



# Aliaksei (Alex) Halavanau

## Resume

### Summary

PhD in Accelerator Physics (graduated in 2018) and Mathematical Physics (graduated in 2015). Background in Physics, Math and Computer Science. Collaborative and leadership qualities, teaching experience, driven and result-oriented.

### Areas of Expertise

- X-ray Free electron lasers: novel concepts, x-ray cavity-based systems
- Electron linear accelerators: photoinjectors
- Mathematical and numerical methods in partial differential equations, nonlinear dynamics, XFELs, classical field theory

### Current position

10/2024 - **Lead Scientist**, *Stanford University, SLAC*, Menlo Park, CA, USA  
Research: high-brightness X-ray lasers, X-ray laser oscillator, cavity-based XFEL

### Education

08/2013 - **PhD**, *Northern Illinois University*, DeKalb, IL, USA  
08/2018 Research: Electron Beam Shaping and its Applications  
06/2013 - **PhD**, *Belarusian State University*, Minsk, Belarus  
07/2015 Research: Topological Solitons in Scalar Field Theory  
09/2012 - **MSc**, *Belarusian State University*, Minsk, Belarus  
06/2013 Research: Coupled  $\phi^4$  Scalar Field Theory  
09/2007 - **BSc**, *Belarusian State University*, Minsk, Belarus  
06/2012 Research:  $\phi^4$  and  $\phi^6$  Scalar Field Theory Models

### PhD thesis

Title *Electron Beam Shaping and its Applications*  
Advisors Prof. Philippe Piot, Dr. Charles Thangaraj

Abstract We proposed new transverse and longitudinal electron beam shaping methods. We demonstrated significant improvement of electron beam quality with microlens array laser transverse shaping. Numerical models of experimental beamlines are benchmarked according to the experimental data. We investigated the transport properties of the superconducting accelerating cavity. Canonical angular momentum dominated and flat beams were produced and transported in the accelerator. The longitudinal space-charge amplification process was explored as a microbunching technique.

## Past experience

### Professional

- 08/2022 - **Staff Scientist**, *Stanford University, SLAC, CA, USA*
  - 10/2024 Project: x-ray laser oscillator
- 07/2020 - **Project Scientist**, *Stanford University, SLAC, CA, USA*
  - 08/2022 Project: x-ray laser oscillator
- 08/2019 - **Research Associate**, *Stanford University, SLAC, CA, USA*
  - 07/2020 Research topic: high power X-ray lasers; with Claudio Pellegrini
- 08/2018 - **Visiting scientist**, *Stanford University, SLAC, CA, USA*
  - 08/2019 Research topic: high power X-ray lasers; with Claudio Pellegrini
- 08/2018 - **Visiting postdoctoral researcher**, *University of California Los Angeles, CA, USA*
  - 08/2019 Research topic: new concepts of light sources; with James Rosenzweig
- 08/2016 - **Visitor**, *Argonne Wakefield Accelerator, Argonne National Lab, Lemont, IL, USA*
  - 05/2018 ○ Transverse and longitudinal electron beam dynamics of AWA
- 09/2015 - **Joint Fermilab Accelerator PhD program fellow**, *Fermilab, Batavia, IL, USA*
  - 08/2018 ○ Transverse and longitudinal electron beam dynamics of FAST
  - Crystal channeling X-ray radiation generation
- 12/2012 **Visiting Scholar**, *Durham University, Durham, UK*
  - Boundary collisions in  $\phi^4$  field theory model
  - Mathematical analysis and numerical simulations
- 06-09/2011 **Summer Intern**, *Fermi National Laboratory, Batavia, IL, USA*
  - Project-X beam dynamics simulations
  - Beam optics matching with TRACK

### Teaching

- 01/2026 - **Instructor**, *US Particle Accelerator School, New Orleans, LA, USA*
  - 02/2026 Synchrotron radiation and free-electron lasers
- 09/2013 - **Teaching Assistant**, *Northern Illinois University, DeKalb, IL, USA*
  - 09/2017 Mechanics 210/211, Electricity and Magnetism 273, Introduction to Astronomy 101
- 02-06/2012 **Teaching Assistant**, *Belarusian State University, Minsk, Belarus*
  - Classical Mechanics, Quantum Mechanics, Nonlinear Methods in Physics
- 09-12/2011 **Astronomy instructor**, *Belarusian State University Lyceum, Minsk, Belarus*
  - Trained high-school students for the state and international Astronomy Olympiads.

