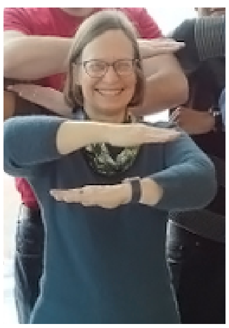
The Center for BRIGHTBEAMS

A NATIONAL SCIENCE FOUNDATION SCIENCE & TECHNOLOGY CENTER

NEWSLETTER

FALL 2022



Dear Friends of CBB,

As for so many people, 2022 has been a year of celebrating togetherness in CBB. For the first time since 2019, CBB met in person for our annual meeting and Symposium. Gathered on the lovely UCLA campus, we shared our ideas, built relationships, and communed as a team. We stayed safe, thanks to masking and lots of time outdoors, and it felt very, very good to be together again.

As always, a highlight was seeing the energy and marvelous work of our students and postdocs, a sampling of which is featured on this Newsletter and on our YouTube channel (@brightbeams). CBB has become well-known in the accelerator community for its role in education. Whether a student is in chemistry, surface science, microscopy, theoretical condensed matter physics, or accelerator science, she or he gets broad training and extensive experience in interdisciplinary team science. This background serves our students and postdocs well, whatever their career path, and for accelerator science, where the demand for trained scientists and engineers far exceeds national production, CBB is filling a critical national need.

This year has seen CBB science and technology put to work in operating accelerators, including high performance photocathodes and techniques for tuning accelerators based on machine learning. In parallel, we're contributing to a national effort to increase the availability of high-power electron beams through better accelerating cavities, with applications ranging from wastewater purification to the production of X-rays for research.

Whether in education or knowledge transfer, it's exciting to see the investment in CBB bear fruit.

Ritchie

J. Ritchie Patterson
Director of the Center for Bright Beams

The Beam Team gathered at UCLA for the first in-person annual meeting since 2019. More on page 8.

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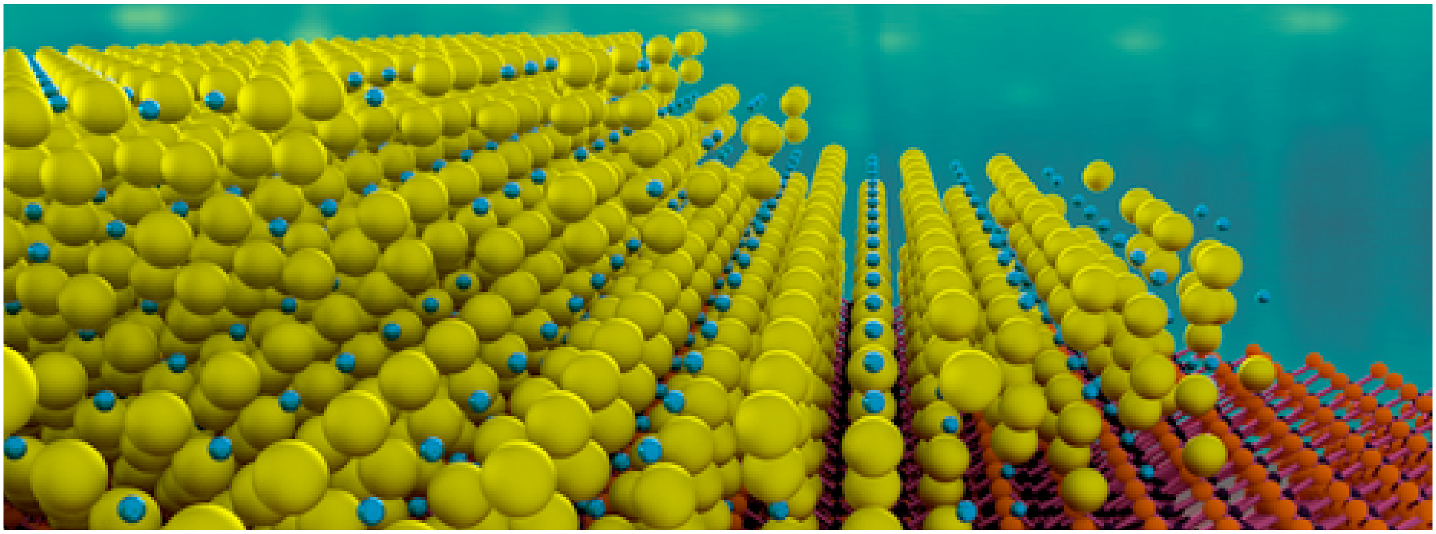
In the Press

Ultrathin Photocathode with High Efficiency

Reprinted with permission from Physics Magazine - March 18, 2022
Original publication Phys. Rev. Lett. 128, 114801 (2022)



Researchers demonstrate a single-crystal photocathode that can emit electrons with higher efficiency than its predecessors.

Scientists use optical microscopes to reveal otherwise invisible worlds, such as those inhabited by wriggling microorganisms and dividing cells. More detailed views of these systems are obtainable via devices such as ultrafast time-resolved electron microscopes, which use electrons rather than photons to image. In these microscopes, the electrons are generated using a photocathode, which emits electrons when illuminated with light. High-performing photocathodes have been around for nearly a century, but scientists have struggled to improve their efficiencies and performance, in part because of the extreme reactivity of the materials from which they are made. Now, a team of researchers from Cornell University has demonstrated a photocathode with an efficiency up to 10 times higher than other photocathode devices [1].

The team made their photocathode from an ultrathin film of the alkali antimonide Cs_3Sb. Alkali antimonide materials have been used for decades in technologies including streak cameras and linear colliders. Researchers have also created photocathodes using alkali antimonides. But they found that surface disorder in films of the material can weaken the brightness of the resulting electron beam. The Cornell team shows that it can fix that performance problem by controlling the orientation of Cs_3Sb's atoms.

The team used molecular-beam epitaxy to deposit onto silicon carbide a 4-nm-thick single-crystal layer of Cs_3Sb. Molecular-beam epitaxy "grows" the material one atomic layer at a time, allowing the team to lock the orientation of the atoms and create a single-crystal film. The team used in situ diagnostic tests, including x-ray and ultraviolet photoemission spectroscopy, to characterize the film's performance. They calculate that the photocathodes have an estimated photoemission response time of just 10 fs—an order of magnitude faster than previous devices.

–Sarah Wells

Sarah Wells is an independent science journalist based in Boston.

