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Denis SHEKA

Curriculum Vitæ

| Personal

Professional title Professor
Position Professor
Date of birth 5th May, 1969
Place of birth Kyiv, Ukraine
Sex Male
Marital Status Married, one child
Citizenship Ukraine

| Research area

- Curvilinear nanomagnetism
- Topological effects in nanomagnets
- Dynamics of magnetic soliton-like excitations: domain walls, vortices, skyrmions, Bloch points

| Academic Degree and Theses

- 2009 ○ **D. Sc. in Theoretical Physics**, *Bogolyubov Institute for Theoretical Physics*, Kyiv, Ukraine
D.Sc. thesis "Dynamics of two-dimensional magnetic solitons"
- 2005–2008 ○ **Dr.Cand. (habilitation) in Theoretical Physics**, *Radiophysics Faculty, National Taras Shevchenko University of Kyiv*, Kyiv, Ukraine
- 1996 ○ **Cand. Sc. in Magnetism**, *Institute for Metal Physics*, Kyiv, Ukraine
Ph.D thesis "Vortices in Two-Dimensional Easy-Plane Magnets. Dynamics, Relaxation, and Contribution to the Magnet Response Functions"

| Academic Ranks

- 2024 ○ **Academician**, *Academy of Sciences of the Higher School of Ukraine*
- 2014 ○ **Full professor**, *National Taras Shevchenko University of Kyiv*, Kyiv, Ukraine
- 2002 ○ **Associate professor**, *National Taras Shevchenko University of Kyiv*, Kyiv, Ukraine

| Education

- 1991–1995 ○ **PhD Student in Physics**, *Radiophysics Faculty, National Taras Shevchenko University of Kyiv*, Kyiv, Ukraine
- 1991 ○ **M. Sc. in Physics**, *Department of Crio- and Micro- electronics, Radiophysics Faculty, National Taras Shevchenko University of Kyiv*, Kyiv, Ukraine
M.Sc thesis "Dynamics of Two-Dimensional Solitons (Magnetic Vortices) and Their Contribution to the Thermodynamics of Layered Magnets"

1986–1991 ○ **Undergraduate Student in Physics**, *Radiophysics Faculty, National Taras Shevchenko University of Kyiv, Kyiv, Ukraine*

| Experience

Full-time appointments

2023–present ○ **Professor**, *Department of Nanophysics of Condensed Media, Educational Scientific Institute of High Technologies, National Taras Shevchenko University of Kyiv, Kyiv, Ukraine*

2013–2023 ○ **Professor**, *Department of Mathematics and Theoretical Radiophysics, Faculty of Radio Physics, Electronics and Computer Systems, National Taras Shevchenko University of Kyiv, Kyiv, Ukraine*

2008–2012 ○ **Associate Professor**, *Department of Mathematics and Theoretical Radiophysics, Faculty of Radio Physics, Electronics and Computer Systems, National Taras Shevchenko University of Kyiv, Kyiv, Ukraine*

2006–2007 ○ **Humboldt Fellow**, *Bayreuth University, Bayreuth, Germany*

2000–2005 ○ **Associate Professor**, *Department of Mathematics and Theoretical Radiophysics, Faculty of Radio Physics, Electronics and Computer Systems, National Taras Shevchenko University of Kyiv, Kyiv, Ukraine*

1994–2000 ○ **Assistant Professor**, *Department of Mathematics and Theoretical Radiophysics, Faculty of Radio Physics, Electronics and Computer Systems, National Taras Shevchenko University of Kyiv, Kyiv, Ukraine*

Part-time appointments

2024–2025 ○ **Non-Resident Academic Associate**, *Virginia Commonwealth University and the Davis Center at Harvard University, USA*

2010–2013 ○ **Professor (partial time)**, *Institute of High Technologies, Kyiv University, Kyiv, Ukraine*

2009–2010 ○ **Senior Research Fellow (half time)**, *Bogolyubov Institute for Theoretical Physics, Kyiv, Ukraine*

Long-Time Commitments

2013–2023 ○ **Scientific Secretary**, *Coordinating Council of the Complex Scientific Programme “Modern Technologies and Materials”, Kyiv University, Kyiv, Ukraine*

2004–2005 ○ **Acting as the Deputy Dean (Scientific Affairs)**, *Radiophysics Faculty, Kyiv University, Kyiv, Ukraine*

