

VASILY KOZHEVNIKOV

Plasma Physics Scientist | Independent Researcher | Scientific Consultant

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EXPERIENCE

Institute of High Current Electronics (Tomsk, Russia)
Leading Researcher (2021 – Present)

Discovered a new physical mechanism of electrodynamic expansion of cathode plasma during the vacuum gap breakdown, providing the first consistent phenomenological theory explaining this process quantitatively. This research elucidates the anomalous acceleration of ions and resolves experimental contradictions in measuring ion velocities relative to their charge.

In collaboration with the Laboratory of Applied Electronics, the average ion current density increase during the transition to short and ultra-short-pulse HiPIMS magnetron discharge has been explained theoretically and experimentally as the afterglow phenomenon.

Institute of High Current Electronics (Tomsk, Russia)
Senior Researcher (2009 – 2021)

Provided the first comprehensive explanation of the apokampic discharge phenomenon, a unique non-convective plasma jet, detailing its formation in electronegative gas media and answering fundamental questions about its behavior and growth.

Established the presence of runaway electrons with “anomalously” high energies in high-pressure gas discharges and developed a self-consistent theoretical framework to calculate their energy spectrum and particle distributions using experimental measurements and advanced modeling techniques.

Proposed and tested the novel theoretical methodology allowing the identification of vulnerabilities in full-scale onboard equipment electronic circuits regarding the potential for arcing, which lead to the autonomous systems failure arcing.

Tomsk State University, Faculty of Physics (Tomsk, Russia)
Associate Professor (2009 – 2015)

Taught “General Physics: Experiment and Practice” to first/second-year students
Taught “Nonlinear Mathematical Physics” to third-year students
Taught “Classical Electrodynamics: Practical Course” to third-year students

EDUCATION

Doctor of Physical and Mathematical Sciences
Institute of High Current Electronics (2019)

Ph.D. in Theoretical Physics
Tomsk State University (2008)

M.S. in Physics
Tomsk State University (2004)

B.S. in Physics
Tomsk State University (2002)

ACHIEVEMENTS

- **Publications in Peer-Review Journals**
Authored and co-authored over 130 research papers on plasma physics and applied research
- **Research Grants Recipient**
Principal investigator and leader of over 15 national and international research grant programs.
- **IEEE Senior Member**
Active IEEE Senior & IEEE Mentor in good standing
- **High-rated journals reviewer**
Regular reviewer of Springer, MDPI, IOPSciencer & Nature publishers journal papers
- **Certified COMSOL Multiphysics expert**
In plasma, ultrasound, electromagnetics & CFD simulation

AREAS OF EXPERTISE

Leadership, methodological support and planning of theoretical and experimental researches

Theoretical fundamentals of low-temperature plasma & vacuum discharge physics

DC, RF & microwave high-pressure gas discharges

Magnetron sputtering discharges (dcMS, MPPMS, C-HPMS & HiPIMS)

Runaway electrons generation & breakdown on runaway electrons

Computational electrodynamics (FDTD, FEM, MOM)

Computational physical kinetics (semi-Lagrangian numerical methods for Vlasov-Poisson & Boltzmann-Maxwell systems of equations)

