for an "ordinary" so-called TNSA regime. Another challenge is the laser beam back reflection from interaction region, which was measured to be of the order of 1% of laser energy. Our findings pave a way to achieving an ion source and desired beam parameters and they encourage further activities for optimisation of laser plasma-based accelerators.	**19:00** **A.A. Bulatov** (*Russia*), A.A. Syssoev, S.S. Davydenko, and D.I. Iudin. **Bidirectional leader development numerical simulation** An advanced 3D numerical model of lightning bidirectional leader initiation and development is presented. The key features of the model include probabilistic branching, streamer-to-leader transition, bidirectional propagation, non-zero internal electric field, simultaneous growth of multiple branches, physical timing, and, for the first time, probabilistic propagation field threshold and channel decay. Also, the proposed model takes into account the differences between initiation and propagation fields of positive and negative streamer discharges.

(synchronized) and incoherent (desynchronized) dynamics. Focusing on a multiplex network of nonlocally coupled identical chaotic maps with delayed interactions we show that the interplay of delay and multiplexing results in an enhanced or suppressed appearance of the chimera state. Additionally, we report a layer chimera state where one layer exhibits coherent and another layer incoherent dynamical evolution.		
	18:40 **A. Soloviev** (*Russia*), K. Burdonov, S.N. Chen, A. Eremeev, S. Pikuz, G.V. Pokrovskiy, T.A. Pikuz, G. Revet, A. Sladkov, V. Ginzburg, E. Khazanov, A. Kuzmin, D.K. Batheja, S. Mironov, R. Osmanov, I. Shaykin, A. Shaykin, I. Yakovlev, M. Starodubtsev, and J. Fuchs. **Laser driven ion acceleration at PEARL laser facility** The talk represents experimental investigation of interaction between femtosecond sub-PW laser pulse from PEARL laser facility and plasmas. The experimentally realized conditions are close to the optimal in terms of effective laser energy deposition into the solid target leading to NTSA proton beams accelerated up to 43 MeV cut-off energy. The characterization of the interaction parameters is achieved by combining of X-ray spectrometry and proton spectra measurements, complimented by detailed laser prepulse characterization. The ways to improve the cut-off energy for the laser driven protons are considered as well as application perspectives.	
	18:55 **J. Fuchs** (*France*). **Horizons of science, driven by super-power lasers** [Invited] During this presentation, I will discuss both the enormous progress that has been made since the inception of the laser with respect to its parameters and its capacity to deliver the highest concentration of energy in time and space, the highest ever achieved by man, but also the vast possibilities this has opened in terms of applications whether in science and progress of our fundamental knowledge of matter and the Universe, or for society at large, in energy, or medicine.	

Nonlinear Dynamics and Complexity	Lasers with High Peak and High Average Power & LaB	Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
	LaB - 5	
	20:30 **D. Kumar** (*Czech Republic*)**,** S. Singh, H. Ahmed, R. Dudzak, J. Dostal, T. Chodukowski, L. Giuffrida, P. Hadjisolomu, T. Hodge, J. Hrebicek, L. Juha, Z. Kalinowska, E. Krousky, M. Krus, P. Lutoslawski, M. De Marco, M. Pfeifer, J. Skala, J. Ullschmeid, T. Pisarczyk, M. Borghesi, and S. Kar. **Generation of sub-MG quasi-stationary magnetic field using cm scale capacitor-coil targets** [Invited] A controlled and strong magnetic field is extremely useful in various laser plasma experiments with applications to fast ignition, laboratory astrophysics and charged particle beam lensing. Mega Gauss (MG) level quasi-stationary fields for such applications can be created by the interaction of a kJ-ns class laser with a capacitor-coil target. On a recent experiment at the Prague Asterix Laser (PALS) facility, cm scale macroscopic capacitor-coil targets were used to achieve fields up to 0.3 MG. The fields were diagnosed using polarimetry at two different wavelengths.	
	20:50 **M.P. Read** (*UK*), C.P. Ridgers, J.J. Bissell, and R.J. Kingham. **Beam self-focusing and electron transport effects in magnetised laser-plasmas** [Invited] Strong magnetic fields can beneficially affect electron transport in under-dense laser-plasma interactions relevant to laboratory HEDP applications. For example, externally applied B-fields have been used to control low density plasma wave-guide formation, to improve laser coupling to gas-filled hohlraums, and will affect laser pre-heating in the MagLIF scheme. Changes to electron transport under magnetised conditions cause heat-flow suppression across field lines but phenomena such as the Nernst effect can also lead to changes in B-field dynamics which must be accounted for.	
	21:20 **K.M. Schoeffler** (*Portugal*), N.F. Loureiro, and L.O. Silva. **Kinetic solution for the generation of magnetic fields via the Biermann battery** [Invited] Fully kinetic analytic calculations of an initially Maxwellian distribution with arbitrary density and temperature gradients exhibit the development of temperature anisotropies and magnetic field growth associated with the Biermann battery. The calculation, performed by taking a small order expansion of the ratio of the Debye length to the gradient scale, predicts anisotropies and magnetic fields as a function of space given an arbitrary temperature and density profile. These predictions are shown to	

