

Max Rakitin

Bio

Personal details

Name: Max Rakitin (a.k.a. Maksim S. Rakitin)

Summary: I am a group leader of the Data Acquisition and Detectors group of the Data Science and Systems Integration Division of NSLS-II, BNL.

News: "Computer, Is My Experiment Finished?" (September 16, 2022)

<https://www.bnl.gov/newsroom/news.php?a=220832>

"Seeing the Forest Through the Trees: Brookhaven Lab Scientists Develop New Computational Approach to Reduce Noise in X-ray Data." (April 18, 2022)

<https://www.bnl.gov/newsroom/news.php?a=219533>

Links: [BNL](#) • [SBU](#) • [SUSU](#)

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Education and training

2008.10–2012.09



Ph.D. in Condensed Matter Physics (defended on September 19, 2012)

South Ural State University (National Research University), Chelyabinsk, Russia

2006.09–2008.06

M.S. in Applied Mathematics and Physics (June 13, 2008)

South Ural State University (SUSU), Chelyabinsk, Russia

2002.09–2006.06

B.S. in Applied Mathematics and Physics (June 20, 2006), *summa cum laude*

South Ural State University (SUSU), Chelyabinsk, Russia

Research and professional expertise



2017.11–present

Associate Computational Scientist, DAMA group, NSLS-II, Brookhaven National Laboratory, Upton, NY (<https://www.bnl.gov>)

2015.12–2017.10

Research Associate (Postdoc), NSLS-II, Brookhaven National Laboratory, Upton, NY (<https://www.bnl.gov>)

2013.10–2015.12



Postdoctoral Associate (Postdoc), Department of Geosciences, Stony Brook University, Stony Brook, NY (<https://stonybrook.edu>, <https://uspex-team.org/en>)

2007.06–2013.10



QA Engineer, QA Team Leader, Applied Technologies Ltd., Chelyabinsk, Russia (<https://www.appliedtech.ru/en/>), a partner of Rocket Software Inc., USA (<https://www.rocketsoftware.com>)

Software projects

• **Bluesky** — a library for experiment control and collection of scientific data and metadata, <https://blueskyproject.io/bluesky>.

• **Ophyd** — a device abstraction library, <https://blueskyproject.io/ophyd>.

• **Databroker** — a simple, user-friendly interface for retrieving stored data and metadata from multiple sources, <https://blueskyproject.io/databroker>.

- **Synchrotron Radiation Workshop (SRW)** — computer code for X-ray source and optics simulations, <https://github.com/mrakitin/SRW>.
- **Sirepo** — a cloud-based framework for SRW, <https://github.com/radiasoft/sirepo>.
- **Databroker extractor** — image processing and data visualization, <https://github.com/mrakitin/databroker-extractor>.
- **CRL simulator** — a code for simulation of a translocator (compound refractive lenses (CRL) for X-ray focusing), <https://github.com/mrakitin/bnlcrl>.
- **USPEX** — a code for evolutionary crystal structure prediction, <https://uspex-team.org/en>.
- **USPEX online utilities** — a set of pre- and post-processing tools for crystal structure simulations, <https://uspex-team.org/en/uspex/tools>.
- **USPEX manual** — <https://uspex-team.org/en/uspex/documentation>.
- Utilities for DFT simulations
- IBM Mainframe software projects

