Curriculum Vitae

Olena Koptieva

Writing as **Elena Kopteva**
✉ **koptieva@illinois.edu**
Cell phone: **+1 2174179219**
ORCID 0000-0001-8364-0481

Work experience

09/2022–present

Visiting Research Specialist (Teaching & Research Faculty)

University of Illinois Urbana-Champaign (UIUC), Grainger Collage of Engineering, Physics Department, Champaign-Urbana, IL, USA

Research topics

Astrophysics, gravitation, and cosmology. Superradiance and horizons structure in generalized black hole space-times. Member of Witek Gravity Group; Member of ICASU; Associate Member of LISA Consortium.

Supervision

Co-supervisor of PhD research projects

"Superradiance in cosmological space-times," 2023- present.

"New inhomogeneous spherically symmetric solutions of the Einstein equations and their implications for the cosmological and astrophysical problems (continued)" in collaboration with Silesian University in Opava, and Institute of Experimental and Applied Physics, Czech Technical University in Prague, Czech Republic, 2018- present;

Supervisor of undergraduate research projects

"Derivation of conformally flat metric for generalized Schwarzschild-like solution", Spring 2025; "Horizon structure of the space-time of the charged black hole surrounded by domain walls," Spring 2024; "Quasinormal modes calculation for the charged scalar field scattering off of the charged black hole surrounded by domain walls," Fall 2024; "Shadows of cosmological black holes," Summer-Fall 2023.

Teaching

Classical Mechanics Phys 211; Special Relativity and Math Phys 225; Electricity and Magnetism Phys 212; Individual Study (Undergraduate) Phys 497.

08/2019–08/2022

Visiting Professor

Institute of Physics and Research Centre of Theoretical Physics and Astrophysics, Faculty of Philosophy and Science in Opava, Silesian University in Opava, Czech Republic (series of 3-5 months visits each year and remote collaboration)

Co-supervisor of PhD research project

"New inhomogeneous spherically symmetric solutions of the Einstein equations and their implication to some cosmological and astrophysical problems."

11/2016–08/2017

Assistant Professor

Scientific Research Center of Theoretical Physics and Astrophysics, Faculty of Philosophy and Science, Silesian University in Opava, Czech Republic

Co-supervisor of PhD research topics

Stefani cosmological models; Exact solutions of Einstein equations for modeling cosmological black holes.

05/2015–06/2016

Visiting Professor

Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, Dubna, Russia

Research topics

Gravitating objects on the cosmological background; Inhomogeneous cosmological models with variable spatial curvature.

12/2006 – 07/2015 **Associate Professor**

Theoretical Physics Department, Dnipropetrovsk National University (DNU), Dnipro, Ukraine

Research topics

Exact solutions for Einstein equations; Inhomogeneous cosmological models; Dark energy and dark matter; Black holes; Cosmological and astrophysical models with variable spatial curvature; Motion of weakly charged test particle near extremely charged black hole; T-models and Kantowski-Sachs models; "Cosmomicrophysics" program.

Teaching

Physics; Theoretical physics; Gravitation and Cosmology; Nonlinear dynamics; Fundamentals of physics and computer science; Physical principles of information technologies and computer science; Experimental practicum in nuclear physics and dosimetry.

12/2003 – 12/2006 **Teaching Assistant**

Physics Department, National Mining University, Dnipro, Ukraine

Research topic

Cosmological and astrophysical models with nonzero cosmological constant.

Teaching

Practical training and discussions in general physics; Physics lab practicum (experimental part in laboratories of mechanics, optics, thermodynamics, electromagnetism, solid state physics)

09/2001 – 12/2003 **Patent Expert at Center of Technology Commercialization, Dnipro, Ukraine**

Intellectual property prosecution, copyright, patents, international patents: World Organization (Patent Cooperation Treaty), European Patent applications etc.

Education

2006 **PhD in Physics**

Main specialty:	Physical and mathematical sciences (theoretical physics).
Field of Study:	General relativity and cosmology.
Thesis title:	"Cosmological and astrophysical models with cosmological constant."
Supervisor:	Professor Maria Korkina.
Institution:	Theoretical Physics Department, Dnipropetrovsk National University (DNU), Dnipro, Ukraine.

11/2000 – 11/2006 **PhD student**

Theoretical Physics Department, DNU, Dnipro, Ukraine.

09/1995 – 06/2000 **Undergraduate**

Diploma (analogous to Bachelor+Master's degree in the USA) With honors, Theoretical Physics Department, DNU, Dnipro, Ukraine.