	qualitatively match the values measured from particle-in-cell simulations, where the development of the Weibel instability occurs at the same location and with a wavenumber aligned with the predicted temperature anisotropy.	
	21:30 A. Soloviev, K. Burdonov, S.N. Chen, A. Eremeev, G. Revet, S. Pikuz, E. Filippov, M. Cerchez, T. Gangly, A. Sladkov, A. Korzhimanov, V. Ginzburg, E. Khazanov, A. Kochetkov, A. Kuzmin, I. Shaykin, A. Shaykin, I. Yakovlev, **M. Starodubtsev** (*Russia*), and J. Fuchs. **Laboratory investigation of laser plasma expansion across the ambient magnetic field** [Invited] We present the results of laboratory and numerical studies of magneto-hydrodynamic interaction of high-velocity streams of dense, highly-conductive plasma with an ambient magnetic field. Such processes take place in numerous astrophysical systems, as accreting compact stars, hot Jupiters etc. The main attention has been paid to the processes developing when the plasma flow expands across the ambient magnetic field. It has been shown that in the region where the pressure of the magnetic field is of the order of the gas dynamic pressure, a Rayleigh–Taylor instability modifies the flow's dynamics forming narrow tongs of supersonic plasma flows penetrating deeply into the magnetic field.	

Nonlinear Dynamics and Complexity	Lasers with High Peak and High Average Power & LaB	Nonlinear Phenomena in the Atmosphere and Ocean
HALL B	**HALL A**	**HALL C**
Neural networks - 2	**LaB - 6**	**Atmosphere and ocean dynamics – 2**
11:00 M. Masoliver and **C. Masoller** (*Spain*). **Subthreshold signal encoding and transmission in coupled FitzHugh-Nagumo neurons** [Invited] We study two coupled neurons using the FitzHugh-Nagumo model. We analyze how mutual coupling affects the detection and transmission of a periodic, subthreshold signal that is applied to only one of the neurons. Recent work has shown that, in a single neuron, the interplay of noise and modulation induces temporal ordering in the spike sequence. We analyze under which conditions the coupling to a second neuron further enhances the temporal order of the spikes of the first neuron, improving signal encoding. We also study which conditions enhance temporal order in the spikes of the second neuron, improving signal transmission.	**11:00** **L. Chen** (*UK*). **Magnetic field amplification and particle acceleration in laboratory astrophysics** [Invited] Cosmic rays have fascinated scientists for more than a century. One possibility is that cosmic rays are accelerated to such high energies through the process of Fermi acceleration, where particles gain energy by scattering off of magnetic field turbulence. The generation and amplification of magnetic fields is thus a crucial step in the understanding of cosmic ray acceleration. The standard model for the amplification of magnetic fields is via the stochastic tangling of small seed fields (either generated by plasma or primordial processes) – the turbulent dynamo mechanism. In this talk we will discuss the basic theory behind turbulent dynamo and its connection with particle acceleration in astrophysical environments. We will also discuss novel laboratory experiments that may help to shed lights in the understanding of these complex processes. The relatively new field of laboratory astrophysics aims at bringing together teams from around the world using the largest most powerful lasers in the world to create scaled astrophysical environments to look into magnetic field amplification and particle acceleration by turbulence.	**11:00** **F. Qiao** (*China*), Y. Yuan, C. Huang, D. Dai, J. Deng, and Z. Song. **Wave turbulence interaction induced vertical mixing and its effects in ocean and climate models** [Invited] Heated from above, the oceans are stably stratified. Therefore, the performance of the general ocean circulation and climate studies through coupled atmosphere-ocean models depend critically on vertical mixing of energy and momentum in the water column. The surface wave, as its spatial scale is too far from that of ocean circulation, is treated as a separate stream from ocean circulation. As a result, oceanic general circulation models (OGCMs) face common problems, including too high simulated sea surface temperature, too cold subsurface temperature and too shallow mixed layer depth especially in summer time, all indicating lack of vertical mixing in OGCMs.
11:30 **U. Feudel** (*Germany*), G. Ansmann, and K. Lehnertz. **Self-induced switchings between multiple space–time patterns on complex networks of excitable units** [Invited] We report on self-induced switchings between multiple distinct space–time patterns in the dynamics of a spatially extended excitable system. These switchings between low-amplitude oscillations, nonlinear waves, and extreme events strongly resemble a random process, although the system is deterministic. We show that a chaotic saddle—which contains all the patterns as well as channel-like structures that mediate the transitions between them—is the backbone of such a pattern switching dynamics.	**11:20** **A.A. Andreev** (*Russia*) and Z. Lech. **Generation and detection of super-strong magnetic fields by ultra-intense laser pulses** [Invited] Magnetic fields are one of the fundamental entities which influence nature on all scales. Developments of laser technology stimulated exploration of methods for generating large magnetic fields from laser pulses directly or via interaction with plasma or solid targets. The generation of high amplitude solenoidal fields described in this presentation is based on the interaction of a screw-shaped laser pulse interacting with an under-dense plasma. This interaction creates a multi-gigaGauss magnetic field within a volume of 10s μm transverse dimensions, depending on the plasma density and laser pulse parameters. The detection of strong magnetic fields by laser accelerated particles is considered.	**11:30** **C. Guan** (*China*) and D. Zhu. **Numerical investigations of wave-induced mixing in upper ocean layer** [Invited] The General Ocean Turbulence Model is employed to investigate the effects of the three mechanisms concerning wave-induced mixing. The numerical investigation is carried out for three turbulence closure schemes with the observational data from OSC Papa station and wave data from ECMWF. The mixing enhancement by various waved-induced mixing mechanisms is investigated and verified.