Publications

59. H. Wijesinghe, A. Barbour, L. Wiegart, E. Carlin, J. Einstein-Curtis, P. Moeller, R. Nagler, R. O'Rourke, N. Cook, and M. Rakitin, "Bluesky and Raydata: An Integrated Platform for Adaptive Experiment Orchestration," in *SC24-W: Workshops of the International Conference for High Performance Computing, Networking, Storage and Analysis*, 2024, pp. 2162–2167. <https://doi.org/10.1109/SCW63240.2024.00271>
58. A. Tayal, D. S. Coburn, D. Abel, M. Rakitin, O. Ivashkevych, J. Wlodek, D. Wierzbicki, W. Xu, E. Nazaretski, E. Stavitski, and D. Leshchev, "Five-analyzer Johann spectrometer for hard X-ray photon-in/photon-out spectroscopy at the Inner Shell Spectroscopy beamline at NSLS-II: design, alignment and data acquisition," *Journal of Synchrotron Radiation*, vol. 31, no. 6, pp. 1609–1621, Nov 2024. <https://doi.org/10.1107/S1600577524009342>
57. T. W. Morris, M. Rakitin, Y. Du, M. Fedurin, A. C. Giles, D. Leshchev, W. H. Li, B. Romasky, E. Stavitski, A. L. Walter, P. Moeller, B. Nash, and A. Islegen-Wojdyla, "A general Bayesian algorithm for the autonomous alignment of beamlines," *Journal of Synchrotron Radiation*, vol. 31, no. 6, pp. 1446–1456, Nov 2024. <https://doi.org/10.1107/S1600577524008993>
56. H. Goel, O. Chubar, R. Li, L. Wiegart, M. Rakitin, and A. Fluerasu, "Efficient end-to-end simulation of time-dependent coherent X-ray scattering experiments," *Journal of Synchrotron Radiation*, vol. 31, no. 3, pp. 517–526, May 2024. <https://doi.org/10.1107/S1600577524001267>
55. N. M. Cook, A. M. Barbour, E. G. Carlin, J. A. Einstein-Curtis, R. Nagler, R. O'Rourke, M. Rakitin, L. Wiegart, and H. Wijesinghe, "Integrating Online Analysis with Experiments to Improve X-Ray Light Source Operations," in *Proc. 19th Int. Conf. Accel. Large Exp. Phys. Control Syst. (ICALEPCS'23)*, ser. International Conference on Accelerator and Large Experimental Physics Control Systems, no. 19. JACoW Publishing, Geneva, Switzerland, 02 2024, paper TUSDSC02, pp. 921–924. <https://jacow.org/icalpcs2023/papers/tusdsc02.pdf>
54. J. A. Einstein-Curtis, D. T. Abell, Y. Du, A. Giles, M. V. Keilman, J. Lynch, P. Moeller, T. Morris, B. Nash, I. V. Pogorelov, M. Rakitin, and A. L. Walter, "Online Models for X-ray Beamlines Using Sirepo-Bluesky," in *Proc. 19th Int. Conf. Accel. Large Exp. Phys. Control Syst. (ICALEPCS'23)*, ser. International Conference on Accelerator and Large Experimental Physics Control Systems, no. 19. JACoW Publishing, Geneva, Switzerland, 02 2024, paper MO3BCO05, pp. 165–170. <https://jacow.org/icalpcs2023/papers/mo3bco05.pdf>
53. P. M. Maffettone, D. B. Allan, A. Barbour, T. A. Caswell, D. Gavrilov, M. D. Handwell, T. Morris, D. Olds, M. Rakitin, S. I. Campbell, and B. Ravel, *Book "Methods and Applications of Autonomous Experimentation". Chapter 8: "Artificial Intelligence Driven Experiments at User Facilities"*, 1st ed. Chapman & Hall/CRC Computational Science, 2023, ch. Chapter 8. <https://doi.org/10.1201/9781003359593>
52. M. Rakitin, R. Bode, T. W. Morris, A. C. Giles, A. L. Walter, J. K. Lynch, J. Maldonado, Y. Du, B. Romasky, M. Fedurin, P. Moeller, and B. Nash, "Recent updates of the Sirepo-Bluesky library for virtual beamline representation," in *Advances in Computational Methods for X-Ray Optics VI*, O. Chubar and T. Tanaka, Eds., vol. 12697, International Society for Optics and Photonics. SPIE, 2023, p. 126970D. <https://doi.org/10.1117/12.2678030>
51. T. W. Morris, Y. Du, M. Fedurin, A. C. Giles, P. Moeller, B. Nash, M. Rakitin, B. Romasky, A. L. Walter, N. Wilson, and A. Wojdyla, "Latent Bayesian optimization for the autonomous alignment of synchrotron beamlines," in *Advances in Computational Methods for X-Ray Optics VI*, O. Chubar and T. Tanaka, Eds., vol. 12697, International Society for Optics and Photonics. SPIE, 2023, p. 126970B. <https://doi.org/10.1117/12.2677895>
50. B. Nash, M. S. Rakitin, D. T. Abell, M. Keilman, P. Moeller, I. Pogorelov, Y. Du, A. Giles, J. Lynch, T. W. Morris, A. L. Walter, and N. Goldring, "Reduced model representations of synchrotron radiation and a software framework for beamline control," in *Advances in Computational Methods for X-Ray Optics VI*, O. Chubar and T. Tanaka, Eds., vol. PC12697, International Society for Optics and Photonics. SPIE, 2023, p. PC1269703. <https://doi.org/10.1117/12.2676921>

