



The Center for

BRIGHTBEAMS

A NATIONAL SCIENCE FOUNDATION SCIENCE & TECHNOLOGY CENTER

HANDBOOK

HANDBOOK OF THE CENTER FOR BRIGHT BEAMS



WRITTEN AND PUBLISHED BY
THE CENTER FOR BRIGHT BEAMS

CBB.CORNELL.EDU

WELCOME TO THE CENTER FOR BRIGHT BEAMS!

A National Science Foundation Science & Technology Center

**“WHEN YOU JOIN CBB,
YOU ARE JOINING
NOT JUST A CENTER,
BUT A COMMUNITY.”**

Dear CBB Collaborator,

When you joined CBB, you joined a team of researchers from across the physical sciences who are working together to create methods for producing, accelerating, and transporting electron beams with unsurpassed brightness. Applications for these beams include better X-ray sources, fast time-resolved electron microscopy, lower cost and higher performing colliders, as well as industrial processes and products such as high-speed quality assurance for the semiconductor industry.

To realize these goals, CBB works in a close knit, interdisciplinary team. Success depends on both individual discovery and close collaboration between researchers leading to a constantly expanding web of knowledge—advances that would normally be out of reach for a single research group. For that reason, CBB actively builds collaboration and counts on the intensive participation of each individual. When you join CBB, you are joining not just a Center, but a community.

In this Handbook, we will explain how CBB works and how you can plug in to make the most of your CBB experience.

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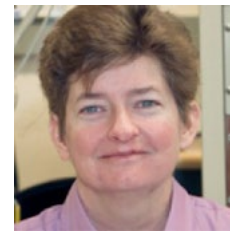
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Welcome to the Beam Team!



J. Ritchie Patterson
Director

Center for Bright Beams
Cornell University



Melissa Hines
Associate Director

Center for Bright Beams



Joan Curtiss
Managing Director

Center for Bright Beams
Cornell University

Who We Are

**“GAINING THE
FUNDAMENTAL
UNDERSTANDING
NEEDED TO TRANSFORM
THE BRIGHTNESS OF
ELECTRON BEAMS
AVAILABLE TO
SCIENCE, MEDICINE
AND INDUSTRY.”**

CBB’s research team consists of about 20 senior investigators, 10 postdocs and 25 graduate students from multiple universities and DOE national labs, each with critical expertise and capabilities. Currently, the participating institutions, which are shown in the map below, are Arizona State University, Brigham Young University, Clark Atlanta University, Cornell University, University of California at Los Angeles, University of Chicago, University of Florida, and Northern Illinois University and the DOE national labs: Fermi National Accelerator Laboratory and Lawrence Berkeley National Laboratory. Cornell is the lead institution and host of CBB’s administration. In addition to the participating institutions, CBB has a growing group of research affiliates as well as partners in industry and at national labs who would like to adopt our discoveries in their commercial processes, products, or in future scientific research facilities. To learn more, visit our website cbb.cornell.edu.

In addition to research, CBB supports the career development of students and postdocs and actively works to promote internal communications. After all, working as a team is possible only if we communicate with one another, and we do so fully and often. From time to time, we solicit your feedback on how CBB could communicate better, and we use your comments to improve CBB systems and strategies.

All CBB members focus their efforts on a common set of goals for research, workforce development, teamwork, and knowledge transfer as captured in CBB’s Strategic Plan. In CBB lingo, the overarching goals are called “Optimal Outcomes,” and each of these has several “Objectives.” Some of the research Optimal Outcomes also identify “Interim Goals,” which are high-impact advances targeted at near-term accelerators. The [Strategic Plan](#) is a living document, and is updated annually to reflect world progress and evolving accelerator priorities.



Our Research

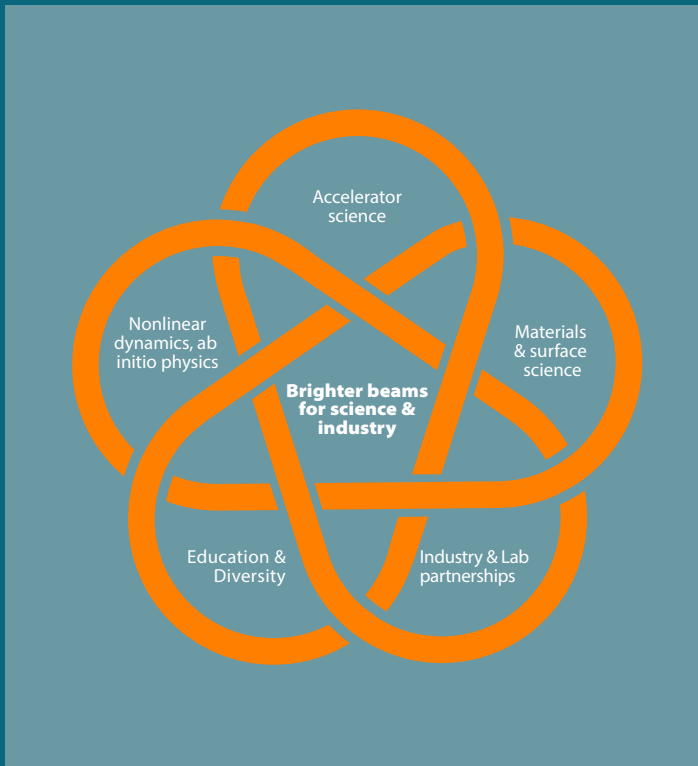
CBB's research is captured in its mission, which is to:

Transform the reach of electron beams by advancing fundamental knowledge and applying it to increase beam brightness $\times 100$ and reduce the cost and size of key enabling technologies.

Ensure that these new approaches are realized in operating accelerators by transferring the best of them to national labs and industry.

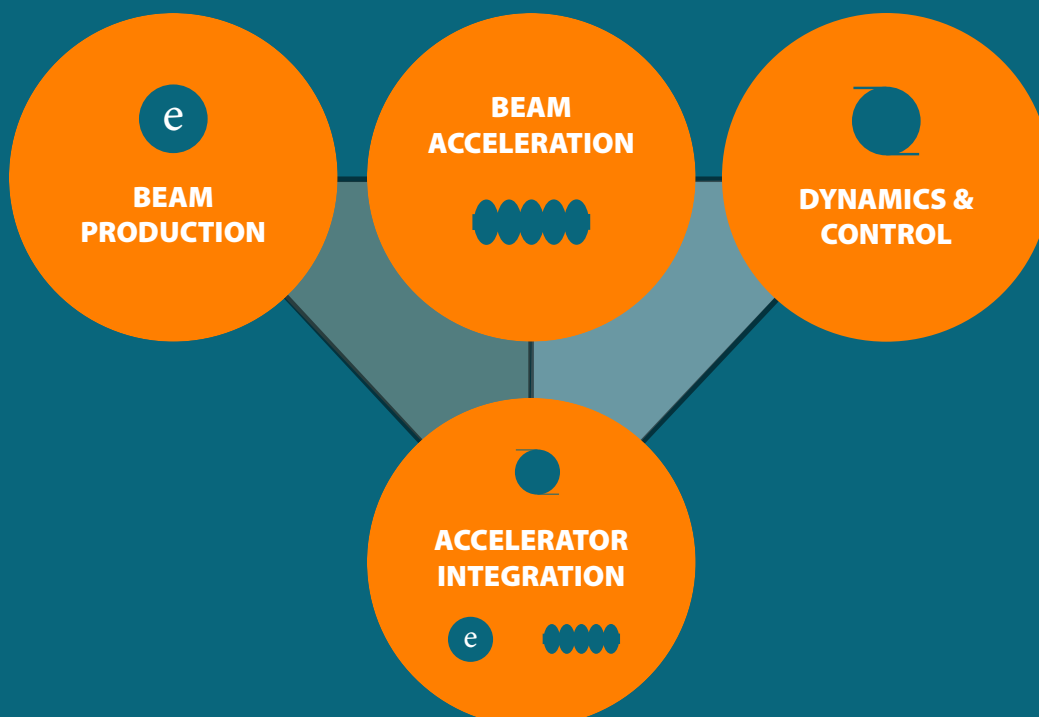
Educate and inspire a diverse generation of students to prepare them for a broad set of career paths, including leadership in interdisciplinary team science.

