Elena Kopteva

Legal name (HR/payroll): Olena Koptieva

ORCID: 0000-0001-8364-0481 — koptieva@illinois.edu — +1 (217) 417-9219 — elena-kopteva.github.io

Appointments

Visiting Research Scientist (Teaching & Research Faculty) 09/2022–present
University of Illinois Urbana–Champaign (UIUC), Grainger College of Engineering, Department of Physics, Champaign–Urbana, IL, USA

Visiting Professor 08/2019–08/2022
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 month visits each year and remote collaboration.

Assistant Professor 11/2016–08/2017
Scientific Research Center of Theoretical Physics and Astrophysics, Faculty of Philosophy and Science, Silesian University in Opava, Czech Republic

Visiting Professor 05/2015–06/2016
Bogoliubov Laboratory of Theoretical Physics, Joint Institute for Nuclear Research, Dubna, Russia

Associate Professor 12/2006–07/2015
Theoretical Physics Department, Dnipropetrovsk National University (DNU), Dnipro, Ukraine

Teaching Assistant 12/2003–12/2006
Physics Department, National Mining University, Dnipro, Ukraine

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

Research Topics

General relativity, cosmology, and astrophysics — including exact solutions of Einstein's equations, black holes in evolving backgrounds, black hole perturbations and superradiance in generalized spacetimes. Member, Witek Gravity Group; Member, ICASU; Associate Member, LISA Consortium.

Supervision

PhD Co-Supervision

- *Superradiance in cosmological spacetimes* (2023–present).
- *New inhomogeneous spherically symmetric solutions of the Einstein equations and their implications for cosmological and astrophysical problems* (2018–present); collaboration with Silesian University in Opava and IEAP, Czech Technical University in Prague.

Undergraduate Supervision

- *Derivation of conformally flat metric for generalized Schwarzschild-like solution* (Spring–Fall 2025).
- *Horizon structure of a charged black hole surrounded by domain walls* (Spring 2024).
- *Quasinormal modes for a charged scalar field scattering off a charged black hole surrounded by domain walls* (Fall 2024).
- *Shadows of cosmological black holes* (Summer–Fall 2023).

Teaching

UIUC — PHYS 211 Classical Mechanics; PHYS 212 Electricity & Magnetism; PHYS 225 Special Relativity & Mathematical Applications; PHYS 497 Individual Study (Undergraduate).

DNU (Ukraine) — General Physics (Physics & Mathematics majors); Gravitation and Cosmology; Nonlinear Dynamics; Fundamentals of Physics & Computer Science; Physical Principles of IT & CS; Nuclear & Atomic Physics lab practicum.

Education

PhD in Physics (Physical and Mathematical Sciences — Theoretical Physics) 2006
Theoretical Physics Department, Dnipropetrovsk National University (DNU), Dnipro, Ukraine
Thesis: *Cosmological and astrophysical models with cosmological constant.*
Supervisor: Prof. Maria Korkina.

PhD Student 11/2000–11/2006
Theoretical Physics Department, DNU, Dnipro, Ukraine

Undergraduate Diploma (BSc+MSc equivalent), with honors 1995–2000
Theoretical Physics Department, DNU, Dnipro, Ukraine

Grants and Fellowships

- NSF PHY Grant No. 2409726: *Black Hole Probes of Beyond-Standard Model Particles and Fields*. Start: 08/15/2024. Amount: $240,000. Role: Co-PI.
- Visiting International Fellowship in Physical Sciences, Silesian University in Opava, Czech Republic (2016–2017).
- National Academy of Sciences of Ukraine program “Cosmomicrophysics” (2007–2013). Role: Member.