References

1. C. T. Parzyck, A. Galdi, J. K. Nangoi, W. J. I. DeBenedetti, J. Balajka, B. D. Faeth, H. Paik, C. Hu, T. A. Arias, M. A. Hines, D. G. Schlom, K. M. Shen, and J. M. Maxson, "Single-Crystal Alkali Antimonide Photocathodes: High Efficiency in the Ultrathin Limit," Phys. Rev. Lett., vol. 128, no. 11, p. 114801, Mar. 2022, doi: 10.1103/PhysRevLett.128.114801.

In the Press

First demonstration of a new particle beam technology at Fermilab

Reprinted with permission from Fermilab News - August 10, 2022

Original publication Nature 608, 287–292 (2022)

Physicists love to smash particles together and study the resulting chaos. Therein lies the discovery of new particles and strange physics, generated for tiny fractions of a second and recreating conditions often not seen in our universe for billions of years. But for the magic to happen, two beams of particles must first collide.

Researchers at the U.S. Department of Energy's Fermi National Accelerator Laboratory have announced the first successful demonstration of a new technique that improves particle beams. Future

The beam particles each emit ultrafast light pulses as they pass through a special magnet called a pickup undulator (bottom right). Information about each particle's energy or trajectory error is encoded in its light pulse. The light pulses are captured, focused and tuned by various light optics. The particles then interact with their own pulses inside an identical kicker undulator (center). The interaction can be used to cool the particles or even control them depending on the configuration of the system. Image: Jonathan Jarvis, Fermilab

particle accelerators could potentially use the method to create better, denser particle beams, increasing the number of collisions and giving researchers a better chance to explore rare physics phenomena that help us understand our universe. The team published its findings in a recent edition of Nature.

Particle beams are made of billions of particles traveling together in groups called bunches. Condensing the particles in each beam so they are packed closely together makes it more likely that particles in colliding bunches will interact—the same way multiple people trying to get through a doorway at the same time are more likely to jostle one another than when walking through a wide-open room.

Packing particles together in a beam requires something similar to what happens when you put an inflated balloon in a freezer. Cooling the gas in the balloon reduces the random motion of the molecules and causes the balloon to shrink. "Cooling" a beam reduces the random motion of the particles and makes the beam narrower and denser.

Scientists at Fermilab used the lab's newest storage ring, the Integrable Optics Test Accelerator, known as IOTA, to demonstrate and explore a new kind of beam cooling technology with the potential to dramatically speed up that cooling process.

"IOTA was built as a flexible machine for research and development in accelerator science and technology," said Jonathan Jarvis, a scientist at Fermilab. "That flexibility lets us quickly reconfigure the storage ring to focus on different high-impact opportunities. That's exactly what we've done with this new cooling technique."

The new technique is called optical stochastic cooling. It was first proposed in the early 1990s, and while significant theoretical progress was made, an experimental demonstration of the technique remained elusive until now.

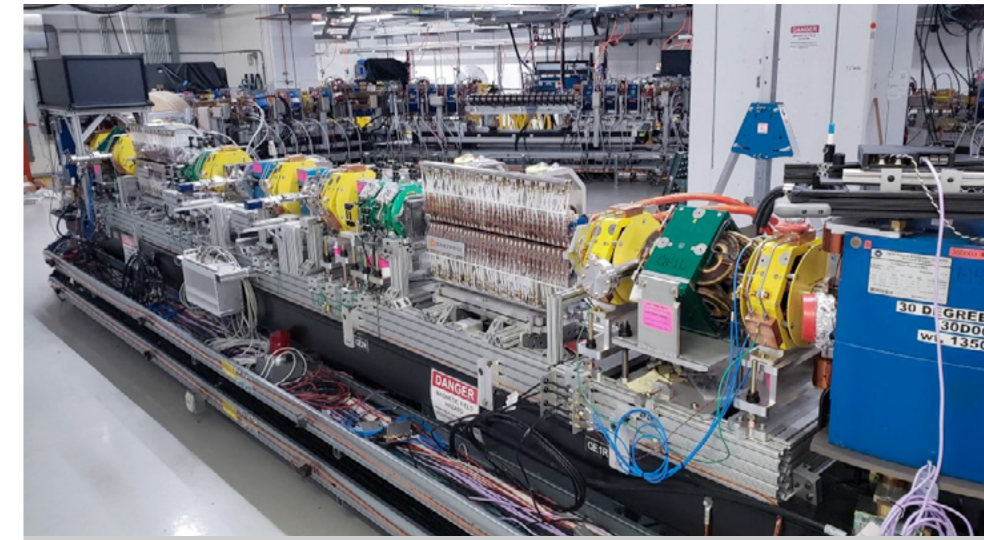
This kind of cooling system measures how particles in a beam move away from their ideal course and then uses a special configuration of magnets, lenses and other optics to give corrective nudges. It works because of a particular feature of charged particles like electrons and protons: As the particles move along a curved path, they radiate energy in the form of light pulses, giving information about the position and velocity of each particle in the bunch. The beam-cooling system can collect this information and use a device called a kicker magnet to bump them back in line.

Conventional stochastic cooling, which earned its inventor, Simon van der Meer, a share of the 1984 Nobel Prize, works by using light in the microwave range with wavelengths of several centimeters. In contrast, optical stochastic cooling uses visible and infrared light, which have wavelengths around a millionth of a meter. The shorter wavelength means scientists can sense the particles' activity more precisely and make more accurate corrections.

To prepare a particle beam for experiments, accelerator operators send it on several passes through the cooling system. The improved resolution of optical stochastic cooling provides more exact kicks to smaller groups of particles, so fewer laps around the storage ring are needed. With the beam cooled more quickly, researchers can spend more time using those particles to produce experimental data.

The cooling also helps preserve beams by continually reigning in the particles as they bounce off one another. In principle, optical stochastic cooling could advance the state-of-the-art cooling rate by up to a factor of 10,000.

This first demonstration at IOTA used a medium-energy electron beam and a configuration called "passive cooling," which doesn't amplify the



The optical stochastic cooling apparatus occupies the entire six-meter length of IOTA's long experimental straight. Designed and built by the IOTA/FAST team and industry partners, the system was recently used to achieve the world's first demonstration of OSC. Photo: Ryan Postel, Fermilab

light pulses from the particles. The team successfully observed the effect and achieved about a tenfold increase in cooling rate compared to the natural "radiation damping" that the beam experiences in IOTA. They were also able to control whether the beam cools in one, two or all three dimensions. Finally, in addition to cooling beams with millions of particles, scientists also ran experiments studying the cooling of a single electron stored in the accelerator.