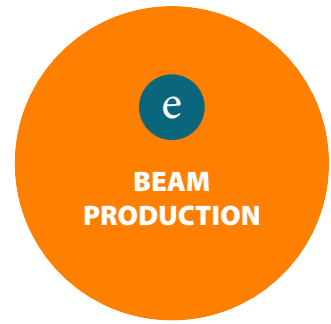
All CBB research projects are aimed at one of the Objectives or Interim Goals outlined in the Strategic Plan. Senior investigators lead the projects, which they carry out with the postdocs and graduate students in their group, coupled with intensive interaction with other members of the CBB team.



The research program is organized along three themes: Beam Production, Beam Acceleration, and Beam Dynamics and Control. The themes serve as the day-to-day forum in which CBB members carry out their research. Each theme meets biweekly, and at the meetings, the team members present updates on their projects, often accompanied with lively discussion.

Each theme has its own Optimal Outcome, and a fourth Optimal Outcome addresses integration among the themes. The Themes and Optimal Outcomes are introduced below. More information, including the Objectives and Interim Goals, are available in the strategic plan (cbb.cornell.edu/Internal/) and at cbb.cornell.edu.





Beam Production

Optimal Outcome:

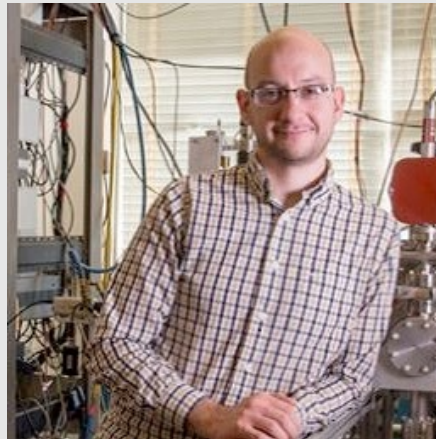
Methods for x100 brighter electron beams through better photocathodes, enabling better X-ray sources, colliders and electron imaging.

The Beam Production theme joins materials scientists, chemists, condensed matter physicists and accelerator scientists to invent photocathode materials capable of producing beams with low mean transverse momentum. These beams will improve X-ray sources, particle colliders and electron imaging.

Theme Leaders:



Siddharth Karkare



Jared Maxson



Cornell University



Tomás Arias



BERKELEY LAB



Beam Acceleration

Optimal Outcome:

Methods for x10 lower power losses and x2 higher accelerating fields in RF cavities made of niobium and compound superconductors, for lower costs, simpler refrigeration and wider access to high-power beams.

The Beam Acceleration theme will enable superconducting accelerating cavities with x10 lower power losses for lower costs, simpler refrigeration and wider access to high-power beams. It also aims to double the available accelerating gradient for less expensive, more compact accelerators. To achieve these goals, it will harness the expertise of condensed matter physicists and physical chemists to understand RF superconductivity, and learn to control the surfaces of niobium and compound superconductor cavities.

Theme Leaders:



Matthias Liepe



Cornell University



Steven Sibener



THE UNIVERSITY OF
CHICAGO



Mark Transtrum

BYU

BRIGHAM YOUNG
UNIVERSITY



Beam Dynamics and Control

Optimal Outcome:

Methods for beam transport that preserve beam quality of x100 brighter beams in linear accelerators and electron microscopes and x10 brighter beams in storage rings.

The Beam Dynamics and Control theme will direct its efforts toward the mastery of non-linear effects that reduce brightness and destabilize stored beams for better, less expensive control of beams in electron microscopes and storage rings. To reach this goal, it will use the tools of nonlinear dynamics to analyze dynamic aperture and test the strategies they suggest for limiting emittance growth.

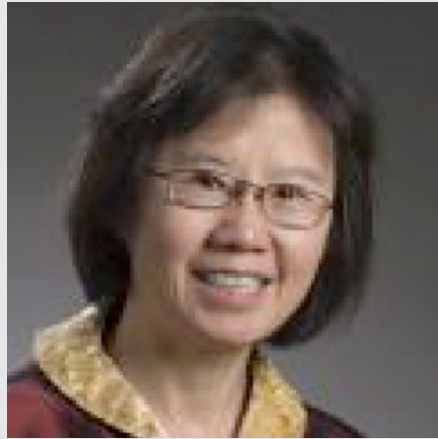
Theme Leaders:



Ivan Bazarov



Cornell University



Young-Kee Kim



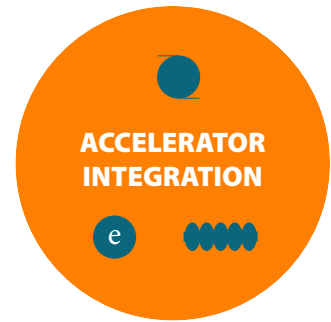
THE UNIVERSITY OF
CHICAGO



Philippe Piot



Northern Illinois
University



Accelerator Integration

Optimal Outcome:

Integration of these methods for optimization of high performance of accelerator systems.

In order to deliver optimized beams to their target, the Beam Production, Beam Acceleration, and Beam Dynamics and Control systems must work symbiotically. Our final Research Optimal Outcome is therefore the Integration of these methods for the optimization of high performance accelerator systems. Bridge researchers are responsible for the cross-connect between themes and this Optimal Outcome.

Bridge Researchers:



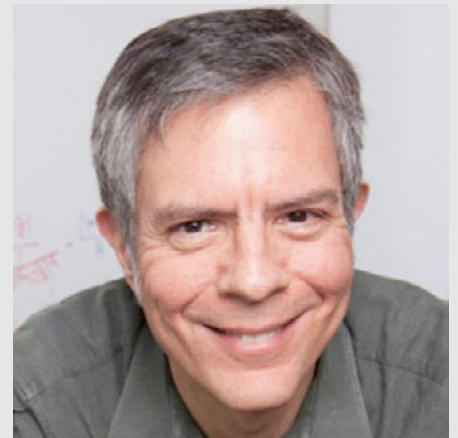
Tomas Arias



Cornell University



Pietro Musumeci



Jim Sethna



Cornell University

Working as a Team

Intense collaboration and collegiality with shared goals are the foundation of CBB's culture and the key to its scientific success.

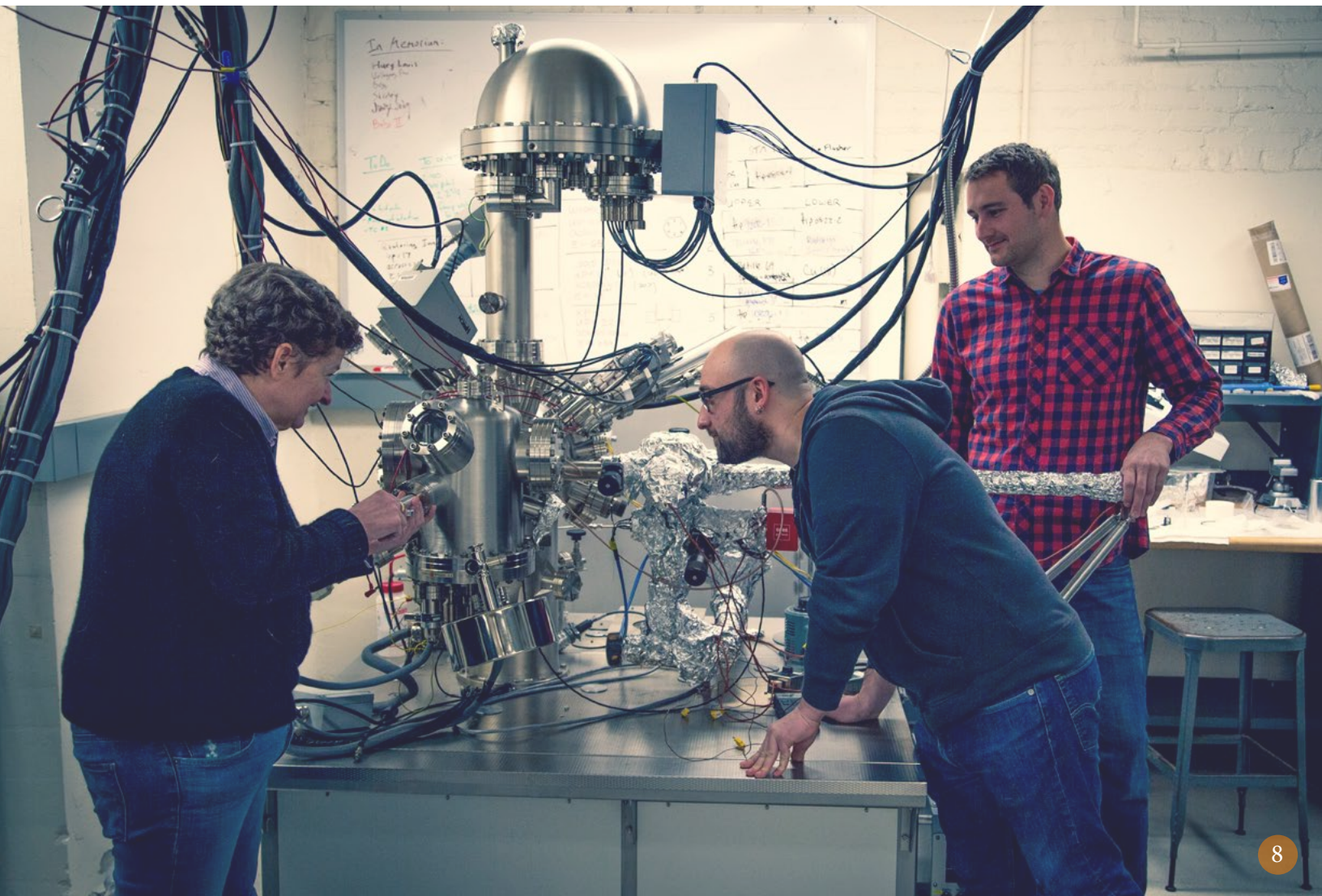
Optimal Outcome:

CBB enables effective collaboration across disciplines and across institutions.

Achieving this requires:

- Multimodal Communication and collaboration across disciplines and across institutions.
- Cross-disciplinary learning, so that all participants are conversant with accelerators and capable of interdisciplinary discussion.
- A culture of inclusion.

The following sections address these topics.



Communication

Communication is essential for teamwork: it builds a shared understanding of our goals, advertises CBB opportunities, inspires collaboration, and is a launchpad for scientific discovery.

To Plug In:

Weekly News - Look for an email every Monday from Managing Director Joan Curtiss providing you with weekly tips, updates on publications, and upcoming meetings & events.

Handbook (you are here!) - How does CBB work? How can you plug in to make the most of your CBB experience? Where is the foosball table located? Answers to these questions and more right here in the palm of your hands!

Seminars - Monthly CBB seminars are held throughout the year on topics related to the accelerator physics field. All members are encouraged to attend to help build their expertise.

Center for Bright Beams [YouTube Channel](#) - You can find a collection of discussions, seminars, and pedagogical videos on topics directly related to the research done by CBB.

Internal Website (cbb.cornell.edu/internal) - Our internal website is where you will find invaluable information and tools to help you on your path to a successful experience here at CBB.

Strategic Plan - Our [strategic plan](#) identifies objectives that will ensure a trained graduate student cohort is capable of recognizing and transferring skills to industry and national labs.

CBB Quarterly Newsletter (public) - Keep up to date on all things CBB with the extensive coverage in our quarterly publication.

To Connect:

Grad-to-grad meetings - Biweekly meetings among grad students in a low key environment.

Theme meetings - Biweekly meetings for research presentations and feedback.

Annual Meeting & Symposium - Yearly meetings featuring research presentations, workshops, talks and discussions on accelerator science.

CBB lounge at UCLA & Cornell - Kick back, play some games, decompress. It's necessary!

To Learn Communication Skills:

All CBB annual meetings include a workshop on communications, addressing topics such as communicating across disciplines and the "60-second elevator speech" (how to get Bill Gates excited about your research in a 60 second elevator ride).

Collaboration

CBB relies on collaboration for success, and our collaborations are rooted in regular research meetings:

Theme Meetings - Each theme meets biweekly for research presentations, often led by students and postdocs, and usually followed by questions and discussion. Some themes, notably Beam Production and Beam Dynamics and Control also hold occasional joint meetings addressing topics where they converge. You are expected to attend all meetings of the themes you're working in, and to present your work often, so that we can best capitalize on each other's success and provide useful feedback to colleagues.

Annual Meeting - CBB meets annually in person. In addition to featuring CBB research, the annual meeting includes workshops in topics such as communications, entrepreneurship, mentoring, professional development, pedagogical lectures, and also sessions where senior investigators plan the research program for the coming year. Each Annual Meeting also includes a public symposium on a topic in accelerator science with invited speakers from labs and industry.

Seminars - CBB routinely invites prominent speakers from both outside and inside CBB to present topics of interest to the CBB community.

Video-conferencing:

All theme meetings are hosted via Zoom for those participants who are remote.

Tips for Interdisciplinary collaboration:

- Use an introductory slide for all presentations, so that non-experts or newcomers can follow. Introduce your topic, and explain not only what you're going to talk about, but why it is important. Introduce all acronyms – not everyone knows what TEM or SRF stands for.
- Always credit results from other researchers, in and out of CBB.
- Upload your slides to Indico in advance of the meeting. This will let people follow your talk on their computer if for some reason their video-connection is lost. This also provides an archive of your talk so that it is available to colleagues (and you!) for reference.
- Avoid side conversations when video-conferencing. For most audio setups, these are difficult for people at other sites to follow and are therefore a time-waster. If you want to talk one-on-one, take it outside.
- Mute your Zoom audio except when talking.
- Treat each other with respect and consideration to create a collegial, inclusive, and professional environment in which people feel free to share their ideas. Better discussion leads to better science.

Acknowledge CBB and **NSF award PHY-1549132** in all posters, presentations, and articles.

Talk agendas and slide archival:

[Indico](#) is CBB's platform for creating meeting agendas and storing slides. If you want to join a meeting, Indico is a place to look. If you want to refer to past slides, Indico is where to go. All CBB members have access to Indico and can create a meeting agenda. Instructions are available on the internal website (cbb.cornell.edu/Internal) .

Exchange visits to CBB collaborators:

Sometimes there's no substitute for face-to-face collaboration, especially when there's equipment involved. In order to facilitate collaborations across institutions, CBB offers Travel Grants for short stints by students and postdocs at partner institutions. See the funding opportunities section (pg. 21) for details.

Cross-disciplinary Learning

CBB combines the expertise of accelerator scientists, chemists, materials scientists, mathematicians, and condensed matter physicists, all working together in a close knit, interdisciplinary team. Making this work requires that we all become renaissance scientists, with enough knowledge in the various disciplines to understand one another. A number of pedagogical resources make this possible.

Pedagogical videos: (cbb.cornell.edu/Internal/Pedagogy.html)

A collection of videos on topics related to CBB research is available on the [CBB YouTube channel](#). Some of the available topics are Bright Beams for Electron Microscopy, Introduction to Superconducting RF, and Introduction to photoemission electron sources. New videos are added regularly.

Ontology: (cbb.cornell.edu/Internal/Ontology.html)

The Ontology serves as the “go to” location for information about unfamiliar techniques and phenomena related to both accelerator science and other disciplines relevant to overcoming accelerator challenges. Each year, CBB graduate students add new entries: Full-time graduate students add ten entries while those participating half-time, or less, add five.

Accelerator courses and USPAS:

We encourage students and postdocs to become familiar with the science of accelerators as well as their core disciplines. This may be done either through university courses or through the U.S. Particle Accelerator School (USPAS), which offers intensive courses each January and June on a variety of accelerator-related topics. USPAS is open to everyone. The USPAS course in Fundamentals is a good starter course geared at undergraduates and beginning grad students in physics, while Accelerator Physics assumes no prior knowledge about accelerators but moves faster and takes a more mathematical approach. By prior agreement with USPAS, students whose advisors specialize in topics other than accelerator physics should apply for a USPAS scholarship, while those whose advisor specializes in accelerator physics should not. For both, CBB will cover USPAS costs not covered by scholarships.

CBB Seminars:

CBB seminars are held throughout the year on topics related to the accelerator physics field. All members are encouraged to attend to help build their expertise.

Grad-to-grad meetings:

Every other week, grad students and postdocs get together for a grad-to-grad meeting. At most of these meetings, a student or postdoc gives a presentation on their work at a level suitable for a non-expert. This is a chance to ask questions and practice presentation skills in a low key environment.

Culture of Inclusion

Working as a team:

CBB commits to the diversity of its membership. A culture of respect, collegiality and trust is required. Collaborating virtually poses additional challenges, and CBB strives to make the technology and best practices available so that all members can contribute and participate equally in all meetings.