09/1989 – 06/1993 **Diploma in Fine Arts, specialty: Painting**

Severobaikalsk School of Arts, Severobaikalsk, Buryatia, Russia.

Professional Activities

Grants and fellowships

- NSF PHY Grant No. 2409726: "Black Hole Probes of Beyond-Standard Model Particles and Fields". Start date: 08/15/2024. Amount: $240,000.
  My role: Co-PI.
- Visiting International Fellowship in Physical Sciences at the Faculty of Philosophy and Science of the Silesian University in Opava, Czech Republic. (2016-2017).
- Program of the National Academy of Sciences of Ukraine "Investigations of the structure and composition of the Universe, hidden mass and dark energy (Cosmomicrophysics)." (2007-2013).
  My role: Member.

International collaboration

- Associate Member of LISA Consortium. (2023-present).
- Member of Illinois Center for Advanced Studies of the Universe (ICASU), UIUC, Champaign-Urbana, IL, USA. (2023-present).
- Member of the American Physical Society (APS) and DGRAV Division. (2024-present).

Selected publications

- A. Stupka, **E. Kopteva**, M. Saliuk, I. Bormotova. (2023). Virial theorem for a cloud of stars obtained from the Jeans equations with second correlation moments. Eur. Phys. J. C, 83 7, 598, arXiv:2208.07695v3.
- **E. Kopteva**, I. Bormotova, M. Churilova, Z. Stuchlik. (2019). Accelerated Expansion of the Universe in the Model with Non-Uniform Pressure. The Astrophysical Journal 887. 98. arXiv:2001.07382v1.
- **E. Kopteva**, P. Jaluvkova, I. Bormotova, Z. Stuchlik. (2018). Exact Solution for a Black Hole Embedded in a Nonstatic Dust-filled Universe. The Astrophysical Journal. 866. 98. arXiv:1810.08613v1.
- M. Korkina, O. Iegurnov, **E. Kopteva**. (2016) Stefani cosmological models with accelerated expansion. Russian Physics Journal V. 59, № 3. P. 328-334. Russian Physics Journal. - № 3, v. 59. P. 328-334. Translated from Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika, No. 3, pp. 11–15, March 2016.
- M. Korkina, **E. Kopteva**. (2012) The generalization of the Tolman-Bondy solution. - Astronomical School's Report. - V. 8, P. 31 - 33.
- M. Korkina, **E. Kopteva**., Kazemir W. (2008) T-Models and Kantowski-Sachs Models. - Ukrainian Physics Journal. V. 53, № 2, P. 107-111.

Selected invited talks

- "Jeans equations with account of gravitational field correlations." Institute of Physics Seminar, Silesian University in Opava, Czech Republic (2022).
- "Generalized Lemaitre-Tolman-Bondi solution with nonzero pressure in modelling of cosmological black holes." Institute of Physics Seminar, Silesian University in Opava, Czech Republic (2022).
- "Luminosity distance within inhomogeneous cosmological models." Institute of Physics Seminar, Silesian University in Opava, Czech Republic (2021).
- "Particle and photon trajectories near a black hole immersed in dust". Seminar in Modern Mathematical Physics, Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, Dubna, Russia (2016).
- "Variable spatial curvature and accelerated cosmological expansion". Seminar in Modern Mathematical Physics, Bogoliubov Laboratory of Theoretical Physics, Joint

Institute for Nuclear Research, Dubna, Russia (2015).

- "The motion of the neutral particle with orbital momentum near extremely charged black hole". Boholubov Institute for Theoretical Physics, Kyiv (2010).
- "Quasi-classical neutral particle in extremely charged black hole field". Report at Summer School in Cosmology, ICTP, Trieste, Italy (2010).
- "Influence of the cosmological constant on the dynamics of a shear-free ideal liquid sphere." Astro Space Centre seminar in theoretical astrophysics, The Lebedev Physical Institute of the Russian Academy of Sciences, Moscow, Russia (2010).