"It's exciting because this is the first cooling technique demonstrated in the optical regime, and this experiment let us study the most the essential physics of the cooling process," Jarvis said. "We've already learned a lot, and now we can add another layer to the experiment that brings us significantly closer to real applications."

With the initial experiment completed, the team is developing an improved system at IOTA that will be the key to advancing the technology. It will use an optical amplifier to strengthen the light from each particle by about a factor of 1,000 and apply machine learning to add flexibility to the system.

"Ultimately, we'll explore a variety of ways to apply this new technique in particle colliders and beyond," Jarvis said. "We think it's very cool."

For more information about IOTA and optical stochastic cooling, read this article.

This work was supported by the U.S. Department of Energy Office of Science, SC High Energy Physics and National Science Foundation.

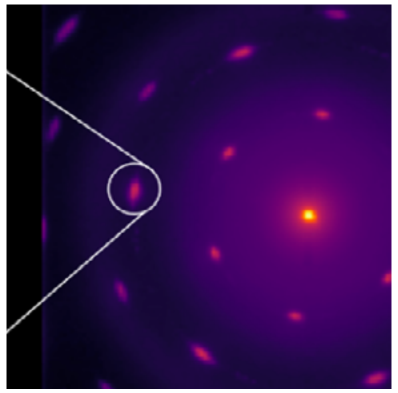
CBB student AJ Dick, working with Professor Philippe Piot at Northern Illinois University, contributed to the system used to synchronize the emitted radiation with the beam to sub-optical wavelength precision. He also implemented a model of cooling in the widely-used particle tracking code, elegant, and used it to simulate IOTA's cooling in detail.

More Research Highlights

Learn more about CBB research at cbb.cornell.edu

Ultrafast electron diffraction in a keV beamline

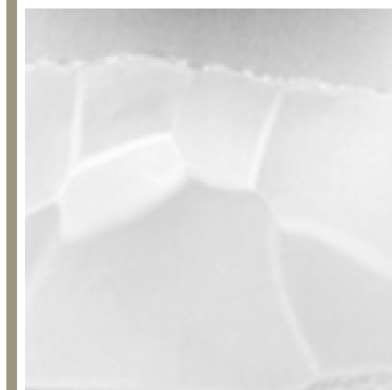
M. Gordon, W. Li, C. Duncan, M. Andorf, C. Pennington, I. Bazarov, YK. Kim, J. Maxson, C. Duncan, and A. Galdi



Recently, grad students Cameron Duncan (Cornell), William Li (Cornell) and Matthew Gordon (U Chicago) used a high-performance semiconductor cathode to produce an electron beam for keV ultrafast diffraction. The emphasis here was to reduce the transverse beam size dramatically, to allow the study of small samples that are hard to fabricate as large crystals.

Accelerators for cleaner wastewater

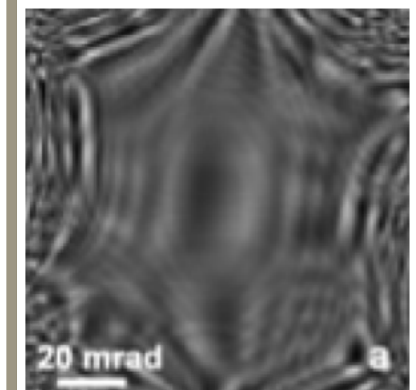
S. Posen, M. Liepe, G. Eremeev, U. Pudasaini, and C.E. Reece, R.D. Porter, Z. Sun, T.A. Arias, Z. Baraissov, D.A. Muller, N. Sitaraman, G. Gaitan, T. Oseroff, M. Kelley, M. Salim, C. Dukes



Unlike traditional niobium cavities, Nb_3Sn cavities can operate at higher temperatures, eliminating the need for expensive and complex cryogenic refrigeration systems. As a result, Nb_3Sn opens the door to far wider application of high-power beams. CBB grad students Nathan Sitaraman, Zhaslan Barraisov and Ryan Porter combined their ab initio calculations, microscopic sample characterization, and growth expertise to diagnose the problem and modify the Nb_3Sn growth procedures, resulting in better uniformity and a 50% reduction in intrinsic energy losses.

Machine learning-based tuning of electron microscopes

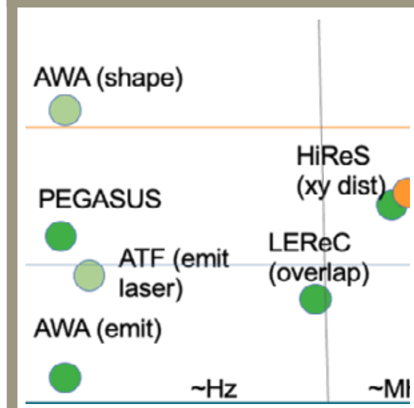
C. Zhang, Y. Shao, Z. Baraissov, C. J. Duncan, A. Hanuka, A. L. Edelen, J. M. Maxson, D. A. Muller



Today's electron microscopes are complicated devices with aberration correction involving hundreds of optical elements like those found in accelerators and synchrotrons. The beam alignment can only be effectively monitored at the end of the column, usually using a interferogram called a Ronchigram (see figure) that maps the phase variation of the beam versus scattering angle.

Machine learning-based live optimization of accelerators

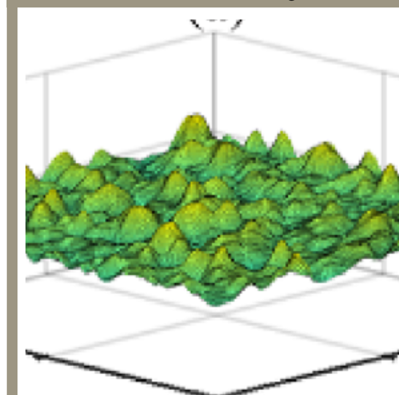
W. Lin, G. Hoffstaetter, A. Scheinker, F. Cropp, D. Filippetto, R. Roussel, J. Aguilera, P. Piot, P. Musumeci, YK. Kim, A. Edelen, and C. Duncan



Recently, CBB student Lucy Lin applied machine learning techniques to cooling at RHIC at BNL (LEReC). A specialized Bayesian optimization algorithm maximizes the cooling rate using a high-dimensional surrogate model trained on LEReC system simulator data. In tests, this system, which was developed in a collaboration between CBB and BNL, has automatically tuned beams to the orbit that maximizes cooling. This success makes full integration with the RHIC control system very promising.