Implicit Bias Diagnostic:

Our society inundates us with stereotypes of people based on their race, ethnicity, gender, disabilities, and their place in the LGBTQ+ spectrum, and inevitably, these shape our thinking and expectations. While we may not be able to remove these stereotypes, even with effort, each of us can become aware of them, and take conscious steps to counteract them. To help with this process, CBB requires that all participants complete the implicit bias diagnostics on “Race IAT” and “Gender-Science IAT” available at Project Implicit (implicit.harvard.edu/implicit/).

Your Career Path

Associate Director, Melissa Hines,
and Education Director Young-Kee Kim
lead Workforce Development for CBB.



Melissa Hines



Young-Kee Kim

Optimal Outcome:

CBB students are well prepared to become leaders in their chosen field and have an appreciation of accelerator science.

CBB consciously helps students develop the skills for success in their chosen career. Doing so requires:

- Development, revision of, and reflection on professional and career goals.
- Professional development opportunities to enhance graduate students' skills.
- Mentoring and networking opportunities.
- Learning about and appreciation of accelerator science.



Career Planning

Individual Development Plans (IDP) -

All CBB graduate students complete an Individual Development Plan, and discuss with their faculty advisor on a yearly basis. Studies show that this practice leads to better career success as measured by salary, promotion and level of responsibility (Hobin, Fuhrmann, Lindstaedt, & Clifford, 2012). CBB uses myIDP (myidp.sciencecareers.org/) to help you explore career possibilities, set goals and develop a career path based on your strengths, skills and interests. You and your advisor will prepare an IDP in your first year in CBB and update it annually after that.

Professional Development

Annual Reports:

Almost every career demands that you describe your progress and plans. For example, they are key ingredients of research proposals, whether within industry or submitted to federal funding agencies such as the National Science Foundation (NSF), National Institutes of Health (NIH), and the Department of Energy (DOE). CBB students develop this skill by preparing an annual report. The information contained in these reports is helpful to CBB as it prepares its annual report to the NSF summarizing its achievements.

Conference Presentations:

All CBB participants have the opportunity to present their work at one or more conferences or workshops of their choice annually. Conferences and workshops are an opportunity to get the word out about your research, and are also a great way to learn about developments in your field and to network with other scientists.

Ethics Training:

Scientific progress depends on the truthfulness of scientific results and the free exchange of ideas, with proper recognition and credit for intellectual contributions. It sounds easy, and with constant attention, it often is. If our attention lapses, difficult situations can come up quickly. Training is essential so that expectations are explicit and widely understood, and workshops can give us tools for addressing the real-life complications that sometimes come up. All CBB participants are expected to complete ethics training and to attend the ethics workshops that are a frequent part of the CBB annual meeting.

Communicating with non-experts:

Most scientific and technical careers involve speaking with non-experts about your work. CBB students and postdocs build this skill by participating in at least one outreach event each year. This could be done through an outreach program at your university, by speaking to a local elementary or high school class, or through CBB's STEP UP! program.

STEP UP! is a CBB initiative to develop Design Experiences (DE) for use in Middle School Science and Technology classes that meet the Next Generation Science Standards (Next Generation Science Standards for States, By States, 2018). CBB Outreach partners with teachers and grad students to design the DEs. At the STEP UP! teacher trainings, the graduate students at the host university will be facilitators.

Professional Development at your Institution

CBB Activities Sponsorship Program:

Do you have an idea for a professional development or inclusion activity at your university? CBB provides up to \$500 for professional development activities and events hosted locally at any participating university. There must be a significant formal component such as instruction or a guest speaker. For instance, the University of Chicago group hosted a workshop on research communication that was open to all graduate students in the Physics Department, and Cornell's CBB group co-sponsored a speaker who gave a presentation on implicit bias, open to the entire campus. We encourage all CBB groups to sponsor speakers, workshops or other activities aimed at professional development or improving diversity at their university. These funds may also be used to support outreach activities involving CBB students or postdocs.

Mentoring and Networking

National Lab Visits:

The Department of Energy has a science graduate student research program that provides graduate thesis research opportunities at DOE labs. Students interested in working with CBB partners and affiliates at national labs should visit <https://www.science.energy.gov/wdts/>

Shorter visits may be possible. If interested contact Joan Curtiss at jcc25@cornell.edu.

Careers in Accelerator Science

Accelerator scientists are in high demand at national labs, industry, and increasingly in academia. Students interested in exploring opportunities should consider attending US Particle Accelerator School.

CBB faculty are available to discuss the opportunities with you at any time.

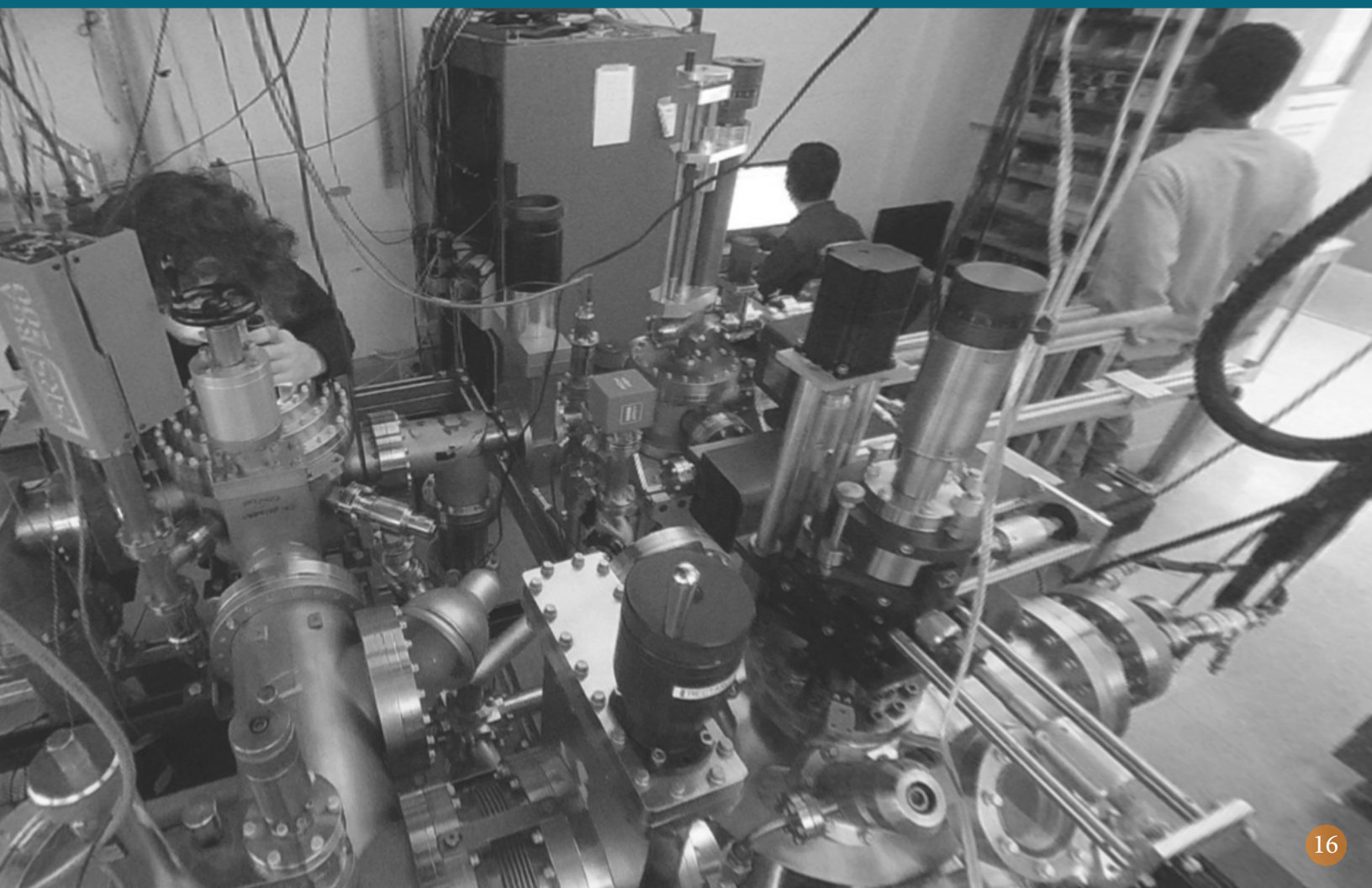
See more information in the section on Cross-disciplinary learning (pg. 11).

Nuts and Bolts of CBB Membership

You'll need some basic information to get started as a bright new CBB member. It's important to know what to expect and what is expected of you.