### Miscellaneous

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01/2014- **Graduate Physics Colloquium host**, *Northern Illinois University*, DeKalb, IL, USA  
09/2016 Organized Physics Graduate Students Colloquium.  
09/2011- **System administrator**, *Belarusian State University*, Minsk, Belarus  
06/2012 Maintained Linux (OS RedHat) computing cluster for nonlinear dynamics simulations

## List of selected publications

- J. Krzywinski, **A. Halavanau** - Simulation package for solving dynamic diffraction problems in deformed crystals. Bragg, Laue geometry, asymmetric reflections, bend crystals, dislocations, crystals with arbitrary shapes, strain distributions and time dependent problems, arXiv preprint arXiv:2601.06340, (2026)
- N.J. Hartley, J. Baxter, S. Curtis, O. Daisuke, **A. Halavanau**, et al. - X-ray parametric down-conversion at an XFEL, *Optica* 12 (7), 961-967 (2025)
- I. Inoue, R. Robles, **A. Halavanau**, et al. - Experimental demonstration of attosecond hard X-ray pulses, arXiv preprint arXiv:2506.07968 (2025)
- T. M Linker, **A. Halavanau**, et al. - Attosecond inner-shell lasing at Angstrom wavelengths, *Nature* 642, 8069, 934-940 (2025)
- I. Inoue, T. Sato, R. Robles, **A. Halavanau**, et al. - Nanofocused attosecond hard x-ray free-electron laser with intensity exceeding  $1e19$  W/cm<sup>2</sup>, *Optica* Vol. 12, Issue 3, pp. 309-310 (2025)
- P. Liu, P. Pradhan, A. Miceli, D. A. Walko, D. Shu, J. Sullivan, K. Lang, M. Rivers, M. Balcazar, **A. Halavanau**, et al. - X-ray diagnostics for the cavity-based x-ray free-electron laser project, *Phys. Rev. Accel. Beams* 27, 110701 (2024)
- R. Margraf-O'Neal, T. Sato, D. Zhu, **A. Halavanau**, G. Marcus - Characterization of a HPHT boron ion-implanted diamond X-ray mirror following high vacuum annealing, *Diamond and Related Materials*, 146, 111212 (2024)
- R. Margraf, J. MacArthur, G. Marcus, A. Lutman, **A. Halavanau**, H.D. Nuhn, Z. Zhang, Z. Huang - Microbunch rotation in an x-ray free-electron laser using a first-order achromatic bend, 27, 030702 (2024)
- N. Hartley, **A. Halavanau**, et. al. - Confirming X-ray parametric down conversion by time-energy correlation, *Results in Physics*, 57, 107328 (2024)
- C. Pellegrini, **A. Halavanau**, A. Benediktovitch, U. Bergmann - XLO-II, a high-repetition rate X-ray laser oscillator, *submitted to Nature Communications* (2024)
- S. Chuchurka, A. Benediktovitch, S. Krusic, **A. Halavanau**, N. Rohringer - Stochastic modeling of x-ray superfluorescence, *Phys.Rev.A.109.033725*, (2024)
- R.R. Robles, **A. Halavanau**, G. Marcus, Z. Huang - Fast modeling of regenerative amplifier free-electron lasers, *Physical Review Research* 5 (4), 043254 (2023)
- R. Margraf, R.R. Robles, **A. Halavanau**, et. al. - Low-loss stable storage of 1.2A X-ray pulses in a 14 m Bragg cavity, *Nature Photonics* 17 (10), 878-882 (2023)
- **A. Halavanau**, P. Piot, S.S. Baturin - Single-shot transverse wakefield mapping with a hollow electron beam, *PRAB* 26 (10), 101301 (2023)
- R.R. Robles, **A. Halavanau**, D. Cesar, A. Lutman, G. Stupakov - Reconstruction of x-ray free-electron laser pulse duration and energy chirp from spectral intensity fluctuations, *PRAB* 26 (3), 030701, (2023)
- **A. Halavanau**, et. al. - Experimental setup for high-resolution characterization of crystal optics for coherent X-ray beam applications, *Journal of Applied Crystallography*, 56 (1), (2023)
- M. Doyle, **A. Halavanau**, et. al. - Seeded stimulated X-ray emission at 5.9 keV, *Optica* 10 (4),