Supervision and co-supervision

PhD students

- **D. Garzon,** PhD student at UIUC, Champaign-Urbana, IL, USA
  Project: "Superradiance in cosmological space-times." (2023-present)
  My role: Co-supervisor.
- **I. Bormotova,** PhD student at Institute of Physics and Research Centre of Theoretical Physics and Astrophysics, Faculty of Philosophy and Science, Silesian University in Opava, Czech Republic.
  Project: "New inhomogeneous spherically symmetric solutions of the Einstein equations and their implication to some cosmological and astrophysical problems." (2017-present).
  My role: Supervisor.
- **P. Jaluvkova**, PhD student at Silesian University in Opava, Faculty of Philosophy and Science, Opava, Czech Republic. Project: "Black holes in the cosmological background." (2015-2018).
  My role: Supervisor.

Undergraduate students

- **Z. Zeng,** 1st year undergraduate student at UIUC, Champaign-Urbana, IL, USA.
  Project: "Derivation of conformally flat metric for generalized Schwarzschild-like solution." Undergraduate research project for PHYS 497, SP25 semester.
  My role: Supervisor.
  In Spring 2025, **Z. Zeng was awarded** the Ralph O. Simmons Undergraduate Research Scholarship by the Department of Physics at UIUC.
- **Yi Zhang,** 3rd year undergraduate student at UIUC, Champaign-Urbana, IL, USA.
  Project I: "Horizon structure of the space-time of the charged black hole surrounded by domain walls." Undergraduate research project for PHYS 497, SP24 semester.
  My role: Supervisor.
  Project II: "Quasinormal modes calculation for the charged scalar field scattering off the charged black hole surrounded by domain walls." Summer-Fall 2024.
  My role: Supervisor.
  In Spring 2025, **Yi Zhang accepted an offer from the Physics graduate program** at UIUC.
- **S. Gupta,** 2nd year undergraduate student at UIUC **awarded** the 2023 Lorella M. Jones Summer Research Award, Champaign-Urbana, IL, USA.
  Project I: "Shadows of cosmological black holes I." (Summer 2023).
  My role: Supervisor.
  Project II: "Shadows of cosmological black holes II." (Summer 2024).
  My role: Supervisor.
- **A. Hradyskyi**, 5th year student at DNU, Dnipro, Ukraine. Master's diploma project: "Possible explanation for dark matter in the Universe." (2014).
  My role: Supervisor.
- **S. Vasilieva** 5th year student at DNU, Dnipro, Ukraine. Master's diploma project: "Friedman models with positive spatial curvature." (2013).
  My role: Supervisor.
- **V. Krivosheina,** 5th year student at DNU, Dnipro, Ukraine. Master's diploma project: "The influence of different types of matter on the CMB anisotropy spectrum." (2012).

My role: Supervisor.

High school students

- **Jyotsna Velu**, Junior at Adlai E. Stevenson High School, Class of 2026, Buffalo Grove IL, USA.
  Xavier Kader, Sophomore at Lane Tech College Prep High School, Class of 2027, Chicago IL, USA.
  The Worldwide Youth in Science and Engineering (WYSE) at The Grainger College of Engineering and the Carle-Illinois College of Medicine 2024 Summer of STEMM Young Scholars Research Program.
  Project: "Colliding Black Holes on Supercomputers." Summer 2024.
  My role: Mentor.

Teaching

- **Phys 225 Special Relativity and Math. Applications**. 1st, 2nd year undergraduate in Physics, UIUC, Champaign-Urbana, IL, USA.
  Responsibility: Course director, main lecturer (119 students), in person. Fall 2023.
  Course director, main lecturer (140 students), in person. Fall 2024.
  Course director, main lecturer (200 students), in person + online section. Spring 2025.
- **Phys 212 Electricity and Magnetism**. 1st year undergraduate, UIUC, Champaign-Urbana, IL, USA.
  Responsibility: Course instructor, second Lecturer (150 students), in person. Spring 2024.
- **Phys 497 Individual Study (Undergraduate).**
- **Phys 211 Classical Mechanics**. 1st year undergraduate, UIUC, Champaign-Urbana, IL, USA.
  Responsibility: Discussion coordinator (25 TAs), Discussion TA (25 of 1200 students), in person. Spring 2023.
- **Phys 225 Special Relativity and Math. Applications**. 1st, 2nd year undergraduate in Physics, UIUC, Champaign-Urbana, IL, USA.
  Responsibility: Course director, main lecturer (116 students), in person. Fall 2023.
- **General Physics.** 1st year undergraduate in Physics, DNU, Dnipro, Ukraine.
  Responsibility: Course director, main lecturer (60 students), in person. Spring-Fall 2014.
- **General Physics.** 1st year undergraduate in Mathematics, DNU, Dnipro, Ukraine.
  Responsibility: Discussion instructor (100 students). Spring-Fall 2013.
- **Gravitation and Cosmology**. 4th year undergraduate in Theoretical Physics, DNU, Dnipro, Ukraine.
  Responsibility: Discussion instructor (20 students). 2010-2014.
- **Physical principles of information technologies and computer science**. 3rd year undergraduate in Physics, DNU, Dnipro, Ukraine.
  Responsibility: Course director, main lecturer (40 students), in person. 2013.
- **Fundamentals of physics and computer science**. 3rd year undergraduate in Physics, DNU, Dnipro, Ukraine.
  Responsibility: Course director, main lecturer (45 students), in person. 2012.
  Nuclear and atomic physics. Experimental practicum in nuclear physics and dosimetry. 2nd year undergraduate in Physics, DNU, Dnipro, Ukraine.
  Responsibility: Lab instructor, (100 students), in person. 2009-2014.
- **Nonlinear dynamics** 2nd year undergraduate in Physics, DNU, Dnipro, Ukraine.
  Responsibility: Lab practicum instructor (20 students). 2007-2009.