Physically and chemically smooth cesium-antimonide photocathodes on single crystal strontium titanate substrates

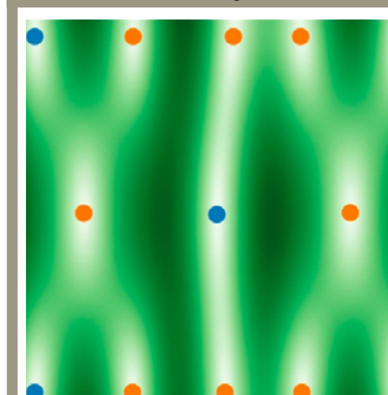
P. Saha, O. Chubenko, G. S. Gevorkyan, A. Kachwala, C. J. Knill, C. Sarabia-Cardenas, E. Montgomery, S. Poddar, J. T. Paul, R. G. Hennig, H. A. Padmore, and S. Karkare



In this work, we show that high QE Cs_3Sb films grown on lattice-matched Strontium Titanate (STO) substrates have a factor of 4 smoother surfaces compared to those traditionally grown on disordered Si surfaces. We perform simulations to calculate roughness induced MTE based on the measured topographical and surface-potential variations on the Cs_3Sb films grown on STO and show that these variations are small enough to have no consequential impact on the MTE and hence the brightness.

Turn-key constrained parameter space exploration for particle accelerators using Bayesian active learning

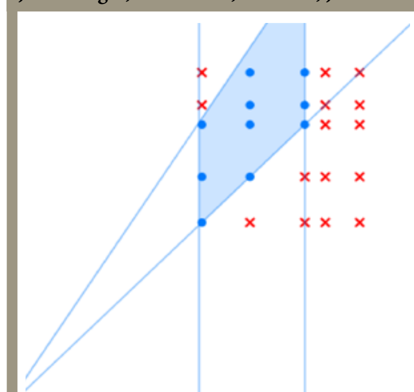
Roussel, R., Gonzalez-Aguilera, J.P., Kim, YK. et al.



This advancement solves an extremely common experimental or computational problem faced by those in the accelerator, physical, chemical and biological scientific fields. As such, it is applicable towards experimental design in many different situations, especially novel or poorly understood contexts. Scientists in the physics community will be able to greatly improve the efficiency and success of their experiments using this work.

Ab initio study of the crystal and electronic structure of mono- and bi-alkali antimonides

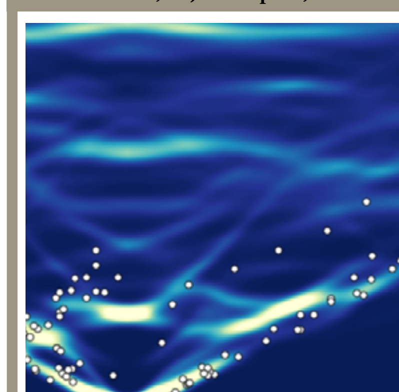
J. K. Nangoi, M. Gaowei, A. Galdi, J. M. Maxson, S. Karkare, J. Smedley, and T. A. Arias



Mono- and bi-alkali antimonides, X_2YSb (X and Y from Group I), are promising for next-generation electron emitters due to their capability of producing high-quality electron beams. How-ever, these materials are not yet well understood, in part due to the technical challenges in growing pure, ordered alkali antimonides.

A combined helium atom scattering and density-functional theory study

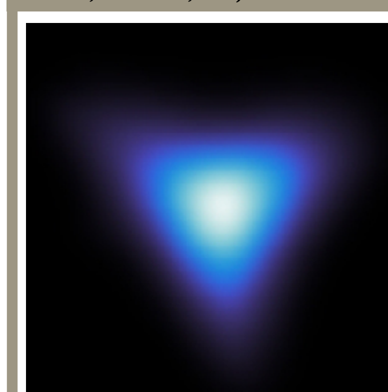
A. A. McMillan, C. J. Thompson, M. M. Kelley, J. D. Graham, T. A. Arias, and S. J. Sibener



This study supplies fundamental information for further development and growth of materials used in superconducting radiofrequency cavities, with the goal of producing cavities producing higher efficiencies and stronger accelerating fields.

Four-dimensional emittance measurements of ultrafast electron diffraction optics corrected up to sextupole order

M. Gordon, W. H. Li, M. B. Andorf, A. C. Bartnik, C. J. R. Duncan, M. Kaemingk, C. A. Pennington, I. V. Bazarov, Y.-K. Kim, and J. M. Maxson



This is the first experimental demonstration of a technique that corrects magnetic field aberrations up to sextupole order in a low emittance beamline. This work enabled the exciting application of ultrafast electron microdiffraction at MEDUSA for studying materials at ultrafast timescales, and can be readily used by other electron microdiffraction facilities.

Science Bites

Each year our students present a "Research Blitz" where they have 60 seconds to explain their research to a non-expert audience. This year five videos were selected to be sent to the National Science Foundation to help the NSF communicate both the importance and the excitement of the science that they fund.