12:00
S. Morfu, M. Bordet, M. Rossé, and **J.M. Bilbault** (*France*).
Impact of perturbations on neuron response [Invited]
We propose an overview of the effects of deterministic and stochastic perturbations on the response of a neuron. Our study is based on numerical simulations and experiments with an elementary neural circuit. We use different excitations to highlight various phenomena such as Mode locking, Vibrational Resonance, Ghost Stochastic Resonance... We close the study with a lattice of coupled circuit.

11:40
Ph. Korneev (*Russia*), E. d'Humieres, V. Tikhonchuk, and T. Pisarczyk.
Laser-plasma magnetization for laboratory astrophysics [Invited]
Spontaneous plasma magnetization is a common process in laser-plasma interaction. The magnetic field amplitudes depend on laser intensity, and may reach kilotesla and even higher level in relativistic regime. One of the most interesting features of these fields is that they can be "frozen" inside the laser-generated plasmas, hot, low collisional, or even relativistic and collisionless. This property makes such plasmas very attractive for studies of astrophysical-related laboratory studies. Here, we present some possibilities to facilitate the generation of the magnetized collisionless plasmas with controllable magnetization.

12:00
I. Kamenkovich (*USA*), M. Rudko, and I. Rypina.
Dynamics and transport characteristics of zonally elongated transients in the ocean [Invited]
Oceanic flows with mesoscale eddies (length scale of 10–100 km) contain zonally-elongated large-scale transients (ZELTs) that can be detected in pressure anomalies as a spectral peak corresponding to long zonal and short meridional length scales, or as leading Empirical Orthogonal Functions. These patterns are generated and maintained by transient nonlinear forcing, associated with mesoscale eddies, and are, therefore, nonlinear phenomena. ZELTs play a key role in anisotropic material transport and in large-scale tracer distributions.

12:30
M. Courbage (*France*), L. Mangin, and F. Rozi.
Respiratory neural network: activity, connectivity and synchronization [Invited]
Chaos in the rhythmic activity is a major issue that has been discussed in many studies of neuro-science and physiology, and especially in the respiratory air flow. Here, we present the results of two studies concerning the activity and the connectivity of the respiratory neural network in healthy humans and patients with obstructive lung disease. Our results show an increase in the dynamic chaos of airway flow in patients, focusing on expiratory flow.

12:00
I.F. Shaikhislamov (*Russia*), Yu.P. Zakharov, V.G. Posukh, A.V. Melekhov, and A.G. Ponomarenko.
Collisionless super-Alfvenic interaction and generation of large amplitude pre-shock magnetosonic wave in laser plasma experiment [Invited]
We report the experiment on generation of strong super-Alfvénic magnetosonic perturbation by laser-produced plasma expanding in magnetized background under conditions when the magnetic cavity size reaches the ion gyroradius. Detailed measurements of plasma density and velocity, electric and magnetic fields are presented which demonstrate strong magnetic compression at the front and cavity dynamics, laser plasma deceleration and formation, with record efficiency of energy transfer 25%, of strong non-linear magnetosonic wave propagating through background plasma.

12:30
J. Li (*China*), A.L. Kohout, H.H. Shen, and C. Guan.
Effect of nonlinear wave-wave interaction on apparent wave attenuation in ice covered seas
Studies of wave propagation in ice covered seas have become increasingly more important due to the rapid reduction of sea ice in the Arctic Ocean. However, in some cases, it is still problematic to interpret the behaviors of measured apparent wave attenuation only with current wave-ice models. Inspired by previous speculation, the effect of nonlinear four-wave interactions on apparent wave damping during a field observation in marginal Antarctic is tested with discrete interaction approximation. The results show that the nonlinear wave-wave interaction does offset wave damping during stormy cases and for short waves in ice covered waters.

13:00
O.V. Maslennikov (*Russia*), I. Franović, and V.I. Nekorkin.
Mean-field model for a network of globally coupled stochastic map-based neurons
We analyze the emergent regimes and the stimulus-response relationship of a population of stochastic spiking neurons modeled by discrete-time systems by means of a mean-field (MF) model, derived within the framework of cumulant approach complemented by the Gaussian closure hypothesis. It is demonstrated that the MF model can qualitatively account for stability and bifurcations of the exact system, capturing all the generic forms of collective behavior, including macroscopic excitability, subthreshold oscillations, periodic or chaotic spiking, and chaotic bursting dynamics. Apart from qualitative analogies, we find a substantial quantitative agreement between the exact and the approximate system, as reflected in matching of the parameter domains admitting the different dynamical regimes, as well as the characteristic properties of the associated time series. The effective model is further shown to reproduce with sufficient accuracy the phase response curves of the exact system and the assembly's response to external stimulation of finite amplitude and duration.