International Collaboration & Memberships

- Associate Member, LISA Consortium (2023–present).
- Member, Illinois Center for Advanced Studies of the Universe (ICASU), UIUC (2023–present).
- Member, American Physical Society (APS), 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:2208.07695.
- **E. Kopteva**, *I. Bormotova*, M. Churilova, Z. Stuchlík (2019). Accelerated Expansion of the Universe in the Model with Non-Uniform Pressure. *Astrophys. J.* **887**, 98. arXiv:2001.07382.
- **E. Kopteva**, P. Jaluvkova, *I. Bormotova*, Z. Stuchlík (2018). Exact Solution for a Black Hole Embedded in a Nonstatic Dust-filled Universe. *Astrophys. J.* **866**, 98. arXiv:1810.08613.
- M. Korkina, O. Iegurnov, **E. Kopteva** (2016). Stefani cosmological models with accelerated expansion. *Russ. Phys. J.* **59**(3), 328–334.
- M. Korkina, **E. Kopteva** (2012). The generalization of the Tolman–Bondi solution. *Astronomical School's Report* **8**, 31–33.
- M. Korkina, **E. Kopteva**, W. Kazemir (2008). T-Models and Kantowski–Sachs Models. *Ukrainian Physics Journal* **53**(2), 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 LTB solution with nonzero pressure in modeling 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, BLTP, JINR, Dubna, Russia (2016).
- "Variable spatial curvature and accelerated cosmological expansion." Seminar in Modern Mathematical Physics, BLTP, JINR, Dubna, Russia (2015).
- "The motion of the neutral particle with orbital momentum near extremely charged black hole." Bogolyubov Institute for Theoretical Physics, Kyiv (2010).
- "Quasi-classical neutral particle in extremely charged black hole field." 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, Lebedev Physical Institute, Moscow, Russia (2010).

Supervision and Co-supervision (Detailed)

PhD Students

- D. Garzon (UIUC): *Superradiance in cosmological spacetimes* (2023–present). Role: Co-supervisor. *Awards: 2025 ICASU Graduate Fellowship, AAUW Fellowship (2024–2025), Mavis Future Faculty Fellowship (2024).*
- *I. Bormotova* (Silesian University in Opava): *New inhomogeneous spherically symmetric solutions of the Einstein equations and their implication to some cosmological and astrophysical problems* (2017–present). Role: Supervisor.
- P. Jaluvkova (Silesian University in Opava): *Black holes in the cosmological background* (2015–2018). Role: Supervisor.

Undergraduate Students

- Z. Zeng (UIUC): *Derivation of a conformally flat metric for a generalized Schwarzschild-like solution.* PHYS 497 (Spring 2025); undergraduate research (Summer–Fall 2025). Role: Supervisor.
  Award: Ralph O. Simmons Undergraduate Research Scholarship (Summer 2025).
- Yi Zhang (UIUC): *Horizon structure of the spacetime of the charged black hole surrounded by domain walls.* PHYS 497 (Spring 2024). Role: Supervisor.
  Project II: Quasinormal modes for charged scalar scattering off a charged black hole surrounded by domain walls. Undergraduate research (Summer–Fall 2024).
  Outcome: Accepted offer from the Physics graduate program at UIUC (Spring 2025).
- S. Gupta (UIUC): *Shadows of cosmological black holes I & II.* (Summer 2023; Summer 2024). Role: Supervisor.
  Award: 2023 Lorella M. Jones Summer Research Award.
- A. Hradyskyi (DNU): *Possible explanation for dark matter in the Universe.* Master diploma project (2014). Role: Supervisor.
- S. Vasilieva (DNU): *Friedmann models with positive spatial curvature.* Master diploma project (2013). Role: Supervisor.
- V. Krivosheina (DNU): *Influence of different types of matter on the CMB anisotropy spectrum.* Master diploma project (2012). Role: Supervisor.

High School Students and Outreach Research

- SriRitvik Yellamilli (High Metea Valley High School, Class of 2027), Maddie Smith (Southland College Prep Charter High School, Class of 2026), within Within WYSE Summer of STEMM Young Scholars Research Program, Grainger College of Engineering & Carle-Illinois College of Medicine: *Visualizing Spacetime: Supercomputer Simulations of Black Hole Coalescence.* (Summer 2025). Role: Mentor.
- Jyotsna Velu (Adlai E. Stevenson High School, Class of 2026), Xavier Kader (Lane Tech College Prep High School, Class of 2027). Within WYSE Summer of STEMM Young Scholars Research Program, Grainger College of Engineering & Carle-Illinois College of Medicine: *Colliding Black Holes on Supercomputers* (Summer 2024). Role: Mentor.