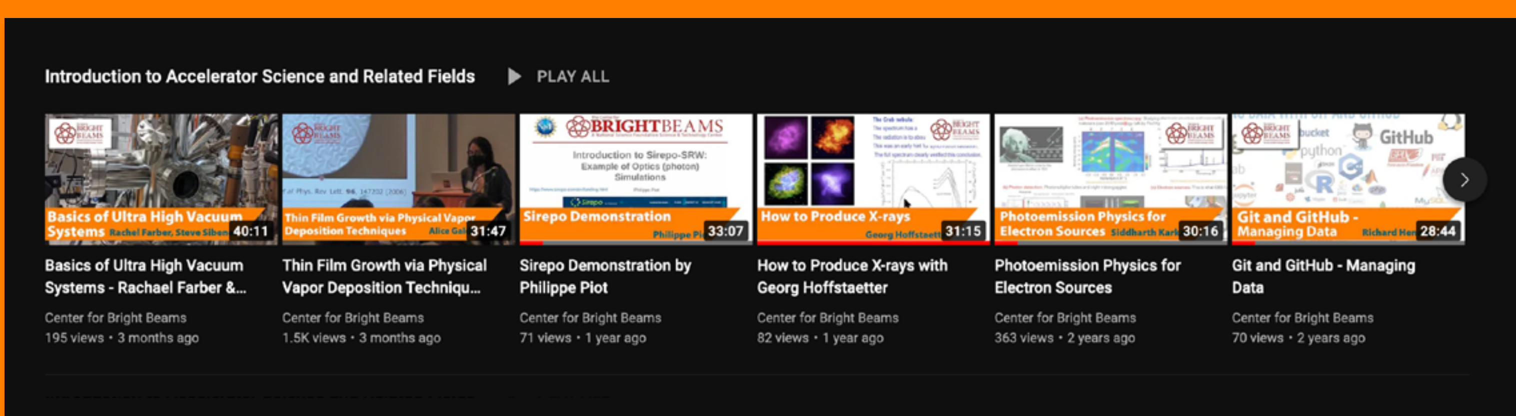
Winning videos were selected by a panel for their ability to creatively communicate CBB science to a broad audience. Watch on the .

Learn More @brightbeams YouTube

Interested in learning more about topics within the accelerator sciences field?

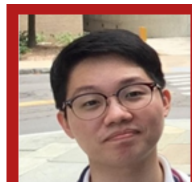
See the Introduction to Accelerator Sciences Playlist on the CBB YouTube Channel.

www.youtube.com/@brightbeams

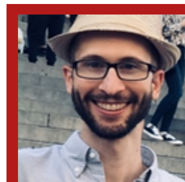


Recent Alumni

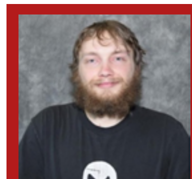
Graduate Students



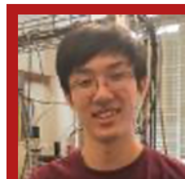
Jai Kwan Bae
Research Associate
Brookhaven National Lab
Thesis: Brightness, Spin Polarization, and Lifetime of Photocathodes for a High Current Electron Beam



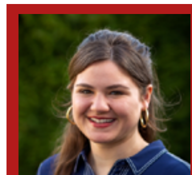
Cameron Duncan
Postdoctoral Fellow
University of Milano-Bicocca
Thesis: Brightness, Spin Polarization, and Lifetime of Photocathodes for a High Current Electron Beam



Matthew Gordon
Postdoctoral Fellow
Cornell University
Thesis: High Brightness Photoelectron Beamlines for Femtosecond Science

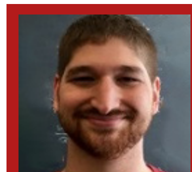


William Li
Research Associate
Brookhaven National Lab
Thesis: Characterization and Applications of Low Intrinsic Emittance Photocathodes

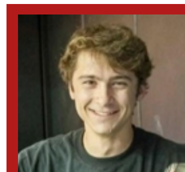


Alison McMillan
Staff Scientist
Global Atomics
Thesis: Surface Stability, Phonon Band Structure, and Vibrational Dynamics of the Nb(100) Surface Oxide Reconstruction

Kevin Nangoi
Postdoctoral Fellow
Univ. of California, Santa Barbara
Thesis: Ab initio study of photoemission processes and photocathode materials for next generation high-brightness electron emitters



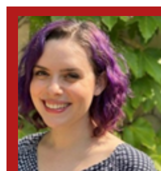
Thomas Oseroff
Research Associate
Cornell University
Thesis: Advancing a superconducting sample host cavity and its application for studying proximity-coupled normal layers in strong microwave fields



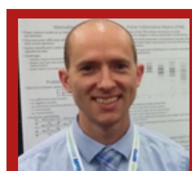
Chris Pierce
Postdoctoral Fellow
University of Chicago
Thesis: Towards High Brightness from Photocathodes

Postdocs

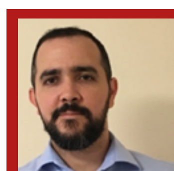
Oksana Chubenko
Assistant Professor
Northern Illinois University



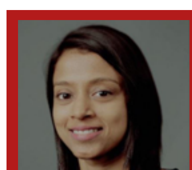
Rachael Farber
Assistant Professor
University of Kansas



Benjamin Francis
Chief Scientist
Achilles Heel Technologies



Danilo Liarte
Research Associate
Cornell University



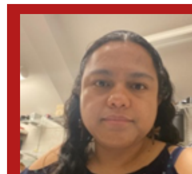
Dulanga Somaratne
Interviewing

Chenyu Zhang
Senior Software Engineer
ASML

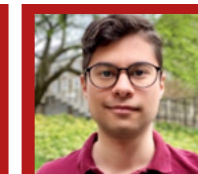
Welcome New CBB Members

Oksana Chubenko
Professor Chubenko from Northern Illinois University
Joins the Center for Bright Beams

Professor Oksana Chubenko received her PhD in Physics from The George Washington University in 2019. Her dissertation was focused on detailed modeling of physical processes and mechanisms in advanced electron sources for accelerator applications with emphasis on photocathodes and field emitters. Then she joined Arizona State University (ASU) as a Postdoctoral Research Associate supported by the Center for Bright Beams (CBB). Her work at ASU was focused on the Monte Carlo modeling of laser-induced heating mechanisms in semiconductor photocathodes and their effect on the brightness of electron beams. She also conducted research on the epitaxial growth and advanced characterization of alkali antimonide photocathodes. Dr. Chubenko joined Northern Illinois University (NIU) as an Assistant Professor in 2022. At NIU, she continues collaborating with CBB's Beam Production group towards improving photocathode capabilities. Her research will be focused on detailed modeling of electron emission from bulk semiconductors and layered structures towards predicting photocathode performance under different operational conditions as well as identifying and reducing mechanisms limiting the beam brightness. Another aspect of her research will be testing CBB-developed photocathodes under realistic photoinjector conditions at leading accelerator facilities.