12:20
S. Sakata (*Japan*), S. Lee, H. Sawada, Y. Iwasa, H. Morita, K. Matsuo, K.F.F. Law, T. Johzaki, H. Nagatomo, Y. Sentoku, A. Sunahara, A. Yao, Y. Arikawa, M. Hata, S. Kojima, Y. Abe, H. Kishimoto, K. Kanbayashi, A. Yogo, A. Morace, H. Sakagami, T. Ozaki, K. Yamanoi, T. Norimatsu, T. Shimizu, Y. Nakata, J. Kawanaka, S. Tokita, N. Miyanaga, M. Murakami, M. Nakai, H. Shiraga, H. Nishimura, K. Mima, H. Azechi, and S. Fujioka.
First experimental demonstration of isochoric heating of a dense plasma core with assistance of external kilo-Tesla magnetic field [Invited]
We have demonstrated efficient heating of a compressed plasma by relativistic electron beams produced by LFEX laser with the assistance of external magnetic field. Emission from Cu tracer atoms contained in the compressed plasma was measured to infer the plasma temperature and the energy coupling efficiency from heating laser to core plasma. Li-like and He-like emission lines, which appeared only with assistance of the external magnetic field, suggest that the electron temperature was ~1.7 keV and density ~ 6 g/cc.

13:00
S.V. Shagalov (*Russia*) and G.V. Rybushkina.
Weakly supercritical dynamics of Rossby wave packets in barotropically unstable zonal JET flows
This study explores the supercritical dynamics of Rossby wave packets comprised of unstable barotropic and baroclinic normal modes feeding on the common critical layers (CL) of a stratified barotropically unstable zonal jet flow. Nonlinear generation mechanisms of slowly modulated wave-trains and CL potential vorticity patterns are examined for the regimes of weakly nonlinear and strongly nonlinear dissipative CL.

HALL B	HALL A	HALL C
	LaB – 6	
	12:40 **Q. Moreno** (*France*), M.E. Dieckmann, X. Ribeyre, S. Jequier, V.T. Tikhonchuk, L. Gremillet, and E. d'Humières. **PIC simulations for the study of collisionless shocks formation in laboratory astrophysics context** [Invited] Laboratory experiments are proposed to investigate collisionless shock formation in the interstellar medium. These shocks are driven by different particle instabilities, which create a strong electromagnetic field, allowing the acceleration of particles. Modeled with particle-in-cell simulations the shocks are created by the collision of two electron-ion clouds at a velocity that exceeds everywhere the threshold velocity for shock formation in a external magnetic field oriented perpendicularly/parallel to their flow velocity vectors, a setup that can accelerate the shock formation process (magnetic field perpendicular) or promotes particles acceleration (magnetic field parallel). Shock formation is a long process, and PIC simulations are very costly in numerical resources and time for such long studies. For these reasons the ion mass is thus reduced below 1836 electron masses, which can affect the plasma dynamics during the initial exponential growth phase of the instabilities and during the subsequent nonlinear saturation. One part of this study is dedicated to assess how far the ion to electron mass ratio can be decreased,without changing qualitatively the physics and the second is the presentation of 2D simulations of shock formation with experimental parameters using a reduced ion mass.	
	13:00 **V.M. Gubchenko** (*Russia*)**.** **On kinetic approach to magnetic reconnection: from space to laser HED plasma** [Invited] Ideas of the magnetic reconnection (MR) first appeared in space physics, later in astrophysics as an explanation of the initial magnetic structure reconfiguration in a selfconsistent way due to some dissipation effects near weakly magnetized regions. Firstly, MR was treated in terms of nonideal MHD developed up to the level of application of the electron MHD dealing finally with temperature anisotropic plasma. Secondly, at the beginning with growing space probes power it was clear that the kinetic approach operating with the shape of the particle VDF (velocity distribution function) and in terms of the Vlasov equation is more adequate for the MR reality by providing the solar corona structuring and heating and for magnetosphere formation by solar wind flow. The argument is that plasma is collisionless and very hot but relatively slowly moving, which provides strong dissipative effects due to “resonant” electron acceleration.	

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Leading scientist – Julien Fuchs

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Leading scientist – Juergen Kurths

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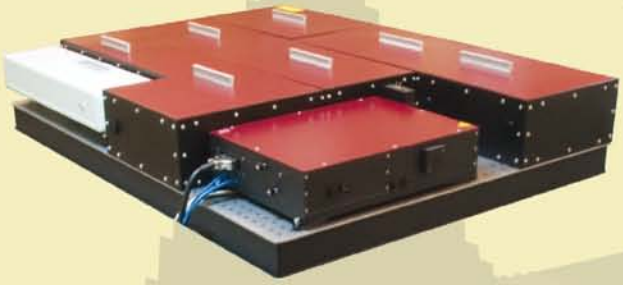

