

Bakhrom Oripov

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SUMMARY

- Enthusiastic and self-motivated scientist with 8 years of experience in fabrication and characterization of novel superconducting materials and devices. Problem solver with strong analytical skills as demonstrated by 5 peer-reviewed publications and 13 conference report presentations.
- Excellent team player and builder of scientific collaborations demonstrated by the peer reviewed scientific publications with 22 co-authors from 5 leading National Laboratories around the world.
- Strong leader with experience supervising junior scientists. Mentor to 6 current and prospective PhD students.

EXPERIENCE

Applied Physics Division, National Institute of Standards and Technology

Professional Research Experience Program (PREP) Associate

Feb 2021 – Present

- Designed, fabricated and characterized arrays of superconducting UV single-photon detectors for NASA's Large Ultraviolet Optical Infrared Surveyor (LUVOIR) mission.
- Improved the yield and demonstrated a 900 x 900 pixel imager, which is 3 orders of magnitude improvement over the state of the art in terms of number of pixels.
- Designed and tested the components to be used in a Megapixel Thermally Coupled Imager (TCI) using Python's PHIDL library developed in-house.
- Developed and optimized cleanroom fabrication processes to achieve reliable performance on 6-layer superconducting electronic devices. Designed and characterized test structures as required to validate each step in the fabrication process.
- Fabricated and tested upwards of 50 6-layer device wafers.
- Measured Superconducting Nanowire Single-Photon Detectors (SNSPD) in cryogenic environment and develop physical models for accurate device characterization.
- Machine Learning: Implemented alternative training methods for Neuromorphic hardware applications, that reduced the time complexity of the calculation from $\mathcal{O}(n^2)$ to $\mathcal{O}(n)$.

Richard Dixon Science Research Center, Morgan State University

Research Assistant

Nov 2020 – Feb 2021

- Designed and simulated 1D nanobeam photonic crystal cavities in Ansys Lumerical finite-difference time-domain solver for Quantum sensing applications.
- Consulted on RF Microwave components needed for the new Diamond Nitrogen Vacancy defect imaging system being assembled.

Quantum Materials Center, University of Maryland

Research Assistant

Jun 2014 – Aug 2020

- In collaboration with scientists from several DOE National labs investigated the material limitations of Superconducting Radio-Frequency cavities (SRF) which are used in next-generation particle accelerators using various experimental techniques.
 - Investigated and identified the implications of material defects in SRF cavities using an SPM based Near-field Magnetic Microwave Microscope that was developed in-house.
 - Developed numerical models to extract critical usable information from large quantities of raw data. Showed that detected non-linear response is a signature of Josephson-junction like defects on the surface.
 - Performed vortex dynamics simulations using time-dependent Ginzburg Landau model in COMSOL Multiphysics finite element simulation solver, shedding light into the nature of vortex nucleation in SRF cavities.
 - Calculated sample surface current distribution by building a model in Ansys HFSS finite element simulation solver.
- Developed a low temperature superconducting RF cavity testing facility.
 - Designed mechanical support and thermalization needed to get the setup to 50mK base temperature.
 - Performed measurements by implementing a Phase-Locked Loop feedback circuit.
 - Designed and implemented a low-cost magnetic shielding with attenuation factor of > 5000 .
 - Designed and implemented a liquid nitrogen pre-cooling system for rapid cool-down.
- Characterized a Boron-doped diamond thin film superconductor using parallel plate resonator technique.
 - Simulated superconducting parallel plate resonator setup in Ansys HFSS finite element simulation solver.
 - Performed the measurement and extracted the surface resistance and absolute value of London penetration depth from resonance frequency $f(T)$ and quality factor $Q(T)$ data.
- Assisted with the writing of a \$450,000 proposal which was successfully funded.
- Mentored three undergraduate students and two first-year graduate students, including successor.

Institute for Research in Electronics and Applied Physics, University of Maryland

Research Assistant

Jan 2014 – Jun 2014

- Built a Frequency-resolved optical gating (FROG) device for femtosecond laser pulse characterization.
 - Designed various custom holders in Solidworks CAD software.
 - Machined various custom holders on a 3-axis Milling Machine.