Teaching (Detailed)

PHYS 225 (UIUC)	Course director, main lecturer; in person. Fall 2023 (119 students), Fall 2024 (140 students), Spring 2025 (200 students, in person + online), Fall 2025 (140 students), Spring 2026 (200 students, in person).
PHYS 212 (UIUC)	Course instructor, second lecturer (150 students), Spring 2024.
PHYS 497 (UIUC)	Individual Study (Undergraduate).
PHYS 211 (UIUC)	Discussion coordinator (25 TAs); Discussion TA (25 of 1200 students), Spring 2023.
General Physics (DNU)	Course director, main lecturer (60 students), Spring–Fall 2014 (Physics); Discussion instructor (100 students), Spring–Fall 2013 (Mathematics).
Gravitation and Cosmology (DNU)	Discussion TA (20 students), 2010–2014.

Physical Principles of IT & CS (DNU)	Course director, main lecturer (40 students, in person), 2013.
Fundamentals of Physics & CS (DNU)	Course director, main lecturer (45 students, in person), 2012.
Nuclear & Atomic Physics (DNU)	Lab instructor (100 students), 2009–2014.
Nonlinear Dynamics (DNU)	Lab instructor (20 students), 2007–2009.

Service

Co-organizer, Astrophysics, Gravitation, and Cosmology Seminar, Department of Physics, UIUC (2024–2026).
Co-organizer and chair, Interdisciplinary Seminar for Natural Sciences, DNU, Dnipro, Ukraine. (2006–2008).
Co-organizer, Seminar on Theoretical Physics, National Miming University, Dipro Ukraine. (2003–2006).

Outreach & Broader Impact

- Member, Scholars at Risk (SAR) network (2023–present).
- Mentor, WYSE Young Scholars Research Program: *Colliding Black Holes on Supercomputers* (Summer 2024; Summer 2025).
- Invited Lecture "Baryogenesis" for PHYS 403, UIUC (Summer 2025).
- Invited talk, "The Human Side of Physics" series, Society of Physics Students, UIUC (Spring 2025).
- Invited lecture "Carrying Two Realities" at OLLI, UIUC (Spring 2025).
- Invited talk "My Family and War" for the Illinois Club Cosmopolitan Group (Winter 2024).
- Invited Lecture "Gravitational Waves" for PHYS 403, UIUC (Summer 2024).
- Invited Lecture "Cosmic Strings, Domain Walls and the Cosmological Vacuum" for PHYS 403, 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 Speaker Series (2023).

Computational and Programming

Primary/routine use: Mathematica, LaTeX.
Working knowledge: Python (read/modify scripts; numerical analysis and visualization).
Additional training: Center for AI Innovation, NCSA–UIUC — *AI Training Seminar Series* (Fall 2025). Topics included AutoEncoders/VAEs, GANs, CycleGANs, and Diffusion Models in PyTorch. Electronic badge awarded.
Legacy/prior exposure: Pascal, BASIC, VB.NET.

Miscellaneous

Languages: English (fluent); Czech (advanced); Ukrainian (native); Russian (native).
Other skills: U.S. Driver's license; Patents and intellectual property expertise; Visual design & scientific illustration (formal training in painting; portfolio on website); literature and poetry (three published books).

Poetry Books

E. M. Kopteva. *All Ways* (Vse dorogi, in Russian). Moscow, 2016. 408 pp.
E. M. Kopteva. *White Beasts* (Belye zveri, in Russian). Dnipropetrovsk University Press, 2002. 27 pp. ISBN 966-551-100-9.
E. M. Kopteva. *Tales* (in Russian). Miniature Poetry Library "Chetverg", St. Petersburg, 2000. 16 pp.

Full Publication List (Selected Entries)

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.