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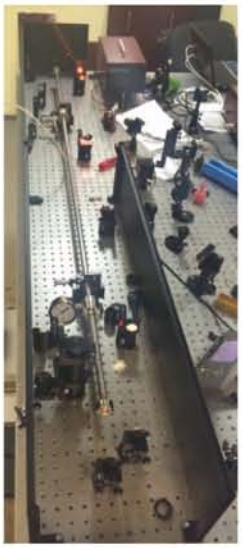

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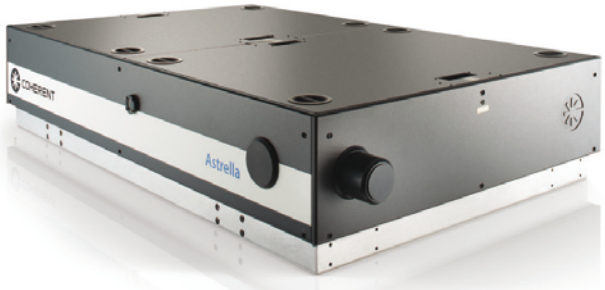

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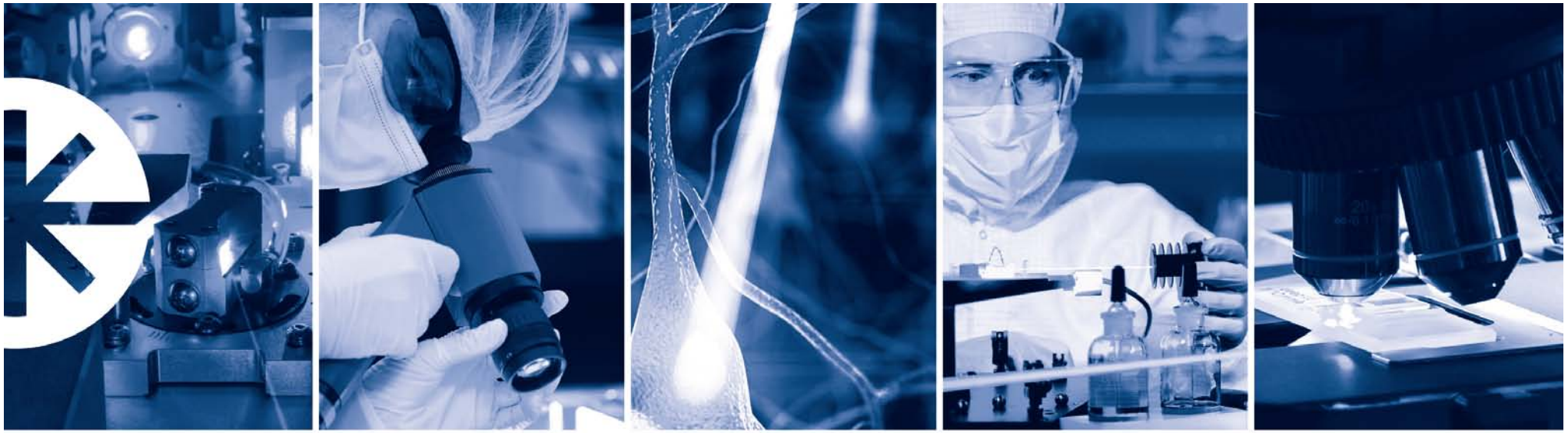

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Important advantages of the company are: many years of experience in the Russian market, an international team of professionals, the ability to control the quality of products at manufacturers, experience with purchasing procedures on electronic trading platforms (FL 223 and FL 44), as well as work on individual accounts within the framework of execution of state contracts (FL 159 and FL 275).

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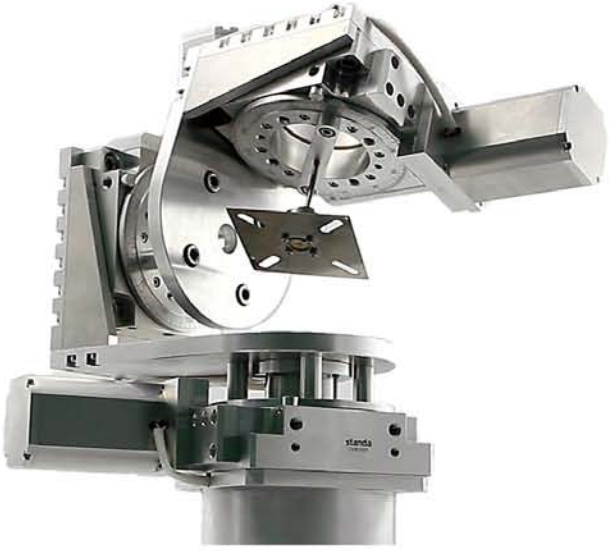