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- 513-519, (2023)
- N. Welke, N. Majernik, **A. Halavanau**, et. al. - Development of spinning-disk solid sample delivery system for high-repetition rate x-ray free electron laser experiments, *Review of scientific instruments* 94 (10), (2023)
  - **A. Halavanau**, et. al. - Ultra-fast transverse beam orbit control in LCLS copper linac. Part I., *JINST*, 17 (11), P11031 (2022)
  - F.J. Decker, A. Lutman, **A. Halavanau**, et. al. - Two- and multi-bucket X-ray Free-Electron laser at LCLS, *Nat. Sci. Rep*, 12, 3253 (2022)
  - Y. Zhang, T. Kroll, A. Benediktovitch, **A. Halavanau**, U. Bergmann, C. Pellegrini, et. al. - Generation of Intense Phase-Stable Femtosecond Hard X-ray Pulse Pairs, *PNAS*, 119 (12), (2022)
  - I. Lobach, S. Nagaitsev, V. Lebedev, **A. Halavanau**, et. al. - Transverse beam emittance measurement by undulator radiation power noise, *Physical Review Letters* 126 (13), 134802, (2021)
  - E. Hemsing, **A. Halavanau**, Z. Zhang - Enhanced self-seeding with ultra-short electron beams, *Phys. Rev. Lett.* 125, 044801, (2020)
  - **A. Halavanau**, et. al. - Population Inversion X-ray Laser Oscillator, *PNAS*, 117 (27), (2020)
  - E. Hemsing, **A. Halavanau**, Z. Zhang - Statistical Theory of a Self-Seeded Free Electron Laser with Noise Pedestal Growth, *Phys. Rev. Accel. Beams* 23, 010701, (2020)
  - I. Lobach, **A. Halavanau**, et. al. - Statistical properties of undulator radiation in the IOTA storage ring, *Phys. Rev. Accel. Beams* 23, 090703, (2020)
  - **A. Halavanau**, et. al. - Tailoring of an electron-bunch current distribution via space-to-time mapping of a transversely shaped, photoemission-laser pulse, *Phys. Rev. Accel. Beams* 22, 114401 (2019)
  - **A. Halavanau**, et. al. - Very high brightness and power LCLS-II hard X-ray pulses, *J. of Synchr. Rad.*, 26, 3, 635 (2019)
  - **A. Halavanau**, et. al. - Spatial control of photoemitted electron beams using a microlens-array transverse-shaping technique, *Phys. Rev. Accel. Beams* 20, 103404 (2017)
  - **A. Halavanau**, et. al. - Analysis and Measurement of the Transfer Matrix of a 9-cell 1.3-GHz Superconducting Cavity, *Phys. Rev. Accel. Beams* 20, 4, 040102 (2017)
  - P. Dorey, **A. Halavanau**, J. Mercer, T. Romanczukiewicz, Y. Shnir - Boundary scattering in the  $\phi^4$  model, *Journal of High Energy Physics*, 107, 1705 (2017)
  - **A. Halavanau**, et. al. - Microlens Array Laser Transverse Shaping Technique for Photoemission Electron Source, technical report, FERMILAB-TM-2634-APC (2016)
  - **A. Halavanau**, P. Piot - Simulation of a cascaded longitudinal space charge amplifier for coherent radiation generation, *NIMA*, 819, (2016) 144-153
  - **A. Halavanau**, Ya. Shnir - Isorotating Baby Skyrmions, *Phys.Rev. D*88 (2013) 085028, *arXiv:1309.4318 [hep-th]*
  - **A. Halavanau**, T. Romanczukiewicz, Ya. Shnir - Resonance structures in coupled two-component  $\phi^4$  model, *Physical Review D* 86, 085027 (2012), *arXiv:1206.4471 [hep-th]*
  - A. Acus, **A. Halavanau**, E. Norvaisas and Ya. Shnir - Hopfion canonical quantization, *Physics Letters B* 711 (2012) 212-216, *arXiv:1204.0504 [hep-th]*