49. L. Huang, T. Wang, O. Chubar, G. Dovillaire, A. He, M. Rakitin, Y. Yang, A. M. Kiss, and M. Idir, "Investigation of x-ray Hartmann wavefront sensing: from simulation to the initial experiment test," in *Advances in Computational Methods for X-Ray Optics VI*, O. Chubar and T. Tanaka, Eds., vol. PC12697, International Society for Optics and Photonics. SPIE, 2023, p. PC1269705. <https://doi.org/10.1117/12.2675754>
48. H. Goel, O. Chubar, L. Wiegart, A. Flueraşu, R. Li, A. He, M. Rakitin, M. Lin, P. Moeller, and R. Nagler, "GPU accelerated simulations of time-dependent coherent x-ray scattering experiments," in *Advances in Computational Methods for X-Ray Optics VI*, O. Chubar and T. Tanaka, Eds., vol. 12697, International Society for Optics and Photonics. SPIE, 2023, p. 1269709. <https://doi.org/10.1117/12.2677888>
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46. M. Rakitin, S. Campbell, D. Allan, T. Caswell, D. Gavrilov, M. Hanwell, and S. Wilkins, "Next generation experimental data access at NSLS-II," *Journal of Physics: Conference Series*, vol. 2380, no. 1, p. 012100, Dec. 2022. <https://doi.org/10.1088/1742-6596/2380/1/012100>
45. B. Nash, D. Abell, R. Nagler, P. Moeller, M. Keilman, I. Pogorelov, N. Goldring, M. Rakitin, J. Lynch, A. Giles, A. Walter, J. Maldonado, T. Morris, S. Bak, and Y. Du, "Combining diagnostics, modeling, and control systems for automated alignment of the TES beamline," *Journal of Physics: Conference Series*, vol. 2380, no. 1, p. 012103, Dec. 2022. <https://doi.org/10.1088/1742-6596/2380/1/012103>
44. H. Goel, O. Chubar, L. Wiegart, A. Flueraşu, R. Li, A. He, M. Rakitin, P. Moeller, and R. Nagler, "Developments in SRW Code and Sirepo Framework Supporting Simulation of Time-Dependent Coherent X-ray Scattering Experiments," *Journal of Physics: Conference Series*, vol. 2380, no. 1, p. 012126, Dec. 2022. <https://doi.org/10.1088/1742-6596/2380/1/012126>
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42. L. Huang, T. Wang, O. Chubar, G. Dovillaire, A. He, M. Rakitin, and M. Idir, "Simulation of X-ray Hartmann wavefront sensing with the Synchrotron Radiation Workshop," *Opt. Express*, Oct. 2022. <https://doi.org/10.1364/oe.470197>
41. T. Konstantinova, L. Wiegart, M. Rakitin, A. M. DeGennaro, and A. M. Barbour, "Machine Learning for analysis of speckle dynamics: quantification and outlier detection," *Phys. Rev. Research*, vol. 4, p. 033228, Sep. 2022. <https://doi.org/10.1103/PhysRevResearch.4.033228>
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39. D. Hidas, A. M. Kiss, M. Rakitin, J. Sinsheimer, T. Tanabe, and M. Musardo, "High precision real-time insertion device and monochromator synchronization at NSLS-II," *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment*, vol. 1031, p. 166505, Mar. 2022. <https://doi.org/10.1016/j.nima.2022.166505>
38. B. Nash, D. T. Abell, D. L. Bruhwiler, E. G. Carlin, Y. Du, J. P. Edelen, A. Giles, M. V. Keilman, J. Lynch, J. Maldonado, P. Moeller, R. Nagler, I. V. Pogorelov, M. S. Rakitin, A. Walter, and S. D. Webb, "X-Ray Beamline Control with Machine Learning and an Online Model," in *Proc. ICALEPCS'21*, ser. International Conference on Accelerator and Large Experimental Physics Control Systems, no. 18. JACoW Publishing, Geneva, Switzerland, Dec. 2021, pp. 695–699. <https://doi.org/10.18429/JACoW-ICALEPCS2021-WEPV024>
37. N. M. Cook, A. M. Barbour, E. G. Carlin, P. Moeller, R. Nagler, B. Nash, M. S. Rakitin, and L. Wiegart, "An Integrated Data Processing and Management Platform for X-Ray Light Source Operations," in *Proc. ICALEPCS'21*, ser. International Conference on Accelerator and Large Experimental Physics Control Systems, no. 18. JACoW Publishing, Geneva, Switzerland, Nov. 2021, pp. 1059–1063. <https://doi.org/10.18429/JACoW-ICALEPCS2021-FRBR02>
36. R. Jain, D. Abel, M. Rakitin, M. Sullivan, D. T. Lodowski, M. R. Chance, and E. R. Farquhar, "New high-throughput endstation to accelerate the experimental optimization pipeline for synchrotron X-ray footprinting," *Journal of Synchrotron Radiation*, vol. 28, no. 5, pp. 1321–1332, Sep. 2021. <https://doi.org/10.1107/S1600577521005026>
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34. M. S. Rakitin and A. A. Mirzoev, "Ab initio Simulation of Dissolution Energy and Bond Energy of Hydrogen with 3sp, 3d, and 4d Impurities in bcc Iron," *Phys. Solid State*, vol. 63, no. 7, pp. 1065–1068, Jul. 2021. <https://doi.org/10.1134/S1063783421070180>