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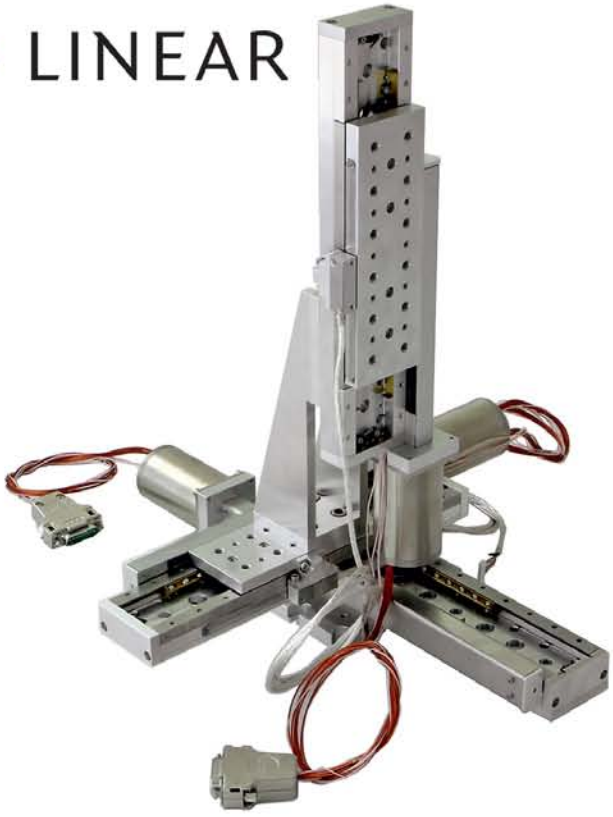

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NOTES

Moscow University. View from the Moskva river

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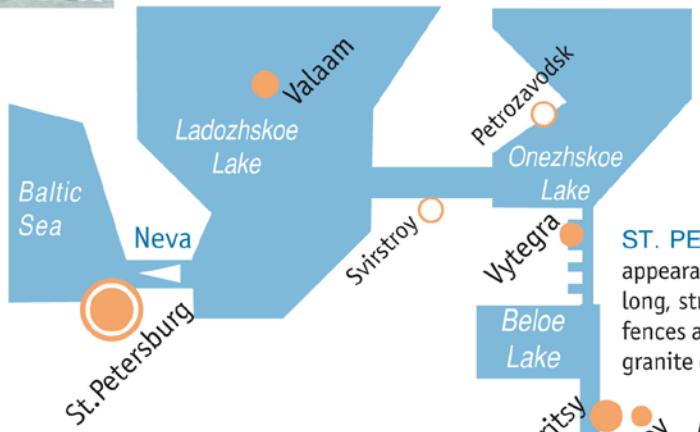
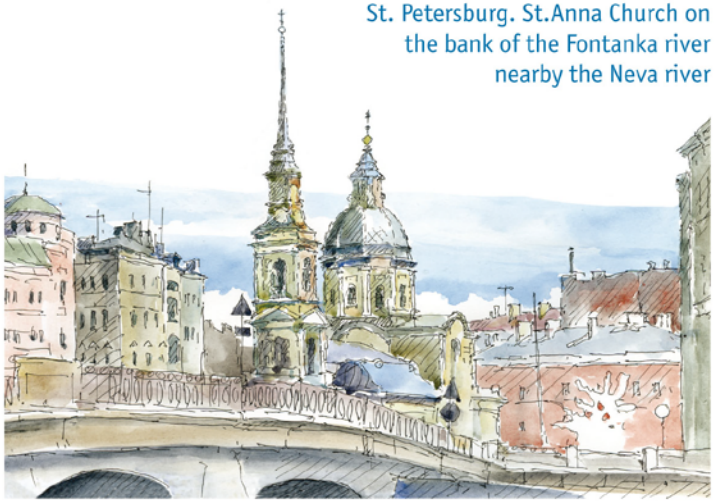


St. Petersburg. St.Anna Church on the bank of the Fontanka river nearby the Neva river



MOSCOW was founded in 1147 by *Prince Yuri Dolgorukiy*. The historical heart of the capital is the ensemble of the Kremlin with the *Armory Chamber*, a treasury of Russian tsars. One can see murals by the world-famous painter *Andrei* Rublev in *the Annunciation Cathedral* of the Kremlin. *The Tsar Cannon* and *Tsar Bell* are unique masterpieces of the Old Russian foundry art.

Moscow, with its popluation of about 12 million people, is multifaced. Its iconic images include *the Red Square, the Spasskaya Tower* with its famous carillon, *St. Basil's Cathedral*, skyscrapers built in the 1930s, and many others. As you walk along *Tverskoy Boulevard, Stoleshnikov Lane, Great Nikitskaya Street*, and *Arbat*, you can feel the living breath of Moscow history.

The streets and lanes of *Zaryadye* and *Zamoskvorechye* have preserved ancient temples, strip malls, and merchant's estates. Moscow has more than a hundred museums. The *State Tretyakov Gallery* and *Pushkin Art Museum* are the richest art collections. The capital has more than thirty professional theaters, including *Bolshoy* with its celebrated Russian ballet.

The wonders of Moscow include Ostankino television tower and Moscow Metro. Moscow is one of the largest scientific centers with tens of universities, R&D institutions, and laboratories.

Panorama of the Moscow Kremlin from the Moskva river

ST. PETERSBURG is one of the most beautiful cities in Europe. The majestic appearance of St. Petersburg is created by a variety of architectural details including long, straight boulevards, vast spaces, gardens and parks, decorative wrought-iron fences and sculptures. The Neva River itself, together with its many canals and their granite embankments and bridges, gives the city a unique and striking ambience.

