

Vitaly Kocharovsky. Curriculum Vitae

Citizenship: Citizen of the United States of America.

Affiliation: Professor, Department of Physics and Astronomy,
Texas A&M University, College Station, TX 77843-4242. E-mail: vkochar@physics.tamu.edu

Professional Preparation:

- Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod, Russia, Physics and Mathematics, M.S. (with the distinction), 1978;
- Radiophysical Research Institute, Nizhny Novgorod, Russia, Physics and Mathematics, Ph.D., 1986;
- The Highest Attestation Commission of the Russian Federation, Moscow, Russia, Physics and Mathematics, Dr. Habilitation Degree, 1997.

Appointments:

2005 - date Professor, Department of Physics and Astronomy, Texas A&M University

2002 - 2005 Associate Professor, Department of Physics, Texas A&M University

2001 - 2001 Visiting Associate Professor, Department of Physics, Texas A&M University

1998 - 2001 Associate Research Scientist, Department of Physics, Texas A&M University

1978 - 1998 Leading Researcher (1996-1998), Senior Researcher (1986-1996), Researcher (1978-1985),
Institute of Applied Physics of the Russian Academy of Science, Nizhny Novgorod, Russia

Teaching Activity:

Professor, Department of Physics and Astronomy, Texas A&M University:

2001 - date "Physics 218", "Physics 206" and "Physics 201" undergraduate courses.

Associate Professor at the Nizhny Novgorod State University (Russia):

1988 - 1989 "Quantum Field Theory" (undergraduate course),

1987 - 1988 "Modern Problems in Physics" (graduate course).

Membership in Professional Societies:

Member of the Optical Society of America (OSA) since 1996,

Member of the American Physical Society (APS) since 1999,

Elected member of the International Astronomical Union (IAU) since 2000.

Synergistic Activities:

- Member of the editorial board of the journal "Entropy" (2019 – to date).
- Guest Editor of the special issue "Exploring the NP-Complexity of Nature: Critical Phenomena, Chaos, Fractals, Graphs, Boson Sampling, Quantum Computing and More" of the journal "Entropy" (2020).
- Member of the Program Committee and International Advisory Committee of the International Conferences "Frontiers of Nonlinear Physics" (2004-2015).
- Organizer of the sessions on BEC and semiconductor optoelectronics at the Winter Colloquium on the Physics of Quantum Electronics (Snowbird, Utah) (2001-2009).
- Member of the Organizing Committee of the 5th International Heidelberg Conf. on Dark Matter in Astro and Particle Physics "DARK2004", College Station, Texas, October, 2004.
- Member of the Organizing Committee of the Symposium on Observational Cosmology, College Station, Texas, April, 2004.
- Organizer of the Symposia at the Texas A&M University, College Station, Texas: "Quantum Control in Atoms, Molecules, Solids, and Nuclei" (2000) and "Novel Optical Materials" (1999).
- Guest Editor of the chapter "Resonance Phenomena" in the Encyclopedia of Life Support Systems, UNESCO, EOLSS Publishers Co. Ltd., 2001.
- 1991-1998 Chairman of Seminar "Theoretical Physics" at Inst. of Appl. Phys. of the Russian Academy of Science.
- 1992-1997 Elected member of the Scientific Council of Electronics and Plasma Physics Division, Institute of Applied Physics of the Russian Academy of Science.
- Member of the committees in the Department of Physics and Astronomy, Texas A&M University: the Undergrad. Curriculum Committee (2003-2008), the Quantum Optics, Nanophysics, and Astronomy/Cosmology Faculty Search Committees (2004 - 2010), the Institute for Quantum Studies Advisory Committee (2003-2014), the Performance Evaluation Committee (2011 - 2019), the Graduate Admission Committee (2017-2019).
- Referee for physics journals: Phys. Rev. Lett., Phys. Rev. A, Phys. Rev. B, Phys. Rev. E, Physics Letters A, J. Phys. A: Math. Theor., J. Phys. B: Atomic, Molecular, and Opt. Phys., Optics Express, New J. Physics, Optical and Quantum

Electronics, Physics-JETP, Physics-Uspekhi, Radiophysics and Quantum Electronics, Semiconductor Science and Technology, J. Modern Optics, Photonics Technology Letters Journal, Optics Commun., IEEE J. Quantum Electronics, Canadian J. Phys., Physics of Plasmas.