33. T. Konstantinova, L. Wiegart, M. Rakitin, A. M. DeGennaro, and A. M. Barbour, "Noise reduction in X-ray photon correlation spectroscopy with convolutional neural networks encoder-decoder models," *Sci Rep*, vol. 11, no. 1, Jul. 2021. <https://doi.org/10.1038/s41598-021-93747-y>
32. S. I. Campbell, D. B. Allan, A. M. Barbour, D. Olds, M. S. Rakitin, R. Smith, and S. B. Wilkins, "Outlook for artificial intelligence and machine learning at the NSLS-II," *Machine Learning: Science and Technology*, vol. 2, no. 1, p. 013001, Mar. 2021. <https://doi.org/10.1088/2632-2153/abbd4e>
31. O. Chubar, L. Wiegart, S. Antipov, R. Celestre, R. Coles, A. Fluerasu, and M. Rakitin, "Analysis of hard x-ray focusing by 2D diamond CRL," in *Advances in Computational Methods for X-Ray Optics V*, O. Chubar and K. Sawhney, Eds., vol. 11493, International Society for Optics and Photonics. SPIE, Aug. 2020, pp. 119–127. <https://doi.org/10.1117/12.2568980>
30. O. Chubar, R. A. Coles, L. Wiegart, A. Fluerasu, M. Rakitin, J. Condie, P. Moeller, and R. Nagler, "Simulations of coherent scattering experiments at storage ring synchrotron radiation sources in the hard x-ray range," in *Advances in Computational Methods for X-Ray Optics V*, O. Chubar and K. Sawhney, Eds., vol. 11493, International Society for Optics and Photonics. SPIE, Aug. 2020, pp. 201–208. <https://doi.org/10.1117/12.2568833>
29. A. He, O. Chubar, M. Rakitin, L. Samoylova, C. Fortmann-Grote, S. Yakubov, and A. Buzmakov, "Parallel performance of "Synchrotron Radiation Workshop" code: partially coherent calculations for storage rings and time-dependent calculations for XFELs," in *Advances in Computational Methods for X-Ray Optics V*, O. Chubar and K. Sawhney, Eds., vol. 11493, International Society for Optics and Photonics. SPIE, Aug. 2020, pp. 78–87. <https://doi.org/10.1117/12.2567448>
28. M. S. Rakitin, A. Giles, K. Swartz, J. Lynch, P. Moeller, R. Nagler, D. B. Allan, T. A. Caswell, L. Wiegart, O. Chubar, and Y. Du, "Introduction of the Sirepo-Bluesky interface and its application to the optimization problems," in *Advances in Computational Methods for X-Ray Optics V*, O. Chubar and K. Sawhney, Eds., vol. 11493, International Society for Optics and Photonics. SPIE, Aug. 2020, pp. 209–226. <https://doi.org/10.1117/12.2569000>
27. B. Nash, O. Chubar, D. Bruhwiler, M. Rakitin, P. Moeller, R. Nagler, and N. Goldring, "Undulator radiation brightness calculations in the Sirepo GUI for SRW," in *Advances in Laboratory-based X-Ray Sources, Optics, and Applications VII*, A. Murokh and D. Spiga, Eds., vol. 11110, International Society for Optics and Photonics. SPIE, 2019, pp. 79–92. <https://doi.org/10.1117/12.2530663>