The most famous of St. Petersburg's museums are *the Hermitage* and *the Russian Museum*. St. Petersburg has been known as the city of palaces. One of the earliest of these is the *Summer Palace*, a modest house built for Peter I in *the Summer Garden* (1710–1714). Much more imposing are the baroque residences of their associates, such as *the Kikin Hall* and *the Menshikov Palace* on the Neva Embankment designed by *Domenico Trezini* in 1710–1716. A residence adjacent to the Menshikov palace was redesigned for *Peter II* and now houses the state university. The most illustrious of imperial palaces is the baroque *Winter Palace* (1754–1762), a huge building with dazzlingly luxurious interiors, now housing *the Hermitage Museum*.

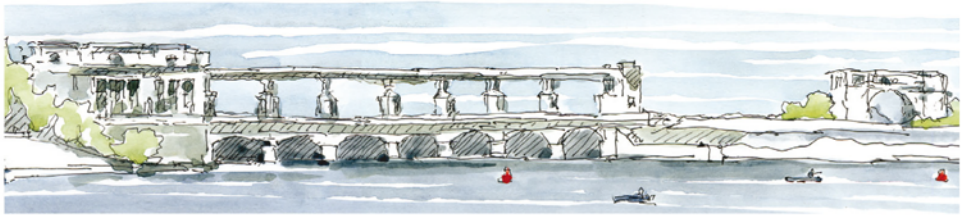
The largest church in the city is *St Isaac's Cathedral* (1818–1858), one of the biggest domed buildings in the world, constructed under supervision of *Auguste de Montferrand*. Another magnificent church in the Empire style is *the Kazan Cathedral* (1801–1811), situated in the Nevsky prospect. No tourist can miss *the Church of the Savior on Blood* (1883–1907), a gorgeous monument in the old Russian style which marks the spot of *Alexander II's* assassination. As *Peter the Great* forbade building onion domes, this church is exceptional in the city with its onion-shaped tower.

St Petersburg is surrounded by imperial residences: *Peterhof*, with *the Grand Peterhof Palace* and glorious fountain cascades; *Tsarskoe Selo* (Pushkin), with the baroque *Catherine Palace* and *the Alexander Palace* in classicist style; and *Pavlovsk*, which contains a domed palace of *Emperor Paul* and one of the largest English-style parks in Europe.

Uglich. Panorama from the Volga river

UGLICH the first records of which date back to 1148, is one of the most picturesque old Russian towns. The magnificent view from the Volga river includes an ensemble of 17th century churches, the Kremlin, trade rows, wooden houses. The most famous and dramatic event in the town's history took place at the end of the 16th century when *Tsarevich Dmitriy*, successor of the throne was allegedly murdered, which gave rise to the political crisis known as the Time of Troubles. In commemoration of Tsarevich Dmitriy a beautiful *church of St. Dmitry-on-Blood* was erected. The 17th-18th centuries was a time when wonderful architectural ensembles were constructed – *the monasteries of St. Alexius, Resurrection, Apparition of Christ*. By the middle of the 19th century the town was rebuilt according to the master-plan. Many buildings in the center of the town are preserved to the present day: the building of the Town Council, the fire tower, as well as some mansions.

Uglich. Dam and lock-gate



MYSHKIN. The site of the present-day Myshkin was inhabited already in the V-III centuries B.C. According to the reform of *Catherine II*, Myshkin got the status of town in 1777. Two cathedrals make the center of the town: *Nikolsky* and *Uspensky*, which was built in the first half of 19th century with the donations of Myshkin merchants.

But it is Mice that the town is famous for. It is the only town in the world that is named in the honor of Mouse.

Myshkin. Former public library

The world's only museum of Mouse boasts enormous collections of decorative mice. Thousands of tourists from all over the world visit the small mouse town every year to kneel before the great Mice.

Goritsy. Panorama from the water

Kirillo-Belozersky Monastery

KIRILLO-BELOZERSKY MONASTERY in the town of Kirillov on *Lake Siverskoye* is situated not far from GORITSY.

The monastery was founded by monk *Kirill Belozersky* at the end of the 14th century. The icons in *the Assumption Cathedral* date back to the 15th century, and the murals in the cathedral telling the story of the Virgin Mary's life, to the 17th century.

The Apocalypse murals in the porch that were painted at the same time are not less interesting. The magnificent ensemble of the monastery comprises *the Churches of Baptism of Our Saviour, of John the Baptist*, and of *the Archangel*, farmeries, fortress walls with high bartizans and two over-the-gate churches. The local museum has collections of manuscripts, ancient utensils, samples of wooden carving and traditional embroideries.

Located at the crossing of a waterway connecting central Russia with Lake Onega and a road connecting St. Petersburg with Arkhangelsk, VYTEGRA was once an important transit point for cargo. The idea to build a canal connecting the drainage basins of the Neva and the Volga rivers was already discussed by *Peter the Great*, but the canal, formerly the *Mariinsky System*, was only built in 1810.

