Program of the conference

“Evolution of complexity and Statistical physics”

May 12-15 2025, Yerevan, AANL

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May 12, ANNL, 3-d floor

09:00 9:15 The greetings from the **Eugene Koonin, NIH**

09:15 9:20 The greetings **Rouben Aroutiounian, NAS Armenia**

9:20-10:00 **Evolution as a functional system,** Chairman**-V. Stepanyan**

9:20-10:00 **Nobuto Takeuchi**, Auckland University, NZ. Building by Losing: A Reductive-Constructive View of Black Queen Dynamics.

10:00-12:00 Stochastic thermodynamics for AI and evolution.

10:00-10:40 **Sosuke Ito**, Tokyo University. Thermodynamic bounds for generative diffusion models.

10:40-11:20 **M. Marsili ICTP,** Abstraction requires breadth: a renormalisation group approach.

11:20-12:00, **D. Saakian**, AANL. Stochastic thermodynamics of evolution.

12:00-12:15, **Coffee break**

12:15-14:35, **Autocatalytic Reaction networks,** Chairman**-V. Redko**

12:15-12:55, **Alexandr Bratus**, Russian University of Transport.

Evolutionary Dynamics of Interacting Autocatalytic Replicator Systems.

12:55-13:35 **Olivier Rivoire**, ESPCI. Evolution in simplicity: minimal physical models with evolutionary features.

13:55-14:35, **Shahin Rouhani**, Evolution of Complexity.

14:35-15:45 **Lunch**

15:45-17:45, Quantum complex systems, Chairman**-S. Rouhani**

15:45-16:25. **Igor Gornyi,** KIT. Manipulating quantum systems by looking at them: Measurement-induced steering and phase transitions.

16:25-17:05, **A. Allahverdyan,** AANL, Bosonic thermodynamics: Linear versus nonlinear interactions.

17:05-17:20 **Coffee Break**

17:20-18:00 The functional systems, Chairman **D. Saakian**

17:20-18:00, E. E. Vityaev, Создание сложности в сознании и поведении путем иерархии причинных связей.

18:00-19:20. Entropy, evolution and complexity growth, Chairman**-A. Allahverdyan**

18:00-18:45, **David Wolpert.** Santa Fe Insutute of Complex systems.
How Constraints Affect Evolution of Entropy - Strengthened Second Laws.

18:45-19:25, **Paul Davies,** Arizona University. Life, the Universe and Everything: Is There a Cosmic Principle of Increasing Complexity?

13 May, ANNL, 5-th floor

14:20-15:00,**Evolution algorithms in Chemistry, Chairman D. Saakian**

14:20-15:00, **Artem Oganov,** Skolkovo Institute of Science and Technology, Evolutionary crystal structure prediction and computational materials discovery

15:00-17:00, **AIN and evolution,** Chairman **A. Allahverdyan**

15:00-15:40 **Mikhail Burtsev**, London Institute for Mathematical Sciences. GENA-LM: a family of open-source foundational DNA language models for long sequences.

15: 40-16:20 **Red'ko V.G**, Scientific Research Institute for System Analysis of the National Research Centre "Kurchatov Institute", Moscow.

16:20-17:00, **Vitaly Vanchurin**, Artificial Neural Computing and Duluth Institute for Advanced Study.

Geometric Learning Dynamics.

17:00-17:10 **Cofee break**

17:10-19:10- Evolution, complexity and cancer, Chairman**-S. Babajanyan**

17:10-17:50 **E. Koonin**, NIH, Origin of complexity in the evolution of protein folds.

17:50-18:30, **San von der Dunk**, Oxford University, Natural protein structures have evolved exceptional robustness to mutations

18:30-19:10 **Kimberly Bussey**, Midwestern University, Testing the Predictions of the Atavism Theory of Cancer",

May 14,AANL, 5-th floor

8:00-9:00, **The Origin of life**,Chairman **D. Saakian**

8:00-9:00, **Stuart Kaufmann,** Institute for Systems Biology, Seattle,

The birth of life as a phase transition.

9:00-11:00 NN, **Master equation,** Chairman **A. Allahverdyan.**
9:00-9:40, Ashot **Chilingaarian,** AANL. Early AI-based data science studies in the Yerevan Physics Institute.

