

Tenio Popmintchev

Tenio Popmintchev (born June 29, 1977) is a Bulgarian-American physicist specializing in ultrafast lasers and coherent X-ray science. He is an Assistant Professor of Physics at the University of California, San Diego (UCSD), where he leads the Popmintchev LABS focused on quantum X-ray technology.^{[1][2]} Popmintchev is known for his pioneering work in developing tabletop X-ray lasers capable of generating coherent extreme ultraviolet (EUV) and soft-to-hard X-rays, enabling attosecond imaging of quantum systems.^{[3][4]}

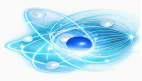
His research has applications in imaging advanced quantum materials, EUV lithography metrology, and ultrafast spectroscopies, pushing the boundaries from attosecond to zeptosecond timescales.^{[5][6]}



Early life and education

Popmintchev was born in Bulgaria in 1977.^[7] He earned his undergraduate degree in Quantum Electronics and Laser Physics from Sofia University.^[8] In 2003, he moved to the United States to pursue graduate studies. He received his Ph.D. in Atomic, Molecular, and Optical Physics from the University of Colorado Boulder in 2010.^{[9][10]}

Born	June 29, 1977 Bulgaria
Fields	Physics Atomic, molecular, and optical physics Ultrafast lasers Coherent X-ray science
Institutions	Technical University of Vienna JILA (University of Colorado Boulder and NIST) University of California, San Diego (<i>current</i>)
Alma mater	Sofia University (BS) University of Colorado Boulder (PhD)
Known for	Tabletop X-ray lasers High-harmonic generation



Following his Ph.D., Popmintchev served as a postdoctoral fellow and later as a research professor at JILA, a joint institute between the University of Colorado Boulder and the National Institute of Standards and Technology (NIST).^{[11][12]} He joined the faculty at UCSD as an Assistant Professor in the Department of Physics and the Center for Advanced Nanoscience.^{[13][14]} He also holds an affiliation with the Technical University of Vienna (TU Wien) in Austria.^[4]

Awards

ERC Starting Grant (2017)
SN 10 Outstanding Young Scientist Award (2016)
Presidential Medal from Bulgaria (2016)
Pythagoras Award for Outstanding Young Scientist (2016)
TOYP 2015 The Outstanding Young Persons of Bulgaria (2015)
Finalist, Outstanding Ph.D. Thesis Research Award (2011)

Research

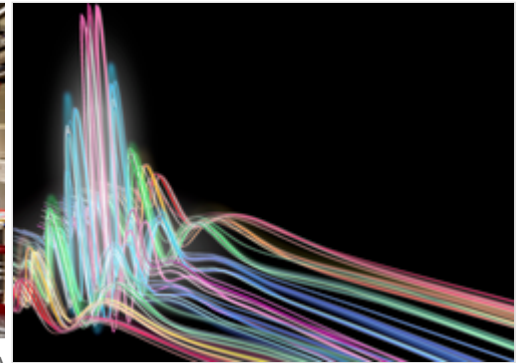
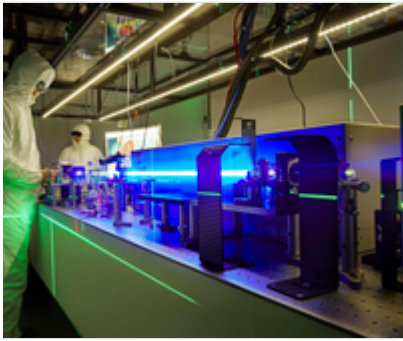
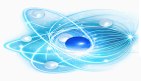
Popmintchev's research centers on quantum EUV and X-ray science and technology, including the development of coherent X-ray light with tunable classical and quantum properties for ultrafast imaging and spectroscopies of quantum materials.^[15] Key areas include:

- **High-Harmonic Generation (HHG):** Pioneering work on generating bright coherent ultrahigh harmonics in the keV X-ray regime using mid-infrared femtosecond lasers.^[4]
- **Tunable X-ray Lasers and Instrumentation:** Developing coherent EUV and X-ray lasers based on HHG with tunable spectral, temporal, spatial shape, and spin and orbital angular momentum, as well as compact, aberration-free spectrometers and monochromators for EUV-soft X-ray applications.^{[16][17]}
- **Attosecond and Zeptosecond Pulses:** Advancing coherent X-ray "combs" and "rainbows" for 5D imaging of quantum nanosystems, including first practical proposal for generating coherent spectral waveforms which can potentially support sub-attosecond, zeptosecond pulse durations.^{[18][19]}
- **Applications:** EUV lithography metrology, femtosecond dynamic imaging, and EUV - X-ray coherent diffractive imaging.^[20]

His lab, Popmintchev LABS, focuses on X-ray combs for ultrafast imaging, quantum design of coherent X-rays, and the zeptosecond hard X-ray frontier.^{[21][22]}

Sloan Research Fellowship (2018)

Attosecond and zeptosecond X-ray pulses



Generation of bright coherent EUV and X-ray light using ultrafast UV-VIS-IR lasers at the Quantum EUV-Xray Labs at University of California San Diego

Artistic impression of a coherent X-ray pulse spanning more than 12 octaves of frequencies - a rainbow of invisible X-ray colors

Awards and honors

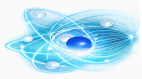
Popmintchev has received several prestigious awards for his contributions to physics:

- 2018: Sloan Research Fellowship, Alfred P. Sloan Foundation
- 2017: European Research Council Starting Grant (ERC STG)
- 2016: SN 10 Outstanding Young Scientist Award, Science News
- 2016: Presidential Medal for Pioneering Contribution to Science and Technology, President of Bulgaria
- 2016: Pythagoras Award for Outstanding Young Scientist, Bulgarian Ministry of Science and Education
- 2015: TOYP 2015 The Outstanding Young Persons of Bulgaria, Junior Chamber International Foundation
- 2011: Finalist, Outstanding Ph.D. Thesis Research Award, American Physical Society (Division of Atomic, Molecular, Optical Physics)^{[23][24][25]}

Selected Publications

Notable publications with high impact in the field include:

- T. Popmintchev, M.-C. Chen, D. Popmintchev, P. Arpin, S. Brown, et al. "Bright coherent ultrahigh harmonics in the keV x-ray regime from mid-infrared femtosecond lasers." *Science*, 336(6086), 1287-1291 (2012). (Cited 2235 times)^[4]
- T. Popmintchev, M.-C. Chen, P. Arpin, M. M. Murnane, H. C. Kapteyn. "The attosecond nonlinear optics of bright coherent X-ray generation." *Nature Photonics*, 4, 822-832 (2010). (Cited 807 times)^[4]
- O. Kfir, P. Grychtol, E. Turgut, R. Knut, D. Zusin, D. Popmintchev, et al. "Generation of bright phase-matched circularly-polarized extreme ultraviolet high harmonics." *Nature Photonics*, 9, 99-105 (2015). (Cited 600 times)^[4]



matching of high harmonic generation in the soft and hard X-ray regions of the spectrum." *Proceedings of the National Academy of Sciences*, 106(26), 10516-10521 (2009). (Cited 552 times)^[4]

- M.-C. Chen, P. Arpin, T. Popmintchev, M. Gerrity, B. Zhang, M. Seaberg, et al. "Bright, Coherent, Ultrafast Soft X-Ray Harmonics Spanning the Water Window from a Tabletop Light Source." *Physical Review Letters*, 105(17), 173901 (2010). (Cited 467 times)^[4]
- T. Fan, P. Grychtol, R. Knut, C. Hernández-García, D. D. Hickstein, D. Zusin, et al. "Bright circularly polarized soft X-ray high harmonics for X-ray magnetic circular dichroism." *Proceedings of the National Academy of Sciences*, 112(46), 14206-14211 (2015). (Cited 347 times)^[4]
- X. Zhang, A. L. Lytle, T. Popmintchev, X. Zhou, H. C. Kapteyn, M. M. Murnane, et al. "Quasi-phase-matching and quantum-path control of high-harmonic generation using counterpropagating light." *Nature Physics*, 3, 270-275 (2007). (Cited 310 times)^[4]
- N. L. Wagner, A. Wüest, I. P. Christov, T. Popmintchev, X. Zhou, M. M. Murnane, et al. "Monitoring molecular dynamics using coherent electrons from high harmonic generation." *Proceedings of the National Academy of Sciences*, 103(36), 13279-13285 (2006). (Cited 261 times)^[4]
- D. Popmintchev, C. Hernández-García, F. Dollar, C. Mancuso, et al. "Ultraviolet surprise: Efficient soft x-ray high-harmonic generation in multiply ionized plasmas." *Science*, 350(6262), 1225-1231 (2015). (Cited 251 times)^[4]

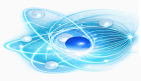
Plenary and keynote talks

Plenary Presentations

1. **Plenary talk:** Quantum Optics Meets Attosecond Science: New Regimes of Coherent X-ray Generation, Conference on Advanced Topics in Photonics 2025, 03-05 July 2025 Sofia, Bulgaria. Presented by Tenio Popmintchev.
2. **Plenary talk:** Quantum Optics Meets Attosecond Science: New Regimes of Coherent X-ray Generation, 32nd ANNUAL INTERNATIONAL LASER PHYSICS WORKSHOP, São Carlos, Brazil, July 3-9, 2024. Presented by Tenio Popmintchev.
3. **Plenary talk:** Bright high harmonics from the UV to the keV X-ray region for dynamic imaging at the space-time limit, PQE Winter Colloquium on the Physics of Quantum Electronics, Snowbird, Utah, USA, Jan 2015. Presented by Tenio Popmintchev.

Keynote Presentations

1. **Keynote talk:** Strong Electron Correlations, Attosecond Rabi Oscillations, and Angular Momentum of X-rays, Sotir Chervenkov, Tenio Popmintchev, Conference on Advanced Topics in Photonics 2025, 03-05 July 2025 Sofia, Bulgaria. Presented by: Sotir Chervenkov.
2. **Keynote talk:** Quantum Regimes of Coherent X-ray Generation with Strongly Correlated Electron Dynamics and Attosecond Rabi Oscillations for Advanced Nanoimaging, 3M NANO - 2023 IEEE International Conference on Manipulation, Manufacturing, and Measurement on the Nanoscale, Chengdu, China, Aug 2023. Presented by Tenio Popmintchev.



References

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4. "Tenio Popmintchev - Google Scholar". scholar.google.com. Retrieved 2026-01-23.
5. "Tenio Popmintchev PhD Physics. Coherent Atto-to-Zeptosecond Soft and Hard X-rays for 5D Imaging Professor at University of California San Diego". *ResearchGate*. Retrieved 2026-01-23.
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