## Selected conference proceedings

- **A. Halavanau**, C. Mayes, S. Gessner - Hollow and flat electron beam generation at FACET-II, IPAC2021, IPAC2021-MOPAB101
- **A. Halavanau**, et. al. - Preliminary Considerations of Atomic Inner-Shell X-Ray Laser for Self-Seeding at LCLS-II, IPAC2019, INSPIRE-1745149
- **A. Halavanau**, et. al. - Generation of High Peak Power Hard X-Rays at LCLS-II with Double Bunch Self-seeding, IPAC2019, INSPIRE-1745147
- **A. Halavanau**, et. al. - Transverse-To-Longitudinal Photocathode Distribution Imaging, IPAC2018, FERMILAB-CONF-18-161-AD-APC
- **A. Halavanau**, et. al. - Magnetized and Flat Beam Generation at the Fermilab's FAST Facility, IPAC2018, FERMILAB-CONF-18-162-AD-APC

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- A. Halavanau, et. al. - Bunch Compression of Flat Beams, IPAC2018, FERMILAB-CONF-18-163-AD-APC
- A. Halavanau, P. Piot - Electron Beam Pattern Rotation as a Method of Tunable Bunch Train Generation , IPAC2018, FERMILAB-CONF-18-164-AD-APC
- A. Halavanau, et. al. - Coherent transition radiation from transversely modulated electron beams, FEL2017, FERMILAB-CONF-17-337-APC
- A. Halavanau, P. Piot, et. al. - Magnetized and flat beam experiment at FAST, IPAC2017, FERMILAB-CONF-17-172-APC
- A. Halavanau, et. al. - Application of Voronoi diagram to mask-based intercepting phase-space measurements, IPAC2017, FERMILAB-CONF-17-171-APC
- A. Halavanau, P. Piot, et. al. - A Simple Method For Measuring The Electron-beam Magnetization, NAPAC2016, FERMILAB-CONF-16-460-APC
- A. Halavanau, et. al. - Measurement Of The Transverse Beam Dynamics In A Tesla-type Superconducting Cavity, LINAC2016, FERMILAB-CONF-16-398-APC
- A. Halavanau, G. Ha, et. al. - Generation of Homogeneous and Patterned Electron Beams using a Microlens Array Laser-Shaping Technique, IPAC2016, THPOW021
- A. Halavanau, P. Piot - Numerical study of three dimensional effects in longitudinal space charge impedance, IPAC2015, FERMILAB-CONF-15-225-APC
- A. Halavanau, P. Piot - Numerical investigation of a cascaded longitudinal space charge amplifier at the Fermilab's Advanced Superconducting Test Accelerator, IPAC2015, FERMILAB-CONF-15-226-APC

## Languages

English	Fluent		<i>Bilingual proficiency</i>
Belarusian	Native		<i>Native proficiency</i>

## Computer skills

<b>Programming languages</b>	Python, C/C++	<b>Beam Physics</b>	Impact-T, Astra, Elegant, SRW, self-written
<b>Computer Algebra</b>	Wolfram Mathematica	<b>HPC</b>	CUDA, MPI, Slurm
<b>Data analysis</b>	Numpy, Scipy, Pandas	<b>Operating Systems</b>	Linux/MacOS/Windows

## Professional references

- Prof. Claudio Pellegrini (claudiop@slac.stanford.edu)
- Prof. Uwe Bergmann (ubergmann@wisc.edu)
- Prof. Zhirong Huang (zrh@slac.stanford.edu)
- Prof. James Rosenzweig (rosen@physics.ucla.edu)
- Prof. Philippe Piot (ppiot@anl.gov)
- Prof. Sergei Nagaitsev (snagaitsev@bnl.gov)
- Prof. Vladimir Litvinenko (vl@bnl.gov)

## Interests

Soccer	Playing in "Silicon Valley Soccer" amateur league
Photography	Keen on astrophotography
Electronics	Beginner in circuit board design
Chess	Frequent chess.com visitor