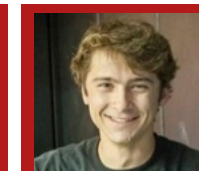


Elena Echeverria
Postdoctoral Fellow
Cornell University
Beam Production



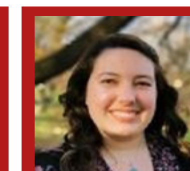
Juan Pablo Gonzalez-Aguilera
Graduate Student
University of Chicago
Beam Dynamics and Control

Desheng Ma
Graduate Student
Cornell University
Beam Dynamics & Control

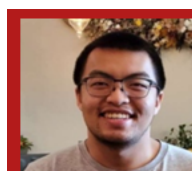


Chris Pierce
Postdoctoral Fellow
University of Chicago
Beam Dynamics and Control

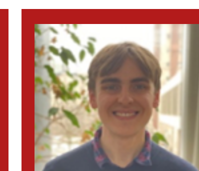
Becky Reynolds
Administrative
Cornell University
Center for Bright Beams



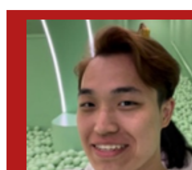
Annabel Selino
Graduate Student
Cornell University
Beam Production



Tyler Wu
Graduate Student
Cornell University
Beam Production



Michael Van Duinen
Graduate Student
University of Chicago
Beam Acceleration



Charles Zhang
Graduate Student
Cornell University
Beam Production

Awards & Honors

Graduate Student Eric Cropp (University of California, Los Angeles)
Department of Energy Office of Science Graduate Student Research Program (SCGSR) Award

Graduate Student Jason Gibson (University of Florida)
NSF Molecular Sciences Software Institute (MolSSI) Seed Software Fellowship

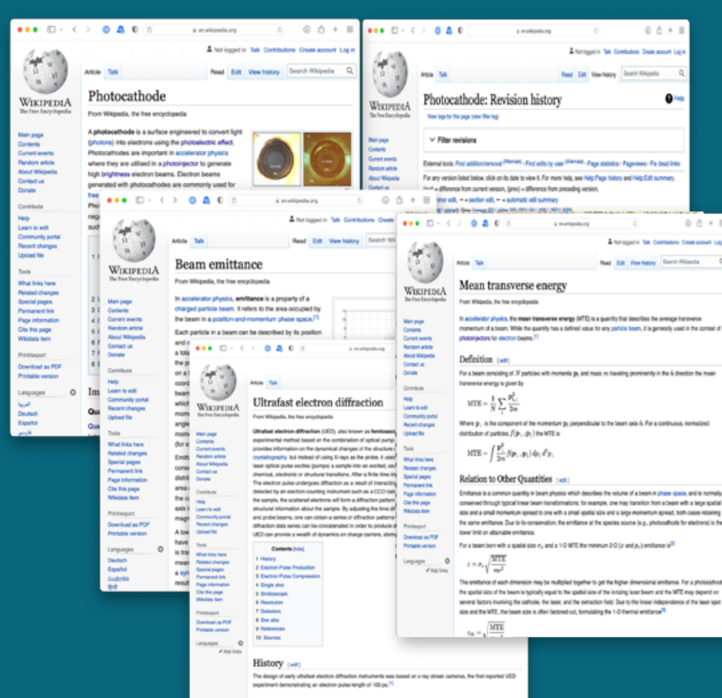
Theme Leader Young-Kee Kim (University of Chicago)
Elected to National Academy of Sciences

Theme Leader David Muller (Cornell University)
Ernst Ruska Prize
Highly Cited Researcher (top 1% by citations in Physics)
"Top 10 science and technology progress in the world in 2021"

Faculty Member Jamie Rosenzweig (University of California, Los Angeles)
Advanced Accelerator Concepts Workshop '22 Prize

Theme Leader Mark Transtrum (Brigham Young University)
BYU Early Career Scholarship Award

Wikipedia-edit-a-thon



Recently, CBB students and postdocs hosted a Wikipedia-edit-a-thon to update entries for terms such as photocathode, beam emittance, ultrafast electron diffraction, and mean transverse energy.

2022 Annual Meeting and Symposium

The 2022 annual meeting was hosted by UCLA on June 3, 2022 followed by the symposium on Compact Light Sources

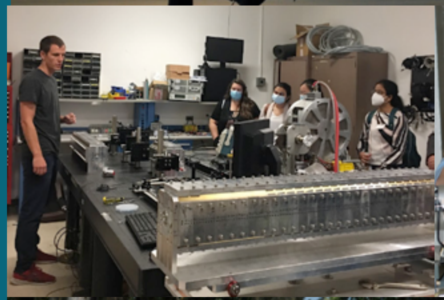
The entire CBB team gathered for the first in-person annual meeting since 2019.

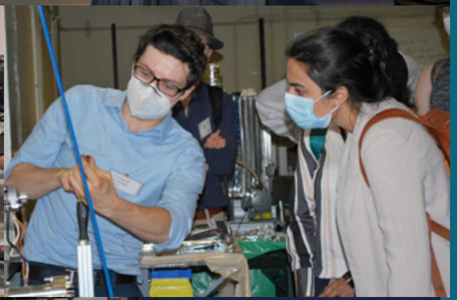
Videos from our pedagogical sessions, "Basics of Ultra High Vacuum Systems" with Rachael Farber and Steve Sibener and "Thin Film Growth via Physical Vapor Deposition Techniques" with Alice Galdi can be found on the CBB YouTube Channel.

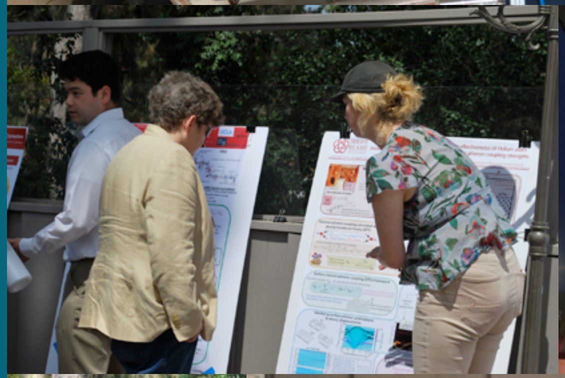
George Gopen, of Writing Transformed, gave an interactive and fascinating seminar on the process of clear scientific writing. A recording of his workshop can be found on the CBB YouTube Channel.

Several days of talks, tours, workshops, poster sessions, a research blitz, and thought-provoking conversations left us reinvigorated and ready to tackle challenges set forth in our strategic plan.

Most of all it was truly wonderful to see everyone in person once again.