9:40-10:20 **Olga Rozanova**, Lomonosov Moscow State University.
Master equations for different free and constrained diffusion processes

10:20-11:00 **Theo Nieuwenhuizen**, Amsterdam University.

Hopfield model for patterns with internal structure

11:00-14:00 Break

14:00-14:40, **Virus evolution,** Chairman**- S. Babajanyan**

14:00-14:40 **Igor Ruzin**, Sechenov Institute, Antigenic evolution of viruses and the evolutionary implications of vaccination

14:40-16:00, **Growing-complexity**, Chairman**-D. Saakian**

14:40-15:20 **Jin Wang**, Stony Brooke University, Evolution from Biomolecules to Population Dynamics.

15:20-16:00 **Fernando Fontanari**, Sao Paulo University When Less is More: Evolutionary Dynamics of Deception in a Sender-Receiver Game.

16:00-16:15 **Cofee break**

16:15-18:15, Growing complexity, Chairman **Y. Mamasakhlisov**

16:15-16:55 **J. Ispolatov,** Univ. Santiago de Chili, The number of immune defense and counter-defense systems sustained in the arms race between prokaryotes and viruses.

16:55-17:35, **D. Saakian**, AANL, The multilevel Selection

17:35-18:15 **Tuan Pham Minh**, Amsterdam University, Robustness of living Systems under noisy environments

May 15, YSU, Faculty of physics, second floor

Complex adaptive systems and econophysics, Chairman**-Shahin Rouhani**

8:30-8:45 **Vlad Suvorov**, Error threshold for asymmetric recombination.

9:00-9:15 **Rozhin Mohamadkian**, Sharif University,TBA

9:15-9:30 **Hanie Hatami**, Sharif University, Crypto-Fiat Exchange Rates Network as indicator of macroeconomic dynamics

9:15-9:30 **Vardan Bardakchyan**, YSU-AANl, Bargaining via Weber's law

9:30-9:50, **Ali Hosseiny**, Shahid Beheshti University, Examining the Impact of Life-Cycle Saving Patterns on Aggregate Economic Variables and Labor Income Share

9:50-12:10,Armenian IT industry. Chairman**- Vahagn Poghosyan**

9:50-10:20,**Gevorg Martirosyan**, Blackmair,

10:20-10:50 **Hrant Manasyan**, Cifora,

10.50-11:20, **Davit Galoyan**, Davaro

11:40-12:10, Vahagn Poghosyan, Instigate

12:10-12:20 **Break**

12:20-13:50, Swarm Intelligence. Chairman**-Vahe Sargsyan**

12:20-12:50 **Astghik Hakobyan**, Center for Scientific Innovations and Education, Risk-restricted management of multiple UAVs

12:50-13:20, **Sevak Sargsyan**, RAU, TBA

13:20-13:50 **Sergey Abrahamyan**, Institute of informatics, NAS Armenia, An intelligent cloud platform for a swarm of self-organizing UAVs, involving multi-agent algorithms and systems.

13:50-14:00 **Break**

14:00-17:10, Econophysics. Chairman**-V. Bardakhchyan**

14:00-14:40, **Thomas Lux**, Kiel University

Estimation of Regime-Switching Diffusions via Fourier Transforms: With Applications to Multifractal Financial Volatility and Animal Motion

14:40-15:20, **Didier Sornette**, Southern Univ. of Science and Technology, Shenzhen, Pseudo-Bifurcations, Accelerated Escape Rates, and Non-Normal Dynamics in Complex Systems: Implications for Socio-Economic Bubbles, Nonlinear transitions and Quantum Measurement

15:20-15:50 **Bruce M. Boghosian**, American University of Armenia and Tufts University Department of Mathematic, The Origins of Inequality and Oligarchy

15:50-16:00, **Break**

16:00-16:30, **Reza Jafari**, Teheran, Shahid Beheshti University, Machine Learning Challenges in Financial Data.

16:30-17:10, **Luciano Pietronero,** Enrico Fermi Research Center, Rome, Italy. Economic Fitness, Complexity and AI.

17:10-17:30- **The closing of the conference**: The evolving complexity, the statistical physics (stochastic thermodynamics), and common trends in advanced Complex adaptive systems.