- *Z. Zeng*, **E. Kopteva** (2026) Isotropic Coordinates for Generalized Schwarzschild-like Solutions. *arXiv preprint.* arXiv:2506.19705.
- 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:2208.07695.
- *I. Bormotova*, **E. Kopteva**, Z. Stuchlík (2021) Geodesic Structure of the Accelerated Stephani Universe. *Symmetry* **13**(6), 1001. arXiv:2103.08999.
- *I. Bormotova*, **E. Kopteva**, M. Churilova, Z. Stuchlík (2020) Accelerated expansion of the universe from the perspective of inhomogeneous cosmology. *Int. J. Mod. Phys. A.* arXiv:2002.00454.
- **E. Kopteva**, *I. Bormotova*, M. Churilova, Z. Stuchlík (2019) Accelerated Expansion of the Universe in the Model with Non-Uniform Pressure. *Astrophys. J.* **887**, 98. arXiv:2001.07382.
- **E. Kopteva**, *P. Jaluvkova*, *I. Bormotova*, Z. Stuchlík (2018) Exact Solution for a Black Hole Embedded in a Nonstatic Dust-filled Universe. *Astrophys. J.* **866**, 98. arXiv:1810.08613.
- P. Jaluvkova, **E. Kopteva**, Z. Stuchlík (2017) The model of the black hole enclosed in dust: the flat space case. *Gen. Rel. Grav.* **49**:80. arXiv:1602.01266.
- *I. Bormotova*, **E. Kopteva** (2016) Geodesic motion of test particles in Korkina–Grigoryev metric. arXiv:1611.07398.
- **E. Kopteva**, *P. Jaluvkova*, Z. Stuchlík (2016) The generalized Lemaitre–Tolman–Bondi solutions with nonzero pressure in modeling the cosmological black holes. arXiv:1611.06182.
- *I. Bormotova*, **E. Kopteva** (2015) Friedmann cosmological models with various equations of state of matter. *Ukrainian Physics Journal.*
- M. Korkina, O. Iegurnov, **E. Kopteva** (2016) Stefani cosmological models with accelerated expansion. *Russ. Phys. J.* **59**(3), 328–334.
- M. Korkina, O. Iegurnov, **E. Kopteva** (2015) Inhomogeneous Cosmological Models Based on the Stephani Solution. *Bulletin of Dnipropetrovsk National University, Physics and Radioelectronics* **23**(22).
- **E. Kopteva**, *A. Hradisky* (2014) Energy Density and Pressure of the Stefani's Universe with Radiation and Negative Spatial Curvature. *Astronomical School's Report* **10**(1), 62–65.

- **E. Kopteva**, *A. Hradisky* (2014) Special case for shiftless cosmological model with radiation under negative space curvature. *Bulletin of Dnipropetrovsk National University, Rocket and Space Technology* **22**(4), issue 18, part 2, 52–57.
- M. Korkina, **E. Kopteva**, S. Grigori'ev (2013) Coordinates and reference systems. In: Proceedings of the International conference "Training theory and technique in reading courses of mathematics, physics and informatics" **11**(2).
- M. Korkina, **E. Kopteva** (2012) The generalization of the Tolman–Bondi solution. *Astronomical School's Report* **8**, 31–33.
- M. Korkina, **E. Kopteva** (2012) The mass function method for obtaining exact solutions in General Relativity. *Space, Time and Fundamental Interactions* **1**, 38–47. arXiv:1604.08247.
- M. Korkina, **E. Kopteva** (2008) Cosmological model with effective state equation. *Bulletin of Dnipropetrovsk National University, Physics and Radioelectronics*.
- M. Korkina, **E. Kopteva**, W. Kazemir (2008) T-Models and Kantowski–Sachs Models. *Ukrainian Physics Journal* **53**(2), 107–111.
- M. Korkina, **E. Kopteva**, O. Orlyansky (2005) The Friedman Models with the Pressure and the Cosmological Constant. *Ukrainian Physics Journal* **50**(1), 11–15.
- **E. Kopteva** (2004) The Homogeneous and Isotropic Universe with Domain Walls. *Bulletin of Dnipropetrovsk National University, Physics and Radioelectronics* **12**, 161–163.

Textbooks, Manuals, Workbooks

- M. P. Korkina, E. M. Kopteva (2012) *The Mass Function Method*. Workbook for cosmology. Dnipropetrovsk National University Press.
- E. M. Kopteva, Ye. A. Yakunin, A. V. Chernay (2005) *Studying the Magnetoelasticity Effect*. Workbook for general physics course, solid state physics section. National Mining University Press.
- 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. National Mining University Press.

Last updated: March 17, 2026