Research Experience:

V.V. Kocharovskiy has co-authored more than 200 papers in refereed journals and proceedings. He originates from the well-known scientific school of the laureate of the Nobel Prize in physics Prof. V.L. Ginzburg and the member of the Russian Academy of Sciences Prof. V.V. Zheleznyakov. His scientific interests cover a wide range of problems in theoretical physics and include statistical physics of quantum and many-body systems, physics of critical phenomena and phase transitions, superconductivity and superfluidity, Bose-Einstein condensation, Ising model, theory of nonequilibrium, relaxation and decoherence phenomena, theory of superradiance, quantum field theory, methods of the Green's function and matrix permanent, quantum computing, physics of semiconductors and nanostructures, optoelectronics and photonics, telecommunications, atomic and molecular physics, quantum and nonlinear optics, quantum electrodynamics including cavity QED, laser physics, fiber optics, astrophysics, cosmology, plasma physics, electronics, electrodynamics and propagation of electromagnetic waves.

Selected publications:

1. S.V. Tarasov, VI.V. Kocharovskiy, V.V. Kocharovskiy, "Bose-Einstein-condensate fluctuations versus an interparticle interaction", *Phys. Rev. A* **102**, 043315, 2020; DOI: 10.1103/PhysRevA.102.043315.
2. V.V. Kocharovskiy, VI.V. Kocharovskiy, S.V. Tarasov, "Unification of the Nature's Complexities via a Matrix Permanent—Critical Phenomena, Fractals, Quantum Computing, #P-Complexity", *Entropy* **22**, 322, 2020; DOI: 10.3390/e22030322.
3. VI.V. Kocharovskiy, A.V. Mishin, A.F. Seleznev, E.R. Kocharovskaya, V.V. Kocharovskiy, "Parametric effect in a superradiant laser with self-mode-locking", *Theoretical and Mathematical Physics* **203**, n.1, 483–500, 2020; DOI: 10.1134/S0040577920040054.
4. V.V. Kocharovskiy, C.B. Reynolds, VI.V. Kocharovskiy, "Eigenmodes of a lamellar optical grating: Profile, propagation, reflection, transmission, and nonadiabatic mode coupling", *Phys. Rev. A* **100**, 053854, 2019; DOI: 10.1103/PhysRevA.100.053854.
5. V.V. Kocharovskiy, VI.V. Kocharovskiy, V.Ju. Martjanov, A.A. Nechaev, "An Analytical Model for the Current Structure of the Magnetosheath Boundary in a Collisionless Plasma", *Astronomy Letters* **45**, n. 8, 551–564, 2019; DOI: 10.1134/S1063773719080048.
6. S.V. Tarasov, VI.V. Kocharovskiy, V.V. Kocharovskiy, "Crossover of quasiparticles and Bose-Einstein condensation statistics under an increasing interaction: from an ideal gas to a Thomas-Fermi regime. The case of a one-dimensional flat trap", *Radiophysics and Quantum Electronics* **62**, n. 4, 293-310, 2019; DOI: 10.1007/s11141-019-09978-7.
7. VI.V. Kocharovskiy, V.A. Kukushkin, S.V. Tarasov, E.R. Kocharovskaya, V.V. Kocharovskiy, "Asymmetric generation of a superradiant laser with a symmetric low-Q cavity", *Semiconductors* **53**, n. 10, 1287-1294, 2019.
8. E.R. Kocharovskaya, A.S. Gavrilo, V.V. Kocharovskiy, E.M. Loskutov, A.V. Mishin, D.N. Mukhin, A.F. Seleznev, VI.V. Kocharovskiy, "Spectral-dynamical peculiarities of a polarization of the active medium and space-time empirical modes of a laser with a low-Q cavity", *Radiophysics and Quantum Electronics* **61**, n. 11, 806-833, 2019; DOI: 10.1007/s11141-019-09939-0.
9. S.V. Tarasov, VI.V. Kocharovskiy, V.V. Kocharovskiy, "Anomalous statistics of Bose-Einstein condensate in an interacting gas: An effect of the trap's form and boundary conditions in the thermodynamic limit", *Entropy* **20**, n. 3, 153, 2018; DOI: 10.3390/e20030153.
10. VI.V. Kocharovskiy, A.S. Gavrilo, E.R. Kocharovskaya, A.V. Mishin, I.S. Ryabinin, A.F. Seleznev, V.V. Kocharovskiy, "Comparative analysis of the dynamical spectra of a polarization of an active medium and an electromagnetic field in the superradiant heterolaser", *KnE Engineering* **3**, n. 6, 160–173, 2018; DOI: 10.18502/keg.v3i6.2988.
11. V.V. Kocharovskiy and VI.V. Kocharovskiy, "On the permanents of the circulant and degenerate Schur matrices", *Linear Algebra Appl.* **519**, 366-381 (2017); DOI: 10.1016/j.laa.2017.01.024.
12. VI.V. Kocharovskiy, V.V. Zheleznyakov, E.R. Kocharovskaya, V.V. Kocharovskiy, "Superradiance: the principles of generation and implementation in lasers", *Physics-Uspekhi* **60**, 345-384, 2017.
13. V.V. Kocharovskiy, VI.V. Kocharovskiy, V.Ju. Martjanov, S.V. Tarasov, "The analytical theory of self-consistent current structures in a collisionless plasma", *Physics-Uspekhi* **59**, 1165-1210, 2016.