2000–2004 ○ **Scientific Secretary**, *Department of Mathematics and Theoretical Radiophysics, Radiophysics Faculty, Kyiv University, Kyiv, Ukraine*

Visits for Joint Research

HZDR Dresden, Germany ○ **Group of Dr. D. Makarov**, *Jan-Feb 16; Jan-Feb 17, Jul-Aug 17, Feb 18, Jul-Aug 18, Jan-Feb 19, Jul-Aug 19, Dec 19-Jan 20, Jul 21, Nov 21*

Kiel University, Germany ○ **Group of Prof. J. McCord**, *Jul 21*

Universidad Técnica Federico Santa María, Valparaíso, Chile ○ **Group of Prof. P. Landeros**, *Mar-Apr 17, Jan 18*

University of Seville, Spain ○ **Group of Prof. N. Quintero**, *Jun 17*

Bristol University, GB ○ **Group of Prof. J. Robbins**, *Feb 15; Sep 16*

Los Alamos National Laboratory, USA ○ **Group of Prof. A. Saxena**, *May 16*

University of Bayreuth, Germany **Group of Prof. F. Mertens**, Nov 99-Jan 00; May-Jun 00; Nov-Dec 01; Nov-Dec 02; Jul-Sep 03; Jan-Feb 04; Jul 04; Jan-Feb 05; Jun 05; Jan 06-Aug 07; Jan-Feb 08; Jul 09; Feb 10; Jul-Aug 10; Jun-Aug 12; Jul-Aug 15

IFW Dresden, Germany **Group of Dr. D. Makarov**, Jun 11; Jun 12; Sep-Oct 13; Jan-Feb 15

MPI Stuttgart, Germany **Group of Dr. H. Stoll**, Jan 07; Jan-Feb 09

INSA de Rouen, France **Group of Dr. J.-G. Caputo**, Nov 04; Jun 05; May 06; Jan-Feb 08

Bose Centre, Kolkata, India **Group of Prof. A. Mookerjee**, Dec 04

Languages

Ukrainian	Fluent	Native language
Russian	Fluent	Mother tongue
English	Good	

Memberships

- Ukrainian Physical Society
- American Physical Society
- American Chemical Society
- IEEE Magnetic Society

Activity as a Referee

Review services for Foundations/Research Commissions	National Science Foundation (NSF, USA), Deutscher Akademischer Austauschdienst (DAAD, Germany), Research Foundation Flanders (FWO, Belgium), Fondo Nacional de Desarrollo Científico y Tecnológico (FONDECYT, Chile), Ukrainian State Agency for Science, Innovation and Informatization (Ukraine), Scientific Council of Ministry of Education and Science (Ukraine), Research Commission of ETH Zurich (Switzerland)
Referee for Journals	Nature Nanotechnology, Nature Physics, ACS Nano, Nature Communications, Physical Review Letters, Materials Research Letters, SciPost Physics, Physical Review Applied, NPG Scientific Reports, Results in Physics, Physical Review B, New Journal of Physics, Nanotechnology, Journal of Magnetism and Magnetic Materials, Royal Society Open Science, Journal of Physics D, Physical Review E, Journal of Applied Physics, Journal of Physics A, Physica Status Solidi, Physics Letters A, IEEE Transactions on Magnetics, Low Temperature Physics, Ukrainian Journal of Physics
Referee for Academic Publishing	Elsevier

Conference Activities

- 2023 ○ **Minicolloquia “Curvilinear condensed matter”**, *Co-organizer*, Joint Conference of the Italian and European Community of Condensed Matter CMD30, Milan, Italy
- 2021 ○ **717 WE-Heraeus-Seminar “Curvilinear condensed matter: fundamentals and applications”**, *Co-organizer*, Online Seminar (MeetAnyWay)
- 2019 ○ **Workshop “Curvilinear micromagnetism”**, funded by Alexander-von-Humboldt Foundation, *Co-organizer*, Kyiv, Ukraine

Awards, grants, etc.