In the 20th century, it was reconstructed and renamed *the Volga–Baltic Waterway*. The remains of *the Mariinsky System*, a few dwelling houses of the 19th century, *the Presentation Church* and *B440 Foxtrot-class submarine* are the main sites of interest in Vytegra.

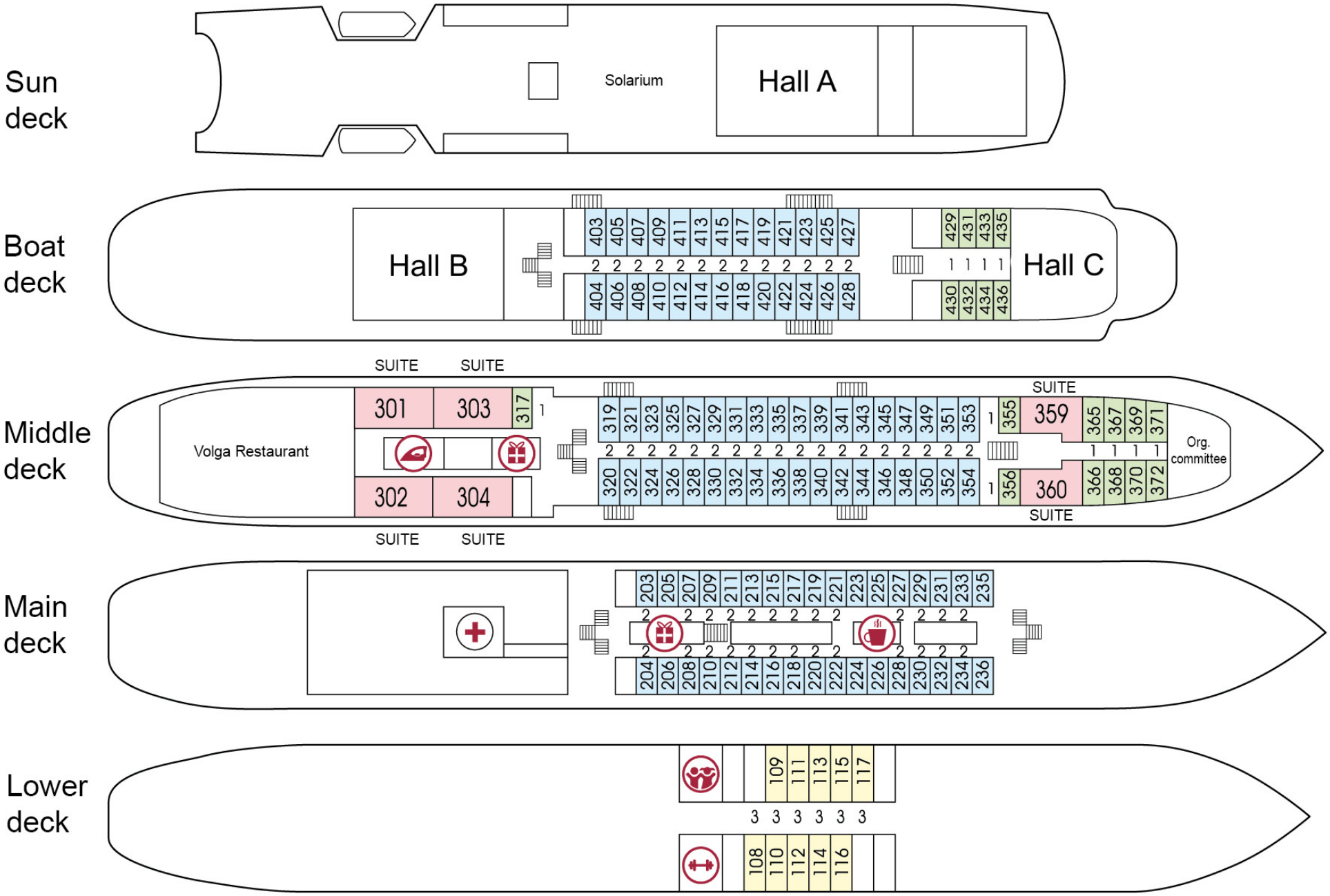
Valaam Monastery. Transfiguration Cathedral

VALAAM ARCHIPELAGO is staggeringly beautiful due to the fantastic maze of its coves, lakes, and rocks. The ancient *Valaam Monastery* is situated here; it was first mentioned in chronicles in the 10th century.

The Monastery was completely self-sufficient and monks produced all the necessary products themselves while working at small factories, sawmills and farms, constructing buildings. At the beginning of the 20th century the Valaam Monastery became one of the wealthiest Russian Monasteries, comprising a kind of a small state with 13 smaller monasteries under control.

During *the Second World War* the Archipelago was under control of Finland and returned back to the USSR in 1944. Since that time the Monastery was closed until 1989. Now it is functioning again. The monastery, hermits' huts, and chapels built in the Russian-Byzantine style are architectural masterpieces.

Vytegra. Submarine-museum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Solarium
Hall A
Boat deck
Hall B
Hall C
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429 431 433 435
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Middle deck
SUITE SUITE
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Volga Restaurant
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Org. committee
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Main deck
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Lower deck
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