14. M.A. Garasev, E.V. Derishev, VI.V. Kocharovsky, V.V. Kocharovsky, "Cyclotron line formation in the magnetized atmospheres of compact stars – I. The transfer equations for polarized radiation", *MNRAS (Monthly Notices of the Royal Astronomical Society)* **459**, 1847, 2016.
15. V.V. Kocharovsky, VI.V. Kocharovsky, S.V. Tarasov, "Bose-Einstein condensation in the mesoscopic systems: Self-similar structure of the critical region and nonequivalence of the canonical and grand canonical ensembles", *JETP Letters* **103**, 62-75, 2016.
16. V.V. Kocharovsky, VI.V. Kocharovsky, "Microscopic theory of phase transitions in a critical region", *Physica Scripta* **90**, 108002, 2015.
17. V.V. Kocharovsky, VI.V. Kocharovsky, "Towards an exact solution for the three-dimensional Ising model: A method of the recurrence equations for partial contractions", *Phys. Lett. A* **379**, 2520-2523, 2015.
18. V.V. Kocharovsky, VI.V. Kocharovsky, "Microscopic theory of a phase transition in a critical region: Bose–Einstein condensation in an interacting gas", *Phys. Lett. A* **379**, 466-470, 2015.
19. S.V. Tarasov, VI.V. Kocharovsky, V.V. Kocharovsky, "Grand Canonical Versus Canonical Ensemble: Universal Structure of Statistics and Thermodynamics in a Critical Region of Bose–Einstein Condensation of an Ideal Gas in Arbitrary Trap", *J. Stat. Phys.* **161**, 942-964, 2015.
20. V.V. Kocharovsky et al., "The breaks and the hidden components in the power-law spectra of synchrotron radiation of the self-consistent current structures", *Physics of Plasmas* **22**, 083303, 2015.
21. S.V. Tarasov, VI.V. Kocharovsky, V.V. Kocharovsky, "Universal scaling in the statistics and thermodynamics of a Bose-Einstein condensation of an ideal gas in an arbitrary trap", *Phys. Rev. A* **90**, 033605, 2014.
22. S.V. Tarasov, VI.V. Kocharovsky, V.V. Kocharovsky, "Universal fine structure of the specific heat at the critical lambda-point for an ideal Bose gas in an arbitrary trap", *J. Phys. A: Math. Theor.* **47**, 415003, 2014.
23. P.A. Kalinin, V.V. Kocharovsky, VI.V. Kocharovsky, "Lasing threshold in traps for Bose-condensation of dipolar excitons", *Solid State Communications* **152**, 1008-1011, 2012.
24. V.V. Kocharovsky, VI.V. Kocharovsky, V.Ju. Martyanov, "Self-consistent current sheets and filaments in relativistic collisionless plasma with arbitrary energy distribution of particles", *Phys. Rev. Lett.* **104**, 215002, 2010.