2024–2028 ○ **COST Action**, *Topological textures in condensed matter (Polytopo) CA23134*

- 2023–2024 ○ **Senior Fellowship**, *Virtual Ukraine Institute for Advanced Study (VUIAS)*
- 2023 ○ **Grant**, *Program “Universities for Ukraine (U4U) Non-Residential Fellowship Program”*
- 2022–2023 ○ **Research Grant No. 9918**, *IEEE Magnetics Society and the Science and Technology Center of Ukraine*
- 2020–2025 ○ **Joined German-Ukrainian project ID MC 9/22-1**, *grant from DFG, Germany*
- 2019–2021 ○ **Research Project No. 19BF052-01**, *Taras Shevchenko National University of Kyiv, Kyiv, Ukraine*
- 2017–2021 ○ **Joined German-Ukrainian project Reserach Group Linkage Programme**, *Alexander von Humboldt Foundation, Helmholtz-Zentrum Dresden-Rossendorf, Dresden, Germany*
- 2018–2019 ○ **Joined German-Ukrainian project ID 57430566**, *grant from DAAD Leonhard Euler Programm, Germany*
- 2016–2017 ○ **Joined German-Ukrainian project ID 57290665**, *grant from DAAD Leonhard Euler Programm, Germany*
- 2015 ○ **Renewal Grant**, *Alexander von Humboldt Foundation, Bayreuth University, Bayreuth, Germany*
- 2013 ○ **Joined German-Ukrainian project ID MA 5144/3-1**, *grant from DFG, Germany*
- 2012 ○ **Renewal Grant**, *Alexander von Humboldt Foundation, Bayreuth University, Bayreuth, Germany*
- 2011–2012 ○ **Research Grant of the President of Ukraine F35/528**, *State fund for fundamental researches, Kyiv, Ukraine*
- 2007–2009 ○ **Research Grant F25.2/081**, *State fund for fundamental researches, Kyiv, Ukraine, Principle Investigator*
- 2010 ○ **Renewal Grant**, *Alexander von Humboldt Foundation, Bayreuth University, Bayreuth, Germany*
- 2006–2007 ○ **Research Grant**, *Alexander von Humboldt Foundation, Bayreuth University, Bayreuth, Germany*
- 2005 ○ **Davydov Prize**, *National Academy of Science of Ukraine, Ukraine*
- 1998 ○ **Soros Grant for Young Teaching Scientists**, *Ukraine*
- 1995 ○ **Soros Postgraduate Student Grant**, *Ukraine*

| PhD theses supervised

- 2016 ○ **O. V. Pylypovskyi**, *“Regular and chaotic dynamics of topological excitations in magnetic nanosystems”*, Kyiv, Ukraine
- 2015 ○ **O. M. Volkov**, *“Periodical magnetization structures induced by spin-polarized current in nanomagnets”*, Kyiv, Ukraine
- 2009 ○ **V. P. Kravchuk**, *“Vortex states of nanodots”*, Kyiv, Ukraine

| Key Research Achievements

- in Quantum Mechanics ○ **Extension of the Levinson Theorem** for the Aharonov-Bohm scattering; this found numerous applications in magnetism for scattering of magnons by 2D solitons, vortices, skyrmions.
- in Field Theory ○ **Generalization of the field-momentum equation** for a classical field with a singularity: in addition to the regular force, there appears the singular one. The collective-variable Lagrangian description is proposed for gyroscopical systems taking into account singularities with applications for magnetic solitons.

- in Theory of Magnetism
- **Exact analytical solution** of the soliton-magnon scattering was found for the isotropic 2D magnets;
 - **Prediction of truly local magnon modes** for the 2D skyrmion in ferromagnets; the resonance mechanism of the skyrmion dynamics was proposed;
 - **Extension of the soliton phenomenology** for the 2D systems with application to magnetic solitons;
 - **New intermediate vortex state** is predicted for ferromagnetic nanorings;
 - **A method of fast switching the vortex chirality** in a magnetic nanodisk by applying a field pulse is proposed.
 - **Prediction of ultrafast magnetic vortex switching by spin-polarized currents** in magnetic nanopillars;
 - **New chaotic regime of a vortex core reversal** by a resonant perpendicular magnetic field;
 - **A mechanism of dynamical formation of vortex-antivortex crystals** generated by spin-polarized current;
 - **Development a fully 3D theory of curved magnets**, which gives a possibility to derive the energy for arbitrary curves and surfaces, and arbitrary magnetization vector fields; numerous applications for different curved nanowires, nanocaps, nanoshells, and curved nanofilms;
 - **A new (geometrical) mechanism of the Dzyaloshinskii-Moriya interaction** is predicted with numerous applications to curved magnets.
 - **A nonlocal chiral** symmetry breaking effect predicted for curved nanoshells