The following section addresses:

- Your Computer Account
- Mailing Lists
- Membership Levels
- Arrivals and Departures
- On-boarding
- Expectations



Your CBB Computer Account

All CBB members are provided with a CBB account (when they join) that provides access to shared resources such as a CBB intranet, meeting agendas, and slides on Indico.

If you forget your password, you should go to the login page to reset your password.

<https://www.classe.cornell.edu/pwm/private/Login>.

Click the “Activate Account / Forgot Password” button and follow the prompts.

Mailing Lists

Mailing lists are used to announce special seminars, theme meetings, general meetings, and special announcements. Everyone is added to the mailing lists of any theme they are participating in, as well as to general lists for students, postdocs, faculty and affiliates.

CBB manages the following mailing lists for participants:

- Cbb-faculty-l - A list that all CBB faculty are subscribed to automatically.
- Cbb-Postdocs-l - A list that all CBB postdocs are subscribed to automatically.
- Cbb-students-l - A list that all graduates students are subscribed to automatically.
- Cbb-stc-photocathodes-l - A mailing list for the Beam Production theme members. Subscribe using the instructions below.
- Cbb-stc-srf-l - A mailing list for the Beam Acceleration theme members. Subscribe using the instructions below.
- Cbb-stc-bst-l - A mailing list for the Beams Storage and Transport theme members. Subscribe using the instructions below.
- Know someone who is interested in receiving CBB news? Please send Joan Curtiss (jcc25@cornell.edu) their information.

To join an e-list (also called subscribing):

1. Send an email message to listname-request@cornell.edu.
2. Where “listname” is the name of the list you want to join, including the hyphen and the letter L at the end of the list name.
3. For the Subject of your message, type the single word “join” (no quotations, just join).
4. Leave the body of the message blank.

Membership Levels

CBB has multiple membership categories that are determined by the level of participation. These definitions are defined by the NSF.

- Participant: Spends more than 160 hours on CBB activities during a CBB year (Oct 1 – Sept 30). This category includes all faculty, postdocs and graduate students whose research is funded by CBB, whether or not they receive salary or stipend support. To reduce fluctuations in membership, participants may drop below the 160-hour threshold for one year without change in status.
- Affiliate: Spends less than 160 hours on CBB activities in a CBB year. This category includes unfunded scientific collaborators, industry and lab partners, as well as educators and external evaluators.

Arrivals and Departures

The NSF requires that we report annually on participation in CBB, so it is essential that we know of any arrivals or departures. If you are new to CBB, have a new person joining your research group, or are aware of any departures, notify us immediately by emailing the name and email address of the person joining or departing to cbb_admin@cornell.edu.

F.Y.I.

“ CBB is providing
accelerator-physics-based
knowledge and experience that
helps graduate students move to faculty,
national lab, and industry positions at places like
ASML, Arizona State University,
Cornell University, SLAC,
and TomTom. ”

On-boarding

All new participants go through on-boarding that introduces them to CBB. The process includes receiving a welcome letter, a survey, checklist with expectations, and a phone meeting with managing director Joan Curtiss to go over essential CBB information.

Expectations

CBB has established expectations for participants that build collaboration and teamwork among CBB members, ensure that our students are prepared for successful careers, and allows us to communicate our achievements to NSF and other partners. Each expectation is explained elsewhere in this Handbook, and they are summarized in the table below. Funding for each group is contingent on each group member fulfilling all of the listed expectations.

EXPECTATIONS	PARTICIPANTS Grads, postdocs, and senior scientists who spend more than 160 hours of effort on CBB work.	AFFILIATES Scientists, educators, and evaluators who spend less than 160 hours of effort on CBB work.
ONBOARDING		
Onboarding Survey	✓	✓
Onboarding Meeting	✓	
Submit Photo for Directory	✓	✓
Implicit Bias Diagnostic	✓	OPTIONAL
Research Code of Conduct Training	✓	OPTIONAL
Submit Demographic Info <small>Opt Out option exists.</small>	✓	OPTIONAL
Create Individual Development Plan <small>Grad students & Postdocs only.</small>	✓	
ANNUAL REQUIREMENTS		
Annual IDP Review <small>Grad students and Postdocs with their advisors.</small>	✓	
Annual Report Completion	✓	
Participate in Annual Meeting	✓	
Attend Annual Symposium	✓	OPTIONAL
Attend NSF Site Visit	✓	
Submit Ontology Entries <small>Students only.</small>	✓	
Acknowledge NSF award PHY-1549132 and CBB in all CBB-related publications, talks, posters, and slides.	✓	
Attend all theme meetings	✓	PREFERRED
Attend Grad-to-Grad Meetings <small>Grad students & Postdocs only.</small>	✓	
Outreach <small>Grad students only.</small>	✓	

Our Industry and Lab Partners



David Muller

CBB continues to build a community of industry partners to create an avenue for knowledge transfer between CBB, companies, and national labs who exploit accelerator know-how. These relationships provide opportunities for licensing our technology and intellectual property, and can provide opportunities for students to network and learn about a range of career paths.

Knowledge Transfer and Industrial Outreach:

Prof. David Muller, Director of Knowledge Transfer and Georg Hoffstaetter, focus on the incorporation of CBB discoveries and designs into a new generation of accelerators and their commercialization as products.

Events:

Our industry and lab partners are invited to all CBB events relevant to their industry.

- Symposium - Industry partners are invited to attend the annual CBB Symposium.
- CBB sponsored Workshops - CBB will sponsor workshops that bring members from relevant industries and labs.



Our strategic plan identifies objectives that will ensure a trained graduate student cohort is capable of recognizing and transferring skills to industry and national labs.

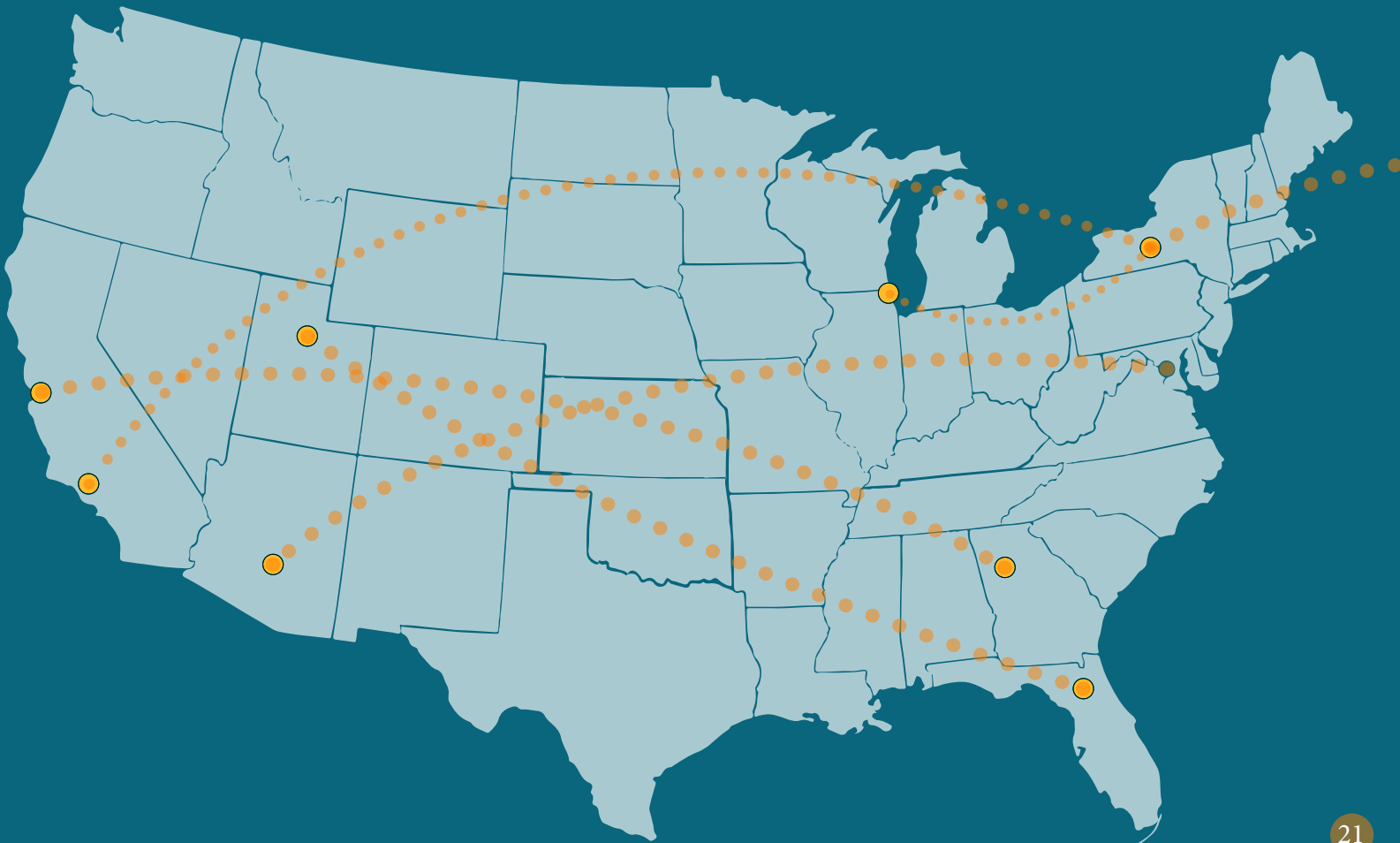


Funding Opportunities

CBB offers a variety of funding opportunities for travel to conferences and workshops, research support, speakers and other activities:

The following section addresses:

- Exchange travel grants
- Activities sponsorship program
- Reimbursement for travel to conferences and workshops
- Support for conferences and workshops
- Research support



Exchange Travel Grants

In the travel exchange program students and postdocs participate in short-term visits, generally less than two weeks, to a CBB member institution where they will work with CBB members to share knowledge, acquire new skills, brainstorm in a multidisciplinary manner, and advance research projects. To apply, email cbb_admin@cornell.edu.

Activities Sponsorship Program

CBB provides funds to sponsor local diversity, outreach or workforce development activities at CBB institutions. To qualify for support, which is typically at the level of \$500, the event must be a structured activity that furthers CBB goals for workforce development or inclusion. Past examples include workshops and travel for a guest speaker. As long as CBB members are part of it, you can invite your department or college too – just remember to credit CBB for its support on the advertisements. Got an event? Email cbb_admin@cornell.edu.

Travel to Conferences and Workshops

CBB provides travel support up to \$1,500 for all participants to one conference or workshop annually where they present CBB results. Faculty must give an invited talk and students must present a poster or give a talk. Additional trips are allowed, but must be paid for from senior investigator research funds. The steps for travel reimbursement are outlined in the travel section of CBB's internal website (cbb.cornell.edu/Internal/). Please note that the instructions for Cornell travelers differ from those for travelers from other institutions.

1. Receive travel approval from senior scientist. Cornell travelers complete a Trip Record.
2. Post slides, posters or writeup on the CBB internal websites.
3. Submit receipts to cbb_admin@cornell.edu. Note that all meals included in conferences must be deducted from the daily per diem.

Please be economical with your travel so that CBB can continue to support travel and other special events and activities. Take inexpensive flights when you can and use the per diem appropriately. For instance, if the standard per diem is \$55, but your daily expenses are approximately \$40, we ask that you submit a per diem rate of \$40.

Conference and Workshop Support

CBB occasionally provides support to workshops and conferences. To qualify, they must:

- Include one or more CBB participants on the scientific organizing committee.
- Include presentations featuring substantive CBB results.

Research Support

Each year, CBB distributes its research funds to faculty, and in order to determine the funding allocation, it uses an internal proposal and review process. All faculty participate, whether they are new or returning, and all projects are reviewed, whether new or continuing.

Faculty submit a single proposal for each project, where the scope of each project is matched to one student (or the same funding applied to a postdoc). Half projects are allowed. Faculty may submit multiple proposals as long as no student or postdoc is over subscribed.

TIMELINE

Early Spring	Theme leaders present goals for the coming year. Faculty submit annual report.
Early June	Annual meeting. Presentation and friendly discussion of all faculty project plans.
Late June	Proposal deadline. Proposals are brief, and follow a template. One proposal for each project.
Early July	Proposals are reviewed internally.
Late July	Faculty are notified of funding decisions

Proposal Budgets:

Budgets must be submitted on **NSF Form 1030** and should include expenses associated with an academic year, starting with the Fall semester or quarter and ending with Summer.

- Graduate student and postdoc support: CBB awards cover student and postdoc costs (tuition, stipend, and health), in fact, this is the dominant use of CBB funds, by far. Funds allocated to students and postdocs must be used for these purposes and cannot be reallocated.
- Materials and Supplies (M&S): Each funded project will receive an M&S allowance which can be used to cover additional travel costs or other CBB-related expenses. In 2018, the allowance was \$7,000; it is subject to change in future years depending on the availability of funding.
- Supplemental funds: Projects that have unusual M&S or equipment expenses may request supplemental funds.

Eligibility:

Any faculty member at a qualified US college or university may submit a proposal. Those who are new to CBB are strongly encouraged to discuss their ideas with the relevant theme leaders in advance and to participate in the discussions at the annual meeting. The theme leaders can provide guidance on the research priorities of the center and foster collaboration by facilitating connection with other faculty doing related work.

Proposal review: Proposals are reviewed internally by two reviewers with relevant expertise from two institutions. They generally provide a consensus review, which is made available afterward to the proposer. Review criteria include:

- Potential to advance CBB goals.
- Suitability for a center, in that it is highly collaborative.

The Director makes the final decision, incorporating the result of the review, and, for continuing faculty, the record of engagement of the group, including participation in meetings and in activities aimed at communications, workforce development and inclusion. She also factors in funding continuity when a student's education might be affected.

Distribution of funds:

- Memorandum of Understanding (MOU) - An MOU between CBB and the award recipient each year.
- Submission of invoices - Each CBB institution is expected to submit invoices at least quarterly. Invoices for the award period ending 9/30 are due within 60 days, or 11/30.
- All expenditures must comply with NSF and federal guidelines.

Unused funds:

Allocated funds that are unspent as of 9/30 are returned to the center, where they are added to the funding pool for the following year.

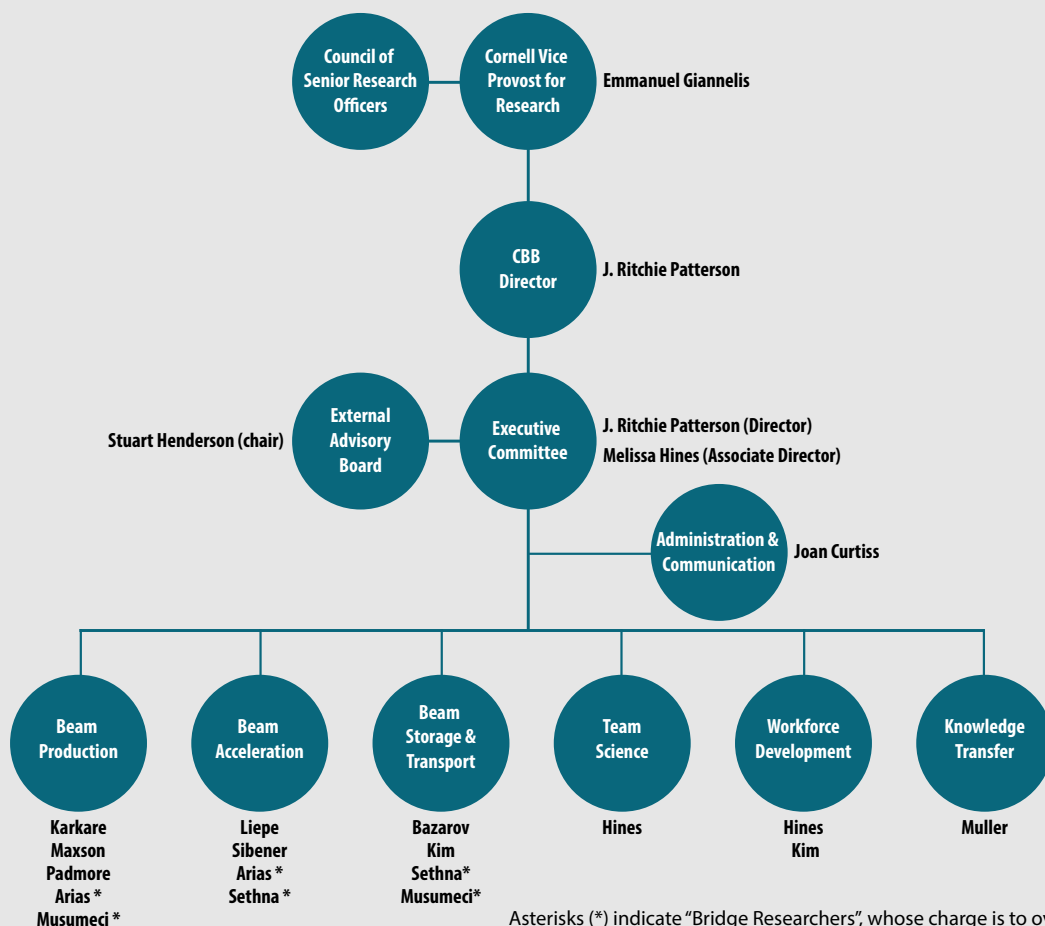
F.Y.I.