LANGUAGES

- ● ● ● ● ● ● ● RUSSIAN & GIPSY
- ● ● ● ● ● ● ● ENGLISH
- ● ● ● ● ● ● ● ITALIAN
- ● ● ● ● ● ● ● GERMAN

SELECTED SCIENTIFIC PUBLICATIONS IN PEER-REVIEWED JOURNALS

- J. Yao, **V.Y. Kozhevnikov**, V. Igumnov, Z. Chu, C. Yuan, and Z. Zhou — The kinetic theory of cathode plasma expansion in a spatially non-uniform geometric configuration of a vacuum diode. // *Plasma Sources Science and Technology*, vol. 33, no. 3, p. 035006, 2024 (DOI: [10.1088/1361-6595/ad34f8](https://doi.org/10.1088/1361-6595/ad34f8))
- V.O. Oskirko, **V.Y. Kozhevnikov**, A.P. Pavlov, A.N. Zakharov, A.S. Grenadyorov, A.A. Solovyev — Effect of peak discharge current on the ion current density on the substrate in the short-pulse HiPIMS. // *Vacuum*, vol. 224, p. 113162, 2024 (DOI: [10.1016/j.vacuum.2024.113162](https://doi.org/10.1016/j.vacuum.2024.113162))
- A. Kozyrev, **V.Y. Kozhevnikov**, N.S. Semeniuk, and A. Kokovin — Initial kinetics of electrons, ions and electric field in planar vacuum diode with plasma cathode. // *Plasma Sources Science and Technology*, vol. 32, no. 10, p. 105010, 2023 (DOI: [10.1088/1361-6595/acfff1](https://doi.org/10.1088/1361-6595/acfff1))
- V.O. Oskirko, A.N. Zakharov, A.S. Grenadyorov, A.P. Pavlov, V.A. Semenov, S.V. Rabotkin, **V.Yu. Kozhevnikov**, A.A. Solovyev — The influence of pulse duration and duty cycle on the energy flux to the substrate in high power impulse magnetron sputtering. // *Vacuum*, vol. 216, p. 112459, 2023 (DOI: [10.1016/j.vacuum.2023.112459](https://doi.org/10.1016/j.vacuum.2023.112459))
- **V.Y. Kozhevnikov**, A.V. Kozyrev, V.F. Tarasenko, A.O. Kokovin, E.K. Baksht, N.P. Vinogradov — Key Modes of Ignition and Maintenance of Corona Discharge in Air. // *Energies*, vol. 16, no. 13, p. 4861, 2023 (DOI: [10.3390/en16134861](https://doi.org/10.3390/en16134861))
- V. Oskirko, **V.Y. Kozhevnikov**, S. Rabotkin, A. Pavlov, V. Semenov, and A. Solovyev — Ion current density on the substrate during short-pulse HiPIMS. // *Plasma Sources Science and Technology*, vol. 32, no. 7, p. 075007, 2023 (DOI: [10.1088/1361-6595/acdd95](https://doi.org/10.1088/1361-6595/acdd95))
- E.A. Sosnin, N.Y. Babaeva, A.V. Kozyrev, **V.Y. Kozhevnikov**, G.V. Naidis, V.S. Skakun, V.A. Panarin, and V.F. Tarasenko — Modeling of transient luminous events in Earth middle atmosphere with apokamp discharge. // *Physics–Uspekhi*, 64 (2), 2021. (DOI: [10.3367/UFNe.2020.03.038735](https://doi.org/10.3367/UFNe.2020.03.038735))
- N.M. Zubarev, **V.Y. Kozhevnikov**, A. Kozyrev, G.A. Mesyats, N.S. Semeniuk, K. Sharypov, S.A. Shunailov, and M.I. Yalandin — Mechanism and dynamics of picosecond radial breakdown of a gas-filled coaxial line. // *Plasma Sources Science and Technology*, vol. 29, no. 12, p. 125008, 2020 (DOI: [10.1088/1361-6595/abc414](https://doi.org/10.1088/1361-6595/abc414))
- A. Kozyrev, **V. Kozhevnikov**, and N. Semeniuk — Kinetic theory of high-voltage low-pressure gas discharge with electron initiation on a cathode in a planar gap. // *Plasma Sources Science and Technology*, vol. 29, no. 12, p. 125023, 2020 (DOI: [10.1088/1361-6595/abbf95](https://doi.org/10.1088/1361-6595/abbf95))
- **V.Y. Kozhevnikov**, A.V. Kozyrev, N.S. Semeniuk, and A.O. Kokovin — Influence of Runaway Electrons on the Formation Time of Nanosecond Discharge. // *IEEE Transactions on Plasma Science*, 2018, Vol. 46, Issue 10, pp. 3468–3472 (DOI: [10.1109/TPS.2018.2866777](https://doi.org/10.1109/TPS.2018.2866777))
- A. Kozyrev, **V. Kozhevnikov**, and N. Semeniuk — Why do Electrons with "Anomalous Energies" appear in High-Pressure Gas Discharges? // *EPJ Web of Conferences*, vol. 167, p. 01005 (DOI: [10.1051/epjconf/201816701005](https://doi.org/10.1051/epjconf/201816701005))
- **V.Yu. Kozhevnikov**, A.V. Kozyrev, and N.S. Semeniuk — Modeling of Space Charge Effects in Intense Electron Beams: Kinetic Equation Method vs PIC-method. // *IEEE Transactions on Plasma Science*, 2017, Vol. 45, Issue 10, pp. 2762–2766. (DOI: [10.1109/TPS.2017.2726501](https://doi.org/10.1109/TPS.2017.2726501))
- V. Tarasenko, C. Zhang, A. Kozyrev, D. Sorokin, X. Hou, N. Semeniuk, A. Burachenko, P. Yan, **V. Kozhevnikov**, E. Baksht, M. Lomaev, T. Shao — Influence of the interelectrode distance and the gas pressure on parameters of a runaway electron beam generating during the nanosecond breakdown in SF₆ and nitrogen. // *High Voltage*, vol. 2, iss. 2, pp. 49–55, 2017 (DOI: [10.1049/hve.2017.0014](https://doi.org/10.1049/hve.2017.0014))
- A.V. Kozyrev, **V.Yu. Kozhevnikov**, and N.S. Semeniuk — Theoretical simulation of high-voltage discharge with runaway electrons in sulfur hexafluoride at atmospheric pressure. // *Matter and Radiation at Extremes*, vol. 1, no. 5, pp. 264–268 (DOI: [10.1016/j.mre.2016.10.001](https://doi.org/10.1016/j.mre.2016.10.001))
- A.V. Kozyrev, **V.Yu. Kozhevnikov**, M.I. Lomaev, D.S. Sorokin, N.S. Semeniuk, and V.F. Tarasenko — Theoretical simulation of the picosecond runaway-electron beam in coaxial diode filled with SF₆ at atmospheric pressure. // *EPL (Europhysics Letters)*, vol. 114, no. 4, p. 45001, 2016 (DOI: [10.1209/0295-5075/114/45001](https://doi.org/10.1209/0295-5075/114/45001))
- A.V. Kozyrev, **V.Yu. Kozhevnikov**, and N.S. Semeniuk — Zero-Dimensional Theoretical Model of Subnanosecond High-Pressure Gas Discharge. // *IEEE Transactions on Plasma Science*, vol. 43, no. 12, pp. 4077–4080 (DOI: [10.1109/TPS.2015.2496218](https://doi.org/10.1109/TPS.2015.2496218))
- **V.Yu. Kozhevnikov**, A.V. Kozyrev, and N.S. Semeniuk — 1D simulation of runaway electrons generation in pulsed high-pressure gas discharge. // *EPL (Europhysics Letters)*, vol. 112, no. 1, p. 15001, 2015 (DOI: [10.1209/0295-5075/112/15001](https://doi.org/10.1209/0295-5075/112/15001))
- Shao T., Tarasenko V.F., Zhang C., Rybka D.V., Kostyrya I.D., Kozyrev A.V., Yan P., **Kozhevnikov V.Yu.** — Runaway electrons and x-rays from a corona discharge in atmospheric pressure air. // *New Journal of Physics*. 2011. Vol. 13., 113035 (20 pp) (DOI: [10.1088/1367-2630/13/11/113035](https://doi.org/10.1088/1367-2630/13/11/113035))