



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

### Education and Academic Grades

- 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**, *National Taras Shevchenko University of Kyiv, Kyiv, Ukraine.*  
Ph.D thesis "Vortices in Two-Dimensional Easy-Plane Magnets. Dynamics, Relaxation, and Contribution to the Magnet Response Functions"
- 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

- 2013–present **Professor**, *Department of Mathematics and Theoretical Radiophysics, Faculty of Radio Physics, Electronics and Computer Systems, Kyiv University, Kyiv, Ukraine.*
- 2008–2012 **Associate Professor**, *Department of Mathematics and Theoretical Radiophysics, Radiophysics Faculty, Kyiv University, Kyiv, Ukraine.*
- 2006–2007 **Humboldt Fellow**, *Bayreuth University, Bayreuth, Germany.*
- 2000–2005 **Associate Professor**, *Department of Mathematics and Theoretical Radiophysics, Radiophysics Faculty, Kyiv University, Kyiv, Ukraine.*
- 1994–2000 **Assistant Professor**, *Department of Mathematics and Theoretical Radiophysics, Radiophysics Faculty, Kyiv University, Kyiv, Ukraine.*

#### Part-time appointments

- 2010–present **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–present **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*

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*

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### Languages

Russian Fluent

*Mother tongue*

Ukrainian Fluent

*Native language*

English Good

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### Activity as a Referee

Review services for foundations 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)

Referee of the Journals Nature Nanotechnology, Nature Physics, ACS Nano, Nature Communications, Physical Review Letters, Materials Research Letters, Physical Review Applied, NPG Scientific Reports, 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

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### Conference Activities

2019 **Workshop “Curvilinear micromagnetism”**, funded by Alexander-von-Humboldt Foundation, *Co-organizer*, Kyiv, Ukraine.

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### Awards, grants, etc.

2020–2023 **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.

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## PhD theses supervised

- 2016 **O. V. Pylypovskiy**, *“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.

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## 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 curve nanofilms;
  - **A new (geometrical) mechanism of the Dzyaloshinskii-Moriya interaction** is predicted with numerous applications to curved magnets.

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## 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);
  - Modern Magnetism (54 hours, lecture course for Masters).

Seminars Classical Mechanics, Electrodynamics, Quantum Mechanics, Statistical Physics, Mathematical Physics, and Modern Magnetism

Educational publications 6 publications, including 4 textbooks.

## List of 10 selected publications

Peer reviewed publications > 80, see [The list of publications](#).

Google Scholar **Denis Sheka**.

Number of citations > 2000.

h-index **25**.

i10-index **52**.

- [1] 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 \(2018\)](#).
- [2] 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 \(2016\)](#).
- [3] D. D. Sheka, V. P. Kravchuk, Y. Gaididei. "Curvature effects in statics and dynamics of low dimensional magnets", *J. Phys. A*, [48 125202 \(2015\)](#).
- [4] O. V. Pylypovskiy, V. P. Kravchuk, D. D. Sheka, D. Makarov, O. G. Schmidt, Y. Gaididei. "Coupling of Chiralities in Spin and Physical Spaces: The Möbius Ring as a Case Study", *Phys.Rev.Lett*, [114 197204 \(2015\)](#).
- [5] Y. Gaididei, V. P. Kravchuk, D. D. Sheka. "Curvature Effects in Thin Magnetic Shells", *Phys.Rev.Lett*, [112 257203 \(2014\)](#).
- [6] Y. Gaididei, V. P. Kravchuk, D. D. Sheka. "Magnetic vortex dynamics induced by an electrical current", *Int. J. Quant. Chem.*, [110 83-97 \(2010\)](#).
- [7] J.-G. Caputo, Y. Gaididei, F. G. Mertens, D. D. Sheka. "Vortex polarity switching by a spin-polarized current", *Phys.Rev.Lett*, [98 056604 \(2007\)](#).
- [8] D. D. Sheka, Y. Gaididei, F. G. Mertens, "Current induced switching of vortex polarity in magnetic nanodisks", *Appl.Phys.Lett*, [91 082509 \(2007\)](#).
- [9] D. D. Sheka, B. A. Ivanov, F. G. Mertens. "Internal modes and magnon scattering on topological solitons in two-dimensional easy-axis ferromagnets", *Phys.Rev.B*, [64 024432 \(2001\)](#).
- [10] B. A. Ivanov, D. D. Sheka. "Dynamics of vortices and their contribution to the response functions of classical quasi-two-dimensional easy-plane antiferromagnet", *Phys.Rev.Lett*, [72 404-407 \(1994\)](#).