25. V.Ju. Martyanov, V.V. Kocharovsky, VI.V. Kocharovsky, "Magnetostatic structures in collisionless plasma and their synchrotron radiation", *Astron. Lett. – J. Astron. Space Astrophys.* **36**, 396, 2010.
26. V.V. Kocharovsky, VI.V. Kocharovsky, "Analytical theory of mesoscopic Bose-Einstein condensation in an ideal gas", *Phys. Rev. A* **81**, 033615, 2010.
27. E.V. Derishev, F.A. Aharonian, V.V. Kocharovsky, and VI.V. Kocharovsky, "A new mechanism for particle acceleration in relativistic jets", *International Journal of Modern Physics D* **17**, 1839-1847, 2008.
28. V.Ju. Martyanov, V.V. Kocharovsky, VI.V. Kocharovsky, "Saturation of the relativistic Weibel instability and stationary current sheets in collisionless plasma", *JETP* **107**, 1049, 2008.
29. Y.D. Jho, X. Wang, X. Wei, J. Kono, D.H. Reitze, A.A. Belyanin, V.V. Kocharovsky, VI.V. Kocharovsky, G.S. Solomon, "Cooperative Recombination of a Quantized High-Density Electron-Hole Plasma in Semiconductor Quantum Wells", *Phys. Rev. Lett.* **96**, 237401, 2006.
30. G.B. Akguc, L.E. Reichl, E.V. Derishev, VI.V. Kocharovsky, V.V. Kocharovsky, "Nonlinear dynamics of gravity and matter creation in a cosmology with an unbounded Hamiltonian", *Phys. Rev. E* **70**, 066210, 2004.
31. M.O. Scully, V.V. Kocharovsky, A.A. Belyanin, E. Fry, F. Capasso, "Enhancing Acceleration Radiation from Ground-State Atoms via Cavity Quantum Electrodynamics", *Phys. Rev. Lett.* **91**, 243004, 2003.
32. E.V. Derishev, F.A. Aharonian, V.V. Kocharovsky, VI.V. Kocharovsky, "Particle acceleration through multiple conversions from a charged into a neutral state and back", *Phys. Rev. D* **68**, 043003, 2003.
33. V.V. Kocharovsky, VI.V. Kocharovsky, "Self-consistent infrared & ultraviolet asymptotically free unitary renormalizable theory of quantum gravity and matter fields", *Foundations of Physics* **26**, 243-256, 1996.
34. V.V. Kocharovsky, VI.V. Kocharovsky, "Origin of Bragg-Coulomb high-Tc superconductivity. Green's function and diagram method for umklapp $e^- - e^-$ scattering", *Physica C* **200**, 385-402, 1992.
35. V.V. Zheleznyakov, V.V. Kocharovsky, VI.V. Kocharovsky, "Polarization waves and superradiance in active media", *Sov. Phys. Uspekhi* **32**, 835-870, 1989.
36. V.V. Kocharovsky, VI.V. Kocharovsky, "Double-flow Bragg-Coulomb mechanism for high-Tc Superconductivity", *Sov. Phys.-JETP Lett.* **48**, 565-569, 1988.
37. V.V. Zheleznyakov, V.V. Kocharovsky, VI.V. Kocharovsky, "Linear coupling of electromagnetic waves in inhomogeneous weakly-anisotropic media", *Sov. Phys. Uspekhi* **26**, 877-905, 1983.