EDUCATION

The Data Incubator, Washington, DC, USA

Data Science Scholar

Sep 2020 – Dec 2020

TDI is an Intensive data science training fellowship with 3% admission rate.

- Capstone Project: Processed 4.6 million rows of T cell repertoire data from a partner biotech company. Utilized PySpark (Apache Spark's Python API) to filter the data, calculate the Levenshtein distance between the unique TCR sequences and separate the data into clusters. Created interactive visualizations using Altair.

University of Maryland, College Park, Maryland, USA

- Ph.D. in Physics
 - Thesis: Superconducting RF Material Science through Near-Field Magnetic Microscopy
 - Adviser: Prof. Steven Anlage

Aug 2013 – Aug 2020

Boğaziçi University, Istanbul, Turkey

- B.Sc. in Physics (Honors List)

Aug 2008 – Jul 2012

PUBLICATIONS

- [8] D. Rampini, C. Yung, B. Oripov, S. Woods, J. Lehman, Sae Woo Nam, A. McCaughan, “Integration of vertically-aligned carbon nanotubes with superconducting nanowire single photon detectors”, **under review**
- [7] S. Alam, D. Rampini, B. Oripov, A. McCaughan, A. Aziz, “Superconducting Heater Cryotron-Based Reconfigurable Logic Towards Cryogenic IC Camouflaging”, **under review**
- [6] B. Oripov, D. Rampini, B. Korzh, J. Allmaras, M. Shaw, Sae Woo Nam, A. McCaughan, “400,000 pixel superconducting-nanowire single photon camera”, **under review**
- [5] A. McCaughan, B. Oripov, N. Ganesh, Sae Woo Nam, A. Dienstfrey, S. M. Buckley, “Multiplexed gradient descent: Fast online training of modern datasets on hardware neuromorphic systems without backpropagation”, **accepted for publication in APL Machine Learning**
- [4] A. McCaughan, Y. Zhai, B. Korzh, J. Allmaras, B. Oripov, M. Shaw, Sae Woo Nam, “The thermally-coupled imager: A scalable readout architecture for superconducting nanowire single photon detectors”, **Applied Physics Letters 121, 102602 (2022), Featured on the cover of the issue and as Editor’s Pick**
- [3] B. Oripov et al, “Large microwave inductance of granular boron-doped diamond superconducting films”, **Applied Physics Letters 118, 242601 (2021)**
- [2] B. Oripov and S. Anlage, “Time-dependent Ginzburg-Landau treatment of RF Magnetic Vortices in Superconductors: Vortex-Semiloops in a Spatially Nonuniform Magnetic Field”, **Physical Review E 101, 033306 (2020)**
- [1] B. Oripov et al, “High-Frequency Nonlinear Response of Superconducting Cavity-Grade Nb Surfaces”, **Physical Review Applied 11, 064030 (2019)**

SKILLS AND QUALIFICATIONS

- Research and analysis
- Data Analysis
- Signal Processing
- Data Visualization
- Numerical Modeling
- Superconducting electronics
- Remote Control of Hardware
- Scientific writing
- Experimental Design
- Team building and leadership
- Project Management
- Presentations and Public Speaking
- Micro-fabrication
- Measurement automation
- Scientific Instruments Designed or Operated:
 - Electron beam evaporators
 - Stepper (lithography)
 - Dilution Refrigerator
 - Cryogenic Probe Station
 - Ultra-high Vacuum (UHV) systems
 - Scanning Electron Microscope (SEM)
 - Scanning Probe Microscope (AFM, STM)
 - Superconducting RF cavities
 - Parallel Plate and dielectric resonators
 - Magnetic Field Shielding
 - Sputtering systems
 - Reactive ion etcher
 - Cryogenic Cryostat
 - Lock-in Amplifier
 - Network Analyzers
 - Spectrum Analyzer
 - Laser Systems
 - Piezo Based Scanning Systems
 - Wire bonding
 - Milling machine
- Computer skills:
 - \LaTeX
 - COMSOL Multiphysics Modeling Software
 - High Frequency Structure Simulator (HFSS)
 - Solidworks 3D Modeling
 - Code Optimization for Parallel Computation
 - Machine Learning Algorithms
 - C language
 - MATLAB
 - Mathematica
 - Python (Pandas, NumPy, Data wrangling)
 - Apache Spark
 - TensorFlow
- Languages:  English •  Russian •  Turkish •  Tajik •  Persian