Service

Co-organizer of Astrophysics, Gravitation, and Cosmology Seminar, Physics UIUC, Champaign-Urbana, IL, USA. 2024-2025.

Outreach and broader impact

- Member of the international network Scholars at Risk (SAR). 2023-present.
- Invited talk “My Family and War” for the Illinois Club Cosmopolitan Group. Winter 2024.
- Mentoring high school students within the Worldwide Youth in Science and Engineering (WYSE) at The Grainger College of Engineering and the Carle-Illinois College of Medicine 2024 Summer of STEMM Young Scholars Research Program. Project: “Colliding Black Holes on Supercomputers.” Summer 2024.
- Invited Lecture “Gravitational Waves” for Phys 403, UIUC, Summer 2024.
- Invited Lecture “Cosmic Strings, Domain Walls and the Cosmological Vacuum” for PHYS403, UIUC, Spring 2024.
- Invited Lecture “Cosmology” for Phys 403, UIUC, Fall 2023.
- Invited Lecture “Accelerated Expansion of the Universe” for Phys 403, UIUC, Summer 2023.
- Invited talk “Family and War” in the Illinois Global Institute as part of Speaker Series "The Global Impacts of the War in Ukraine”, 2023.

Miscellaneous

Languages

- English (fluent)
- Czech (fluent)
- Ukrainian (native)
- Russian (native)

Advanced Computer skills

- Numerical methods and scientific computing, Mathematica.
- Numerical modeling of nonlinear dynamical systems.
- Programming (Basic, Pascal, VB.Net).
- Computer art (Photoshop).

Other skills

- US Driver's license.
- Patents and intellectual property expertise.
- Professional painting.
- Literature, poetry. Three published books with my poetry.
  E.M. Kopteva. All Ways. (Vse dorogi (in Russian)). Moskow 2016. 408 p.
  E.M. Kopteva. White Beasts. (Belyje zveri (in Russian)). Dnipropetrovsk University Press, 2002. 27p. ISBN 966-551-100-9.
  E.M. Kopteva. Tales (in Russian). Miniature Poetry Library."Chetverg", St. Petersburg, 2000. 16p.
- Professional drama acting.
- Athletic running, basketball playing, wild forest surviving, hiking, 2nd category in orienteering.

Full Publication list

In the publications listed, the order of authors reflects the relative contribution, with the first author being the primary contributor. My supervised students are highlighted in italics.