26. B. Nash, N. Goldring, D. L. Bruhwiler, O. Tchoubar, A. He, M. Rakitin, R. Nagler, and P. Moeller, "Phase IIA Final Technical Report for "Development of software framework for x-Ray optics simulation and modeling"," Jul. 2019. <https://www.osti.gov/biblio/1532614>
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22. M. S. Rakitin, P. Moeller, R. Nagler, B. Nash, D. L. Bruhwiler, D. Smalyuk, M. Zhernenkova, and O. Chubar, "Sirepo: an open-source cloud-based software interface for X-ray source and optics simulations," *Journal of Synchrotron Radiation*, vol. 25, no. 6, pp. 1877–1892, Nov. 2018. <https://doi.org/10.1107/S1600577518010986>
21. A. Blednykh, B. Bacha, G. Bassi, W. Cheng, O. Chubar, A. Derbenev, R. Lindberg, M. Rakitin, V. Smaluk, M. Zhernenkova, Y.-c. K. Chen-Wiegart, and L. Wiegart, "New aspects of longitudinal instabilities in electron storage rings (*DOE Science Highlight*)," *Scientific Reports*, vol. 8, no. 1, p. 11918, 2018. <https://doi.org/10.1038/s41598-018-30306-y>
20. O. Chubar, C. Kitegi, Y.-C. K. Chen-Wiegart, D. Hidas, Y. Hidaka, T. Tanabe, G. Williams, J. Thieme, T. Caswell, M. Rakitin, L. Wiegart, A. Fluerasu, L. Yang, S. Chodankar, and M. Zhernenkova, "Spectrum-Based Alignment of In-Vacuum Undulators in a Low-Emittance Storage Ring," *Synchrotron Radiation News*, vol. 31, no. 3, pp. 4–8, 2018. <https://doi.org/10.1080/08940886.2018.1460173>
19. M. Rakitin, A. A. Mirzoev, and D. A. Mirzaev, "First-Principles and Thermodynamic Simulation of Elastic Stress Effect on Energy of Hydrogen Dissolution in Alpha Iron," *Russian Physics Journal*, vol. 60, no. 12, pp. 2136–2143, Apr. 2018. <https://doi.org/10.1007/s11182-018-1337-2>
18. M. S. Rakitin, O. Chubar, P. Moeller, R. Nagler, and D. L. Bruhwiler, "Sirepo: a web-based interface for physical optics simulations - its deployment and use at NSLS-II (**invited paper**)," in *Proc. SPIE, Advances in Computational Methods for X-Ray Optics IV (23 August 2017)*, vol. 10388, 2017, p. 103880R. <https://doi.org/10.1117/12.2274031>
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9. Y. H. R. Chang, T. L. Yoon, T. L. Lim, and M. Rakitin, "Thorough investigations of the structural and electronic properties of $\text{Al}_x\text{In}_{1-x}\text{N}$ ternary compound via *ab initio* computations," *Journal of Alloys and Compounds*, vol. 682, pp. 338–344, 2016. <https://doi.org/10.1016/j.jallcom.2016.04.281>
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