AWARDS & SCHOLARSHIPS

- Dean’s Fellowship, University of Maryland Aug 2013
- Boğaziçi University Honors List Jul 2012
- Bronze Medal, 39th International Physics Olympiad (IPhO), Vietnam Jul 2008
- Bronze Medal, 9th Asian Physics Olympiad (APhO), Mongolia Apr 2008
- Bronze Medal , 4th Zhautykov Physics Olympiad (ZPhO), Kazakhstan Apr 2008

- Gold Medal , Tajikistan Nationwide Physics Olympiad, Tajikistan Mar 2008
- Honorable Mention, 38th International Physics Olympiad (IPhO), Iran Jul 2007
- Honorable Mention , 8th Asian Physics Olympiad (APhO), China Apr 2007

**CONFERENCE
TALKS
& PRESENTATIONS**

- [16] B. Oripov, A. McCaughan, S. M. Buckley “Node-perturbed multiplexed gradient descent for online-training of hardware neural networks,” at *International Conference on Neuromorphic Systems (ICONS 2023)*, Santa Fe, New Mexico, Aug 2023.
- [15] B. Oripov, D. Rampini, B. Korzh, J. Allmaras, Sae Woo Nam, A. McCaughan “Development of a 400,000 pixel superconducting-nanowire single photon imager,” Invited talk at SPIE DCS meeting, Orlando, Florida, May 2023.
- [15] B. Oripov, D. Rampini, B. Korzh, J. Allmaras, Sae Woo Nam, A. McCaughan “Development of a 10,000 pixel superconducting-nanowire single photon camera,” at *53th Applied Superconductivity Conference*, Honolulu, Hawaii, Oct 2022.
- [14] B. Oripov, D. Rampini, J. Allmaras, Sae Woo Nam, A. McCaughan “Switching regimes of a multilayer heater-tron superconducting switch,” at *53th Applied Superconductivity Conference*, Honolulu, Hawaii, Oct 2022.
- [13] B. Oripov and S. Anlage, “High-Frequency Nonlinear Microscopy of Nb for Superconducting RF Cavity Applications,” at *52th Applied Superconductivity Conference*, Boulder, Colorado, Oct 2020.
- [12] B. Oripov and S. Anlage, “Time-Dependent Ginzburg-Landau Treatment of RF Magnetic Vortex Semi-loops in Superconductors,” at *52th Applied Superconductivity Conference*, Oct 2020.
- [11] B. Oripov and S. Anlage, “High Frequency Near-Field Magnetic Microscopy ,” at *National Institute of Standards and Technology (NIST) High Frequency Scanning Probe Microscopy Workshop* , Boulder, Colorado, Dec 2019.
- [10] B. Oripov and S. Anlage, “Microwave Microscopy of Materials Limitations of Superconducting RF Cavities,” in *Cryogenic Engineering Conference and International Cryogenic Materials Conference*, Hartford, Connecticut, Jul 2019.
- [9] B. Oripov and S. Anlage, “Microwave Microscopy of Materials Limitations of Superconducting RF Cavities,” at *American Physics Society March Meeting*, Boston, Massachusetts, Mar 2019.
- [8] B. Oripov, G. Ciovatti and S. Anlage, “SRF Cavity Residual Losses at mK Temperatures,” at *51st Applied Superconductivity Conference*, Seattle, Washington, Nov 2018.
- [7] B. Oripov and S. Anlage, “Microscopic Investigation of Materials Limitations of Superconducting RF Cavities,” at *51th Applied Superconductivity Conference*, Seattle, Washington, Nov 2018.
- [6] B. Oripov and S. Anlage, “Study of RF flux penetration on Nb for SRF Applications,” in *American Physics Society March Meeting*, Los Angeles, California, Mar 2018.
- [5] B. Oripov, S. Bae, T. Tai and S. Anlage, “Near-Field Nonlinear Microwave Microscopy of Superconductors,” at *Radio Frequency Scanning Probe Microscopy Workshop*, Boulder, Colorado, Nov 2017.
- [4] B. Oripov and S. Anlage, “Extreme and Local Electrodynamic Measurement of Nb for SRF Applications,” at *50th Applied Superconductivity Conference*, Denver, Colorado, Sep 2016.
- [3] B. Oripov and S. Anlage, “Extreme Electrodynamic and Local Harmonic Measurement of Nb Thin Films,” at *7th International Workshop on Thin Films and New Ideas for Pushing the Limits of RF Superconductivity*, Jefferson Lab, Newport News, Virginia, Jul 2016.
- [2] B. Oripov, T.Tai and S. Anlage, “Extreme and Local 3rd Harmonic Response of Niobium (Nb) SC,” at *American Physics Society March Meeting*, Baltimore, Maryland, Mar 2016.
- [1] B. Oripov, T.Tai and S. Anlage, “Microscopic Investigation of Materials Limitations of Superconducting RF Cavities,” Poster presented at: *17th International Conference on RF Superconductivity*, Whistler, British Columbia, Canada, Sep 2015.