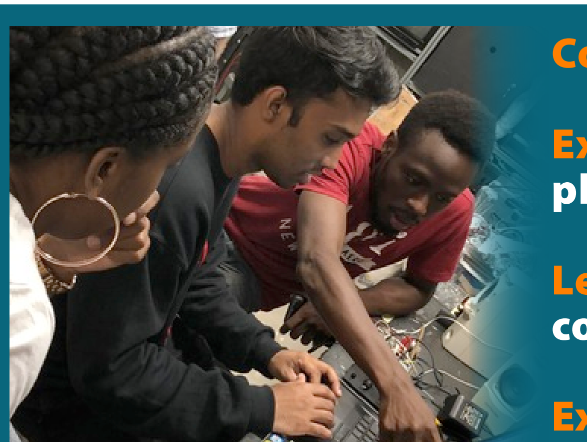




Each year the CBB Symposium addresses a topic of current interest in accelerator science.

This year's symposium addressed compact light sources. Presentations included "Applications of compact light sources" with Rober Kaindl of Arizona State University, "Paths toward compact FELs" by Zhirong Huang of SLAC, "Laser-based beam manipulation" with Luca Giannessi of INFN, "X-ray FELs based on plasma accelerators" by Marie-Emmanuelle Couprie of SOLEIL, and "X-ray FELs based on high-gradient conventional acceleration" by Nathan Majernik of UCLA.

Research Experiences for Undergraduates



Contribute to cutting-edge research at world leading institutions.

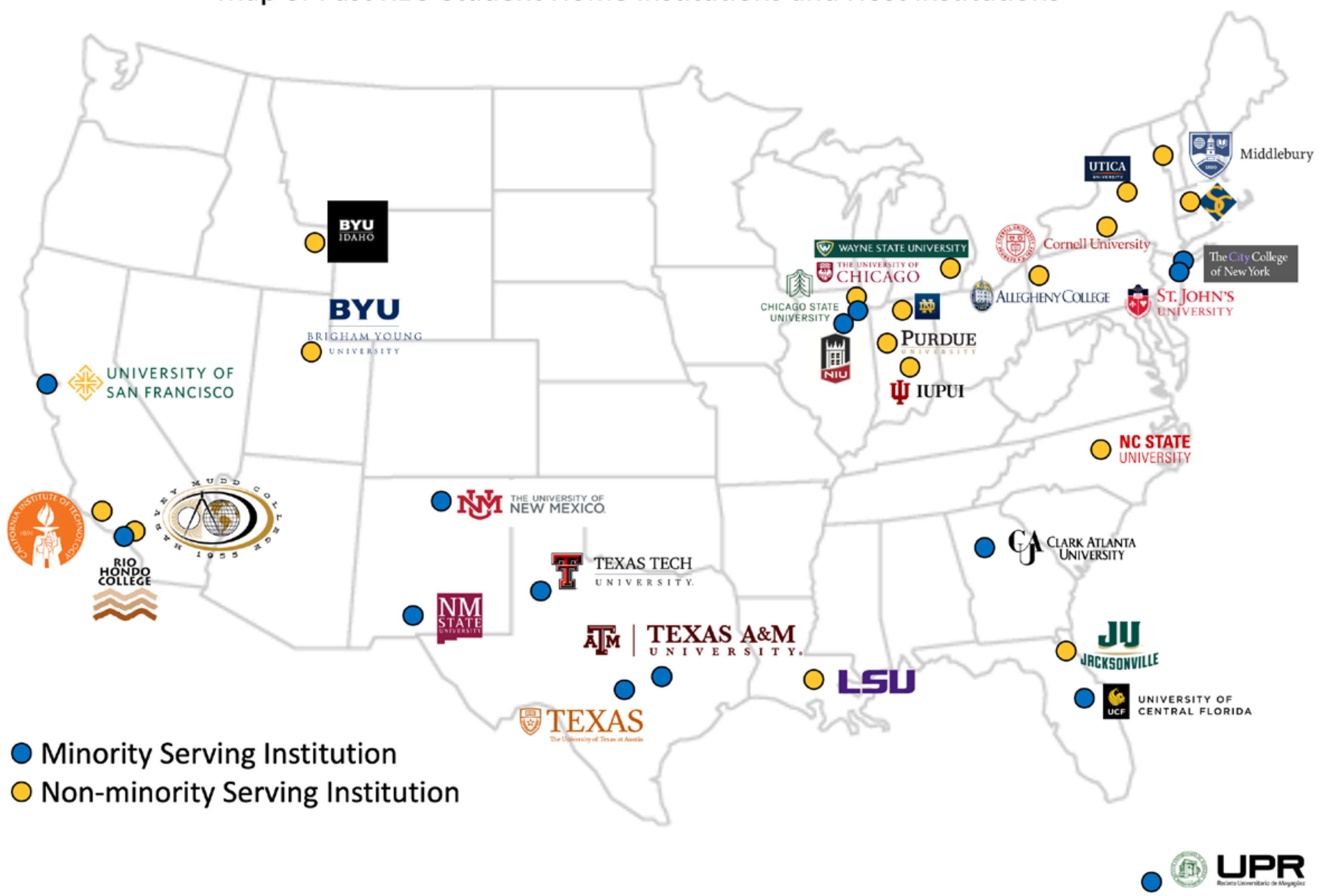
Experience interdisciplinary research, working side-by-side with material scientists, chemists, condensed matter physicists and accelerator scientists.

Learn alongside individuals from a wide range of nationalities, cultures and educational backgrounds. CBB continuously works toward the inclusion of underrepresented minorities, women, and first-generation students.

Explore high demand career opportunities.

CBB strives to broaden the pipeline of accelerator scientists by increasing awareness of the discipline beyond the walls of national accelerator laboratories and by actively seeking out the participation of students and senior researchers from underrepresented groups. The Research Experience for Undergraduates (REU) has been a key component of this goal. Brigham Young University, University of Chicago, Cornell University, and Northern Illinois University regularly host CBB REU programs each summer. **We are currently accepting applications for the 2023 REU Program.**

Map of Past REU Student Home Institutions and Host Institutions



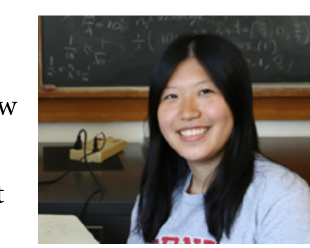
Check out what a few of our past students had to say.