“ CBB provides funds to sponsor local diversity, outreach or workforce development activities at CBB institutions. ”

Organization and Management

The management of the Center is guided by an overarching set of principles and values. These are:

- **Research alignment** - Research projects will address Center Outcomes and will be aimed at gaining a fundamental understanding of the phenomena that limit accelerator performance, and at using that understanding to overcome those barriers.
- **Team science** - Every project will be uniquely suited to a Center in that it will depend for success on the diverse expertise of at least two team members, typically from distinct disciplines.
- **Program evolution** - The research program will be dynamic, responding to new opportunities, reacting to new insights into the needs of beam users from industry and national laboratories, and moving on when projects come to completion or no longer bear fruit.
- **Civic engagement** - Participants will participate fully in activities within their Theme and across the Center in order to build a coherent, collaborative community and capitalize on opportunities at the intersections of the themes.
- **Diversity** - Participants will commit to diversity, and to gaining the awareness and knowledge needed to create an environment in which students, postdocs and faculty of all races, ethnicities, and genders can thrive.



Asterisks (*) indicate "Bridge Researchers", whose charge is to oversee Accelerator Integration.

Leadership

Director:

The Center Director chairs the Executive Committee and establishes the CBB vision, assumes responsibility for achieving the goals, maintains fiscal discipline and represents CBB on the national network of STC directors.

Associate Director:

The Associate Director focuses on professional development and communications. Serves on executive committee.

Managing Director:

CBB is led by a managing director who coordinates the strategic development, direction, and implementation of business operations and financial stewardship for the Center for Bright Beams.

Executive Committee:

The Executive Committee coordinates CBB activities and advises the Director on CBB policies and practices, oversees engagement with the scientific and industrial communities, identifies and recruits senior investigators from underrepresented groups, and organizes the annual meeting.

Theme Leaders:

Theme leaders coordinate the research activities of their themes and serve on the Executive Committee.

Theme Postdocs:

In addition to their research, theme postdocs are charged with activities such as organizing meetings, leading theme meeting discussions, and working with graduate students to facilitate research within the theme, and capturing recent results for newsletters.

Bridge Researchers:

Bridge researchers facilitate work at the intersections of the themes, and oversee the Integration Optimal Outcome. They also serve on the Executive Committee.

Director of Education:

The Director of Education coordinates professional development in accelerator science.

Director of Knowledge Transfer:

The Director of Knowledge Transfer's focus is on the incorporation of CBB discoveries and designs into a new generation of accelerators and their commercialization as products.

Council:

The CBB Council consists of senior research officers at all of the CBB participating institutions. The Council meets at least once annually outside of the Site Visit to learn about CBB advances, and to share insights about how best to support Center activities at their institutions.

External Advisory Board:

The External Advisory Board (EAB) provides high level guidance, ensuring that CBB is addressing important issues in the field, ensuring CBB is aware of the global developments in the field, sharing expertise that will guide the Center, seeking synergies across Center themes and projects, and advising CBB on fostering a team culture and on its education and diversity activities. The EAB includes leading experts in accelerator science, education and diversity, as well as industry representatives.

Sponsored Funding

CBB is funded by the National Science Foundation as a Science and Technology Center, in the Office of Integrative Activities, which sponsors “innovative, potentially transformative, complex research and education projects that require large-scale, long-term awards.”

Our Award:

NSF-1549132. All papers and presentations must acknowledge our award from the NSF by noting this award number.

Funding period:

CBB's award period is October 2016 – September 2021, with an opportunity to renew for an additional five years. The CBB annual award period is October 1 – September 30. Funds are awarded on a yearly basis.

Annual report to NSF:

CBB must submit an Annual Report to the NSF each year that presents all of our achievements and activities. CBB relies on your annual reports for much of the information, so please take the time to be accurate and complete.

Site Visit:

Each year the NSF convenes a committee to come to Cornell for three days to review CBB progress. Continued funding is contingent on a successful site visit. We encourage all faculty to attend, and we invite some graduate students and postdocs to participate. Because of the expense, we need to limit participation.

Renewal:

As an NSF Science and Technology Center, CBB's award is for five years, and is eligible for renewal for a second five years. Renewal will depend on CBB meeting its scientific goals, having an observable impact on accelerators, and meeting its aspirations for workforce development and inclusion. The main assessment of its success will take place at its fourth year site visit in June 2020.



NSF BUILDING 2415 Eisenhower Avenue, Alexandria, VA 22314

Fun Stuff

We know, we know...Bright beams are fun enough, but here are some other fun activities that CBB has to offer:

Graduate Student Lounge:

CBB has funded a graduate student lounge on the fourth floor of Newman Laboratory at Cornell. We encourage CBB graduate students to enjoy a game of foosball or ping pong, or relax with a book in the lounge.

Graduate Student / Postdoc Dinner at the annual meeting:

Each year the graduate students are invited to dinner as part of the annual meeting. This is an opportunity to strengthen the relationships between institutions, themes, and students.

Contests:

We periodically hold contests for CBB members, such as best CBB t-shirt design, best lab photos, and most interesting accelerator science fact.

Getting Involved:

There are a number of opportunities to get involved in new aspects of CBB.

- Interested in sharing your excitement for accelerator physics with the next generation of scientists? Get involved in STEP UP! and other outreach activities.
- Become a mentor to a summer REU student.
- Become a CBB star with a YouTube video of you and your research (we can help!)



Frequently Asked Questions

What is a Science and Technology Center?

- The Science and Technology Center program is run by the Office of Integrative Activities of the National Science Foundation. The STCs are “innovative, potentially transformative, complex research and education projects that require large-scale, long-term awards. STCs conduct world-class research through partnerships among academic institutions, national laboratories, industrial organizations, and/or other public/private entities. STCs provide a means to undertake significant investigations at the interfaces of disciplines and/or fresh approaches within disciplines.”

Where can I find out more about CBB plans?

- See the Strategic Plan on the Internal website. cbb.cornell.edu/Internal/

I'm a good person, so why did I bomb the implicit bias diagnostic?

- Implicit biases result from social conditioning and associations, and everybody has them. This is because our brains are wired to stereotype so that we can make snap decisions to help our survival — think of a T-Rex coming your way. The problem is that sometimes snap decisions are not smart ones, and they can run counter to our values. For example, most of us stereotype based on gender, race or ethnicity because our brains were conditioned by society to do so. This is the case even though we may find stereotyping repugnant and are aware of the data showing that diverse groups perform better in business than homogeneous ones. Awareness of our own implicit biases gives us the opportunity to decondition ourselves, e.g., by increasing exposure to positive role models, and to pause on occasions where stereotyping may be a factor, override our snap judgment, and act in a way that is smart and consistent with our values.

How do I use Indico to...

- Create a meeting?
 1. Click the pencil.
 2. Enter the Zoom information, if any, under Description.
- Set an agenda?
 1. Go to the meeting page, created above.
 2. Click the pencil icon at the top of the page.
 3. Select “Timetable” from the left menu.
 4. Choose “Add New” and select “Contribution,” and enter the talk title and duration. Then click “Add Indico User” and type in a few letters of the speaker’s name, followed by “Search.” The speaker’s name should appear in the box, where you can click on it and then “Add” the speaker. Adding the speaker allows him or her to upload slides.
 5. Click on “Add” to go back to the event page and, if necessary, drag and drop the talks to adjust.
- Add your slides or other material?
 1. Go to the meeting page on Indico.
 2. Click on the pencil in the upper right corner of the meeting window.
 3. Select “Materials Editor.”
 4. Click the “Upload files” button.
 5. Choose your presentation and upload.

What is the limit on travel each year?

- CBB will cover up to \$1,500 in travel costs for each participant.
- Senior scientists have received additional materials and supplies funds that may be used to cover excess travel expenses.

What are the requirements for travel?

- All travelers must upload their presentations or posters to the CBB internal travel repository.
- Travel must be approved by supervisor.
- Graduate students and postdocs must present their work in a poster or talk.
- PIs must give an invited talk.