**CO-AUTHORED
CONFERENCE
PRESENTATIONS**

- [10] Chung-Yang Wang, B. Oripov and S. Anlage, “Investigation of Local Nonlinear Microwave Response of Nb₃Sn in the Superconducting State,” Talk given by Chung-Yang Wang at *American Physics Society March Meeting*, Virtual, Mar 2021.

- [9] B. Oripov, Chung-Yang Wang and S. Anlage, “Investigation of Local Nonlinear Microwave Response of Nb₃Sn in the Superconducting State,” Talk given by S. Anlage at *Virtual International Workshop on Nb₃Sn SRF Science, Technology, and Applications (Nb₃SnSRF’20)*, hosted by The Center for Bright Beams, Cornell, Ithaca, NY, Nov 2020.
- [8] C. Garcia, A. Sirota, A. Herr, V. Talanov, B. Oripov and S. Anlage, “Confluence of complex surface impedance and critical current studies of model defects in niobium films near critical temperature,” Talk given by C. Garcia at *American Physics Society March Meeting*, Denver, Colorado, Mar 2020.
- [7] B. Oripov and S. Anlage, “Microscopic Investigation Of Materials Limitations of Superconducting RF Cavities,” Talk given by S. Anlage at *TESLA Technology Collaboration*, European Organization for Nuclear Research (CERN), Geneva, Switzerland, Feb 2020.
- [6] B. Oripov, G. Ciovatti and S. Anlage, “Superconducting Radio Frequency Cavity Residual Losses at mK Temperatures,” Poster presented by S. Anlage at: *19th International Conference on RF Superconductivity*, Dresden, Germany, Jul 2019.
- [5] B. Oripov and S. Anlage, “High-Frequency Nonlinear Response of Superconducting Cavity-Grade Nb Surfaces,” Poster presented by S. Anlage at: *19th International Conference on RF Superconductivity*, Dresden, Germany, Jul 2019.
- [4] B. Oripov and S. Anlage, “Microscopic Investigation of Materials Limitations of Superconducting RF Cavities,” Talk given by S. Anlage at *8th International Workshop on Thin Films and New Ideas for Pushing the Limits of RF Superconductivity*, Laboratori Nazionali di Legnaro, Padua, Italy, Oct 2018.
- [3] B. Oripov and S. Anlage, “Measurements of local nonlinear rf response of superconductors using a scanned magnetic microwave microscope” Talk given by S. Anlage at *14th International Workshop of High-Temperature Superconductors in High Frequency Field*, Zao-Onsen, Yamagata, Japan, Jun 2018.
- [2] B. Oripov, S. Bae, T. Tai and S. Anlage, “Near-Field Nonlinear Microwave Microscopy of Superconductors,” Talk given by S. Anlage at *Radio Frequency Scanning Probe Microscopy Workshop*, Boulder, Colorado, Nov 2017.
- [1] B. Oripov and S. Anlage, “Study of RF flux penetration on Nb for SRF Applications,” Talk given by S. Bae at *American Physics Society March Meeting*, New Orleans, Louisiana, Mar 2017.