Eliza Walters

"This experience has opened my eyes to the independence, challenges, and sense of responsibility that come with being a researcher.... I have also come to realize how many more experienced researchers go through a similar process; there are always unanswered questions, and grappling with unknown ideas is truly how research is conducted and scientific progress is made"

Michelle Kwok

"I've really enjoyed being able to completely focus on conducting research, as that is something I've not been able to do prior to now due to schoolwork and other jobs. I also enjoy working with my peers and mentors and being a part of a research group where I got to see where everyone's smaller project fit into a larger project and the implications that has for physics as a whole."



Maya Caskey

"This experience has made me realize how much of a community effort research is today."

Year 7 Projects

PI Name	Projects	Theme	Students & Post-docs
Arias	Ab initio theory of many-body photoemission and of photomaterials	PHC	Tyler Chun Wai Wu (GRA)
Arias	Ab initio studies of lattice and electron excitations relevant to SRF performance and inverse-Q behavior	SRF	Michelle Kelley (GRA)
Arias	Ab initio exploration of beyond-Nb SRF materials for low cooling power and high field performance	PHC	Nathan Sitaraman (GRA)
Bazarov	Improvement of Photocathode Robustness with Alkali-Halides	PHC	Samuel Levenson (GRA)
Bazarov	Nanoscale Photoemission in the Cornell MTE Meter	PHC	TBD
Biedron	Applications of Machine Learning in Compact Photoinjectors	BDC	Aasma Aslam (GRA)
Chubenko	Photocathodes under realistic accelerator conditions	PHC	Tariqul Hasan (GRA)
Chubenko	Monte Carlo modeling of photoemission from semiconductors	PHC	Daniel Franklin (GRA)
Hennig	Computational synthesis of photocathodes by epitaxial growth	PHC	Jason Gibson (GRA)
Hennig	Thermodynamics and Superconducting Properties of Novel SRF Superconductors	SRF	Ajinkya Hire (GRA)
Hines	Air-stable, high performance photocathodes	PHC	Annabel Selino (GRA) Mariam Hasany (GRA)
Hoffstaetter	Machine Learned diagnostics techniques for bright beams, e.g. 6D diagnostics in the Coherent electron Cooler	BDC	Lucy Lin (GRA)
Karkare	Optical, X-ray and surface characterization of Alkali-antimonides	PHC	Pallavi Saha (GRA)
Karkare	Study of Nano-scale photoemitters using PEEM	PHC	Alimohammed Kachwala (GRA)
Karkare	Measurements of low energy electron distributions	PHC	Chris Knill (GRA)
Karkare	Nano-scale photoemitters via light focusing nano-structures	PHC	TBD (PD)
Karkare	Development of ASU DC cryogun and beam diagnostics	BDC	Gevork Gevorkyan (GRA)
Kim	Auto-differentiable Accelerator Modeling	BDC	JP Gonzalez Aguilera (GRA)
Kim	Physics-Informed Priors for Fast and Differentiable Accelerator Surrogate Models	BDC	Chris Pierce (PD)
Liepe	Advancing RF Performance via Alloying and Layering	SRF	Sadie Seddon-Stettler (GRA)
Liepe	High-performance Nb_3Sn	SRF	Liana Shpani (GRA)
Liepe	Electroplating-based Growth and Characterization of Next-Gen SRF Films	SRF	Zeming Sun (PD)
Liepe	CVD-based Growth of Next-Gen SRF Surfaces	SRF	Gabriel Gaitan (GRA)
Maxson	Tackling the 100nm @ 100pC & 10 A Challenge at Pegasus and FAST	BDC	TBD - PD
Maxson	Growth and characterization of epitaxial alkali antimonides: MTE, spectral response, protection layers, new compounds	PHC	Elena Echeverria (PD)
Maxson	Growth & characterization of high efficiency, low MTE photocathodes: epitaxy & performance at high field	PHC	Chad Pennington (GRA)
Maxson	MTE measurements on CBB cathodes: studying temperature, wavelength, crystallinity, and nonlinearity	PHC	Charles Zhang (GRA)
Muller	Machine Learning for precise phase space control of electron microscopes	BDC	Desheng Ma (GRA)
Muller	Electron Microscopy characterization of the microstructure of materials for SRF cavities	SRF	Zhaslan Baraissov (GRA)
Musumeci	Advanced beam manipulations enabled by novel computational techniques in beam physics	BDC	Eric Cropp (GRA)
Musumeci	Testing alkali antimonides photocathodes in high field environment using tunable/shapeable laser pulses	PHC	David Garcia (GRA)
Piot	Exploring the Impact of Radiation Field on Brightness	BDC	Afnan Al Marzouk (PD)
Piot	Optical Transport and Beam Manipulation for Optical Stochastic Cooling	BDC	Austin (AJ) Dick (GRA)
Rosenzweig	Optimization of ultra-compact free-electron laser performance with very low MTE photocathodes	BDC	Nathan Majernik (PD) Gerald Lawler (GRA)
Rosenzweig	Extreme High Brightness Electron Source from Intense Laser Illumination of Nano-Blades	PHC	Gerald Lawler (GRA) Joshua Mann (GRA)
Shen	Atomically Ordered & Engineered Materials for Photocathodes	PHC	Vivek Anil (GRA)
Sibener	Investigating the Atomic and Micron-Scale Morphological Development of Nb_3Sn Leading to Smooth Homogeneous Thin Films	SRF	Sarah Willson (GRA) TBD (GRA)
Sibener	Visualization of Nb_3Sn and Zr Doped Nb Growth Mechanisms to Inform Optimal Growth Procedures for Next-Generation SRF Materials	SRF	Sarah Willson (GRA) TBD (GRA)
Sibener	Bonding, Diffusion, and Structure of Nb and Nb_3Sn Surfaces with Nitrogen Doping, Oxidation, Defects, Impurities and Sn or Zr Alloying	SRF	Mike Van Duinen (GRA) Caleb Thompson (GRA)
Sibener	The Influence of Atomic Scale Surface Structural Changes and Composition on the Superconductivity of Nb_3Sn and Nb due to Alloying, Doping, Domain Morphology, and Defects	SRF	Mike Van Duinen (GRA) Caleb Thompson (GRA)
Transtrum	Time-Dependent Ginzburg-Landau Studies of Realistic Materials and Surfaces	SRF	Aiden Harbick (GRA)

Recent Publications

Full publications list online at https://cbb.cornell.edu/publications

2022

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