What if I don't know my CBB / CLASSE password?

- If you are experiencing problems logging into CBB services, please verify that your account is active or reset your password if you've forgotten.
- To reset your password or activate your account please visit <https://www.classe.cornell.edu/pwm/private/Login>.

What can I do if my question isn't covered in the Handbook?

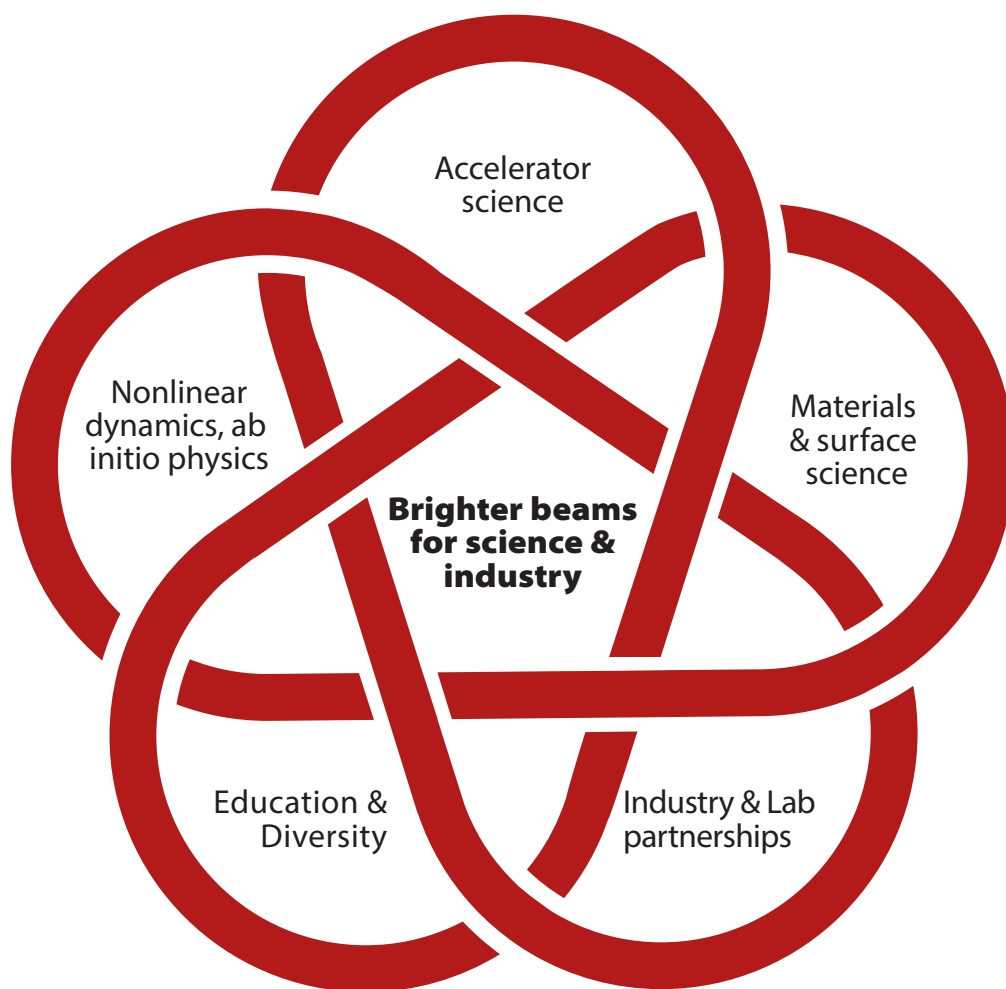
- Contact Joan Curtiss, managing director, at cbb_admin@cornell.edu or jcc25@cornell.edu.

Appendix A - Glossary:

Term	Definition
Affiliate	A person who spends <160 hours of CBB effort per year
AFM Characterizations	Atomic Force Microscope allows for 3D characterization of nanoparticles with sub-nanometer resolution
BMAD	An object oriented, open source, subroutine library for relativistic charged-particle dynamics simulations in high energy accelerators and storage rings
BST	Beam Storage and Transport Theme
CAU	Clark Atlanta University
CBB	Center for Bright Beams
CEBAF	Continuous Electron Beam Accelerator Facility - DOE
CEOS	Electron microscope manufacturer
CESR	Cornell Electron Storage Ring
DE	Design Experiences developed as part of CBB outreach
DFT Calculations	Density functional theory is a computational quantum mechanical modeling method used to investigate the electron structure of many-body systems
DOE	Department of Energy
EAB	External Advisory Board
EMPAD	Electron Microscope Pixel Array Detector
FELs	Free Electron Lasers
FNAL	Fermi National Accelerator Laboratory
GRA	Graduate Research Assistant
HBCU's	Historically Black Colleges and Universities
IDP	Individual Development Plan used to help students clarify career plans
Indico	The CBB web schedule of CBB events and meetings. All meeting slides are to be uploaded to Indico for each theme. http://Indico.classe.cornell.edu
IPAC	International Particle Accelerator Conference
LANL	Los Alamos National Lab
LBNL	Lawrence Berkeley National Laboratory
LCLS2	Builds upon LCLS, the world's first hard x-ray free-electron laser. Moves from 120 pulses per second to 1 million pulses per second.
MaRIE free-electron laser	Matter-Radiation Interactions in Extremes facility
MeV	Electron volt measurement (million electron volts)
ML	Marginal / Maximum Likelihood
MOU	Memorandum of Understanding
MTE	Mean Transverse Energy
NSF	National Science Foundation
Participant	A person who spends >160 hours of CBB effort per year
PHC	Beam Production Theme (Photocathodes)
PI	Principal Investigator
R&D	Research and Development
SBIR/STTR	Small Business Innovation Research and Small Business Technology Transfer
SQUID magnetometers	Superconducting Quantum Interference Device
SRF	Beam Acceleration Theme

TEM grids	Transmission Electron Microscopy Grids
TJNAF	Jefferson National Lab
UED	Ultrafast Electron Diffraction
URM	Under Represented Minorities
USPAS	U.S. Particle Accelerator School
XFELS	X-ray Free Electron Lasers

Appendix B - CBB Connects:



Appendix C - Code of Conduct:

It is expected that all Center for Bright Beams members, including students, postdocs, affiliates, and faculty, will conduct themselves in a professional manner that is welcoming to all members and free from any form of discrimination, harassment, or retaliation. Members will treat each other with respect and consideration to create a collegial, inclusive, and professional environment. Creating a supportive environment to enable scientific discourse within CBB is the responsibility of all members.

Members will avoid any inappropriate actions or statements based on individual characteristics such as age, race, ethnicity, sexual orientation, gender identity, gender expression, marital status, nationality, political affiliation, ability status, educational background, or any other characteristic protected by law. Disruptive or harassing behavior of any kind will not be tolerated. Harassment includes but is not limited to inappropriate or intimidating behavior and language, unwelcome jokes or comments, unwanted touching or attention, offensive images, photography without permission, and stalking.

Violations of this code of conduct policy should be reported to either or both the director, Ritchie Patterson, or managing director, Joan Curtiss, or a theme leader. Retaliation for complaints of inappropriate conduct will not be tolerated. If a member observes inappropriate comments or actions and personal intervention seems appropriate and safe, they should be considerate of all parties before intervening.

Appendix D - Travel Exchange Program:

The exchange program allows students and postdocs to participate in a short-term visit, generally less than two weeks, to a CBB member institution where they will work with CBB members to share knowledge, acquire new skills, brainstorm in a multidisciplinary manner, and advance research projects.

Requirements -

Exchange program participants will be required to submit a one paragraph report at the completion of the exchange that describes the outcomes realized through the program.

Eligibility -

CBB graduate students and postdocs may apply to participate in the exchange program.

Approvals are dependent upon the availability of funding and the merit of the proposal in advancing CBB objectives.

Students must be in good academic standing and have the approval of their academic advisor. Postdocs must have the approval of their faculty advisor.

Proposals will be submitted to the managing director, Joan Curtiss (jcc25@cornell.edu) that contains:

- Project name
- Institution to visit
- Length of visit
- List of collaborators
- Optimal outcomes from exchange and how it advances the project
- Estimated cost of trip (airfare, hotel, AirBnB, etc.)

Approval Process

Theme leaders and director will review proposals using a similar process to the yearly PI proposal evaluation. Theme leader, student/postdoc and mentor will be notified of decision. The student or postdoc will work with the managing director to make trip arrangements.