| Teaching Activity

- Lecture Courses
- Classical Electrodynamics (36 hours, general lecture course)
 - Complex Analysis (36 hours, general lecture course)
 - Mathematical Physics (36 hours, general lecture course)
 - Introduction to the Physics of Solitons (16 hours, lecture course for Masters)
 - Nanomagnetism (36 hours, lecture course for Masters)
 - Physics of Magnetism (36 hours, lecture course for Masters)
 - Modern Magnetism (54 hours, lecture course for Masters)
 - Computer Modeling in Natural Sciences (20 hours, lecture course for Masters)
- Seminars Classical Mechanics, Electrodynamics, Quantum Mechanics, Statistical Physics, Mathematical Physics, Modern Magnetism, Electronic Transport of Meso- and Nanosystems
- Educational publications 6 publications, including 4 textbooks.

| Profiles

- [Google Scholar](#) Number of citations > 4000, **h-index 37**
- [Scopus](#) Scopus Author ID: 6701719591, Number of citations > 3000, **h-index 33**
- [Web of Science](#) ResearcherID: F-3901-2012, Number of citations > 2800, **h-index 32**
- [ORCID](#) ORCID ID: 0000-0001-7311-0639

| Publications

[Peer reviewed publications](#)

- > **100** see [The list of publications](#)

[List of 10 selected publications](#)

- Books
- D. Makarov, D. D. Sheka "Curvilinear Micromagnetism: From Fundamentals to Applications", [Springer \(2022\)](#)

Review papers

- [1] D. D. Sheka. "Curvilinear Magnetism" (Review), *Encyclopedia of Materials: Electronics*, **1** 760–776 (2023)
- [2] D. D. Sheka, O. V. Pylypovskyi, O. M. Volkov, K. V. Yershov, V. P. Kravchuk, D. Makarov, "Fundamentals of Curvilinear Ferromagnetism: Statics and Dynamics of Geometrically Curved Wires and Narrow Ribbons" (Review), *Small* **18** 2105219 (2022)
- [3] D. D. Sheka. "A perspective on curvilinear magnetism" (Review), *Appl. Phys. Lett.*, **118** 230502 (2021)
- [4] E. Y. Vedmedenko, R. K. Kawakami, D. D. Sheka, P. Gambardella, A. Kirilyuk, A. Hirohata, C. Binek, O. Chubykalo-Fesenko, S. Sanvito, B. J. Kirby, J. Grollier, K. Everschor-Sitte, T. Kampfrath, C-Y You, A. Berger. "The 2020 magnetism roadmap" (Review), *J. Phys. D* **53** 453001 (2020)
- [5] R. Streubel, P. Fischer, F. Kronast, V. P. Kravchuk, D. D. Sheka, Y. Gaididei, O. G. Schmidt, and D. Makarov, "Magnetism in curved geometries", *J. Phys. D: Appl. Phys. (Topical Review)*, **49**, 363001 (2016).

Research papers

- [6] O. Volkov, D. Wolf, O. Pylypovskyi, A. Kákay, D. Sheka, B. Büchner, J. Fassbender, A. Lubk, D. Makarov, "Chirality coupling in topological magnetic textures with multiple magnetochiral parameters", *Nature Communications*, **14**, 1491 (2023).
- [7] N. Hedrich, K. Wagner, O. V. Pylypovskyi, B. J. Shields, T. Kosub, D. D. Sheka, D. Makarov, P. Maletinsky, "Nanoscale mechanics of antiferromagnetic domain walls", *Nature Physics*, **17**, 574 (2021).
- [8] D. D. Sheka, O. V. Pylypovskyi, P. Landeros, Y. Gaididei, A. Kákay, D. Makarov, "Nonlocal chiral symmetry breaking in curvilinear magnetic shells", *Comm. Phys.*, **3** 128 (2020)
- [9] V. P. Kravchuk, D. D. Sheka, O. M. Volkov, A. Kákay, U. K. Röbler, J. van den Brink, D. Makarov, Y. Gaididei. "Multiplet of Skyrmion States on a Curvilinear Defect: Reconfigurable Skyrmion Lattices", *Phys.Rev.Lett.*, **120** 067201 (2018).
- [10] Y. Gaididei, V. P. Kravchuk, D. D. Sheka. "Curvature Effects in Thin Magnetic Shells", *Phys.Rev.Lett.*, **112** 257203 (2014).