1. A. Stupka, **E. Kopteva**, M. Saliuk, *I. Bormotova*. (2023) Virial theorem for a cloud of stars obtained from the Jeans equations with second correlation moments. Eur. Phys. J. C, 83 7, 598, arXiv:2208.07695v3.
3. *I. Bormotova*, **E. Kopteva**, Z. Stuchlik. (2021) Geodesic Structure of the Accelerated Stephani Universe. Symmetry, 13(6), 1001 arXiv:2103.08999v2
4. *I. Bormotova*, **E. Kopteva**, M. Churilova, Z. Stuchlik. (2020) Accelerated expansion of the universe from the perspective of inhomogeneous cosmology. Int. J. Mod. Phys. A arXiv:2002.00454v1
5. **E. Kopteva**, *I. Bormotova*, M. Churilova, Z. Stuchlik. (2019) Accelerated Expansion of the Universe in the Model with Non-Uniform Pressure. The Astrophysical Journal 887. 98. arXiv:2001.07382v1
6. **E. Kopteva**, *P. Jaluvkova*, *I. Bormotova*, Z. Stuchlik. (2018) Exact Solution for a Black Hole Embedded in a Nonstatic Dust-filled Universe. The Astrophysical Journal. 866. 98. arXiv:1810.08613v1
7. *P. Jaluvkova*, **E. Kopteva**, Z. Stuchlik. The model of the black hole enclosed in dust: the flat space case. Gen. Rel. Grav. (2017). 49: 80. arXiv:1602.01266v2
8. *I. Bormotova*, **E. Kopteva**. (2016) Geodesic motion of test particles in Korkina-Grigoryev metric. arXiv:1611.07398v1
9. **E. Kopteva**, *P. Jaluvkova*, Z. Stuchlik. (2016) The generalized Lemaitre-Tolman-Bondi solutions with nonzero pressure in modeling the cosmological black holes. arXiv:1611.06182v2
10. *I. Bormotova*, **E. Kopteva**. Friedmann cosmological models with various equations of state of matter. (2015) Ukrainian Physics Journal.
11. M. Korkina, O. Iegurnov, **E. Kopteva**. (2016) Stefani cosmological models with accelerated expansion. Russian Physics Journal V. 59, № 3. P. 328-334. Russian Physics Journal. - № 3, v. 59. P. 328-334. Translated from Izvestiya Vysshikh Uchebnykh Zavedenii, Fizika, No. 3, P. 11 - 15, March, 2016.
12. M. Korkina, O. Iegurnov, **E. Kopteva**. (2015) Inhomogeneous Cosmological Models Based on the Stephani Solution. The bulletin of Dnipropetrovsk National University, Physics and Radioelectronics. - V. 23, issue 22.
13. **E. Kopteva**, *A. Hradisky*. (2014) Energy Density and Pressure of the Stefani's Universe with Radiation and Negative Spatial Curvature. - Astronomical School's Report. V. 10, № 1, P. 62 - 65.
14. **E. Kopteva**, *A. Hradisky*. (2014) Special case for shiftless cosmological model with radiation under negative space curvature. - The bulletin of Dnipropetrovsk National University, Rocket and Space Technology. - V. 22, № 4, issue 18, part 2. P. 52 - 57.
15. M. Korkina, **E. Kopteva**, S. Grigori'ev. (2013) Coordinates and reference systems. - Proceedings for International conference "Training theory and technique in reading courses of mathematics, physics and informatics", № 11, v. 2.
16. M. Korkina, **E. Kopteva**. (2012) The generalization of the Tolman-Bondy solution. - Astronomical School's Report. - V. 8, P. 31 - 33.
17. M. Korkina, **E. Kopteva**. (2012) The mass function method for obtaining exact solutions in General Relativity. - Space, Time and Fundamental Interactions. V. 1, P. 38 - 47. arXiv:1604.08247v2
18. M. Korkina, **E. Kopteva**. (2008) Cosmological model with effective state equation. - The bulletin of Dnipropetrovsk National University, Physics and Radio electronics.
19. M. Korkina, **E. Kopteva**., Kazemir W. (2008) T-Models and Kantowski-Sachs Models. - Ukrainian Physics Journal. V. 53, № 2, P. 107-111.
20. M. Korkina, **E. Kopteva**, O. Orlyansky. (2005) The Friedman Models with the Pressure and the Cosmological Constant. - Ukrainian Physics Journal. V. 50, № 1. - P. 11-15.
21. **E. Kopteva**. (2004) The Homogeneous and Isotropic Universe with Domain Walls. - The bulletin of Dnipropetrovsk National University, Physics and Radio electronics. part 12. - P. 161-163

Textbooks, manuals, workbooks

1. M.P. Korkina, **E.M. Kopteva** (2012) The Mass Function Method. Workbook for cosmology. – Dnipropetrovsk National University Press.
2. **E.M. Kopteva**, Ye.A. Yakunin, A.V. Chernay (2005) Studying the Magnetoelasticity Effect. Workbook for general physics course, solid state physics section. – Dnipropetrovsk: National Mining University Press.
3. **E.M. Kopteva**, Ye.A. Yakunin, A.V. Chernay, A.V. Podlyatskaya (2005) Studying the temperature dependence of resistance of the semiconductor and finding its forbidden band. Workbook for general physics course, solid state physics section. – Dnipropetrovsk: National Mining University Press.