Welcome to the first issue of the Center for Bright Beams newsletter. The last few months have been exciting ones at CBB, with strides in the production, acceleration and transport of very bright electron beams. Each discovery capitalizes on the teamwork and collaborations made possible by CBB.

Inside CBB, we are increasing communications and transparency. This month, we launched a new internal website and published the CBB Handbook. Did you know that CBB can fund a diversity or outreach event at your university? Or that travel grants are available to students so that they can visit collaborators? Or that CBB welcomes new members? The web site and Handbook explain these opportunities and much more.

Finally, I’m excited to announce CBB’s upcoming annual meeting at Cornell University on June 19-22. It will include a collaboration meeting (June 19-22), with a public one-day Symposium on Friday, June 21. I hope you will join us. The NSF’s annual site visit will take place the following week, and while CBB will go under the microscope there, I look forward to the opportunity to highlight the year’s many accomplishments.

Ritchie Patterson
Director of the Center for Bright Beams
CBB’s research is aimed at increasing the brightness (current/size) of electron beams for applications ranging from electron microscopes to X-ray sources to particle colliders. It targets specific technologies where gaining a first principles understanding can make a difference and where progress requires the combined expertise of physical scientists from multiple disciplines and institutions. Focus areas include beam production from photoemission sources, superconducting accelerating devices, and beam dynamics.

(Click on each research highlight to learn more)
Theoretical descriptions of the anti-$Q$ slope of SRF cavities

Instability suppression using octupoles

Stochastic space charge algorithm

New metrics to compute beam brightness

New simulations of magnetic vortex entry at grain boundaries
CBB’s science depends on intensive collaboration among its members, each of whom brings unique expertise to a deeply interdisciplinary enterprise.

WELCOME NEW MEMBERS!

April 2019

Postdocs & Graduate Students

Matt Andorf  
Cornell University  
Postdoc

Jan Balajka  
Cornell University  
Postdoc

Oksana Chubenko  
Arizona State Univ.  
Postdoc

Zeming Sun  
Cornell University  
Postdoc

Eric Cropp  
UCLA  
Graduate Student

Gevork Gevorkyan  
Arizona State Univ.  
Graduate Student

Frank Ikponmwen  
Clark Atlanta Univ.  
Graduate Student

Nikita Kuklev  
University of Chicago  
Graduate Student

Gerard Lawler  
UCLA  
Graduate Student

Joshua Mann  
UCLA  
Graduate Student

CBB Affiliates

Daniele Filippetto -  
Lawrence Berkely National Lab

Andreas Schroeder -  
University of Illinois at Chicago

Alexander Valishev -  
Fermilab

CBB Staff

Michèle van de Walle  
Cornell University  
Director of Industrial Relations

Nev Singhota  
Cornell University  
Outreach

Mark Walsh  
Cornell University  
Outreach
October 2018:
- Eight students and faculty present at P3 (Photocathodes Physics for Photoinjectors Workshop) at Los Alamos National Laboratory
- CBB Seminar: Martin Schmeisser, Helmholtz-Zentrum Berlin, Alkali Antinodes Photocathodes for an SRF Photoinjector

November 2018:
- Bradley Siwick presents Structure and Dynamics with Ultrafast Electron Microscopes… or “How to make atomic-level movies of molecules and materials”
- CBB creates new YouTube video on “Physics and Technology of Bright Beams”, by Ivan Bazarov: [https://www.youtube.com/watch?v=fCLU2yyD3hU](https://www.youtube.com/watch?v=fCLU2yyD3hU)
- CBB General Meeting

January 2019:
- Six students attend the U.S. Particle Accelerator School
- CBB begins the review of its Strategic Plan

February 2019:
- CBB sponsors “Hidden Biases of Good People” at Cornell University with Mahzarin Banaji, Clark Cabot Professor of Social Ethics and chair in the department of Psychology at Harvard
- Best practices for Center collaboration are published in the CBB Handbook
- CBB Seminar: Auralee Edelen (SLAC) Neural Networks for Modeling and Control of Particle Accelerators

March 2019:
- Expanding Your Horizons (EYH), a program partially funded by CBB, that nurtures girls’ interest in science and math to encourage them to consider careers in STEM
- CBB members present accelerators to the world of condensed matter physicists at the APS March meeting

April 2019:
- CBB cosponsors the International Physics and Applications of High Brightness Beams in Crete, Greece
- CBB Seminar: Thorsten Kamps (Humboldt-Universitat zu Berlin) Monday, 4/1, 2:30pm EST

May 2019:
- CBB sponsors “Equity, Diversity and Inclusion” at the University of Chicago with Elizabeth Simmons, the UC San Diego Executive Chancellor for Academic Affairs
- CBB members attend and present their progress at the International Particle Accelerator Conference (IPAC), in Melbourne Australia

June 2019:
- CBB Annual Meeting, Cornell University, June 19-22
- Symposium: Bright beams - Looking at the Ultrafast and Ultrasmall, Cornell University, June 21
- 3rd annual NSF site visit
- Research Experience for Undergraduates begins (Cornell University & University of Chicago)
The STEP UP! program offers resources for middle school science and technology teachers as well as summer professional development opportunities. The Lending Library of Design Experiences offers activity sheets, demonstration materials and design materials for different science and engineering themes, addressing the Next Generation Science Standards. These Design Experiences can be checked out free of charge from our lending library.

**Making Sense of Circuits in After-School Settings**
On January 16th, a group of fifteen Tompkins County educators from different youth programs across the county participated in the Sensible Circuit and Kinetic Contraptions Workshop at Cornell University, co-sponsored by the Center for Bright Beams. Participants, primarily youth program managers and educators of after-school programs targeting middle school students, had the opportunity to explore hands on modules that focused on open and closed circuits, electricity, and motion.

**Science Olympiad, National K-12 Extracurricular Program**
This year at the University of Chicago, we held two invitational-level competitions for middle (Division B) and high school (Division C) students, with an amazing turnout of over 400 and 600 students respectively, spanning Illinois and the neighboring 3 states. These events were made possible by the support of our sponsors, including CBB, and took months of prep work by dedicated graduate and undergraduate student volunteers. It is our way to motivate and promote interest in STEM, and inspire the future generation of scientists.

**REU Summer Students to start in June!**
Students in the CBB Summer Program for underrepresented minorities can do research through REU programs at Brigham Young University, UCLA, the University of Chicago, and Cornell University. Participating students are guaranteed a Center for Bright Beams research project with a focus on producing, accelerating and transporting the brightest beams of electrons for applications from giant particle colliders to electron microscopes.
Helping Teachers Teach with Sensible Circuits
On average teachers in New York State must complete 35 hours of professional development every year, but they often struggle to find relevant training for their classroom. To meet this need a Cornell-led Science, Technology, Engineering, and Mathematics (STEM) workshop provides a day of professional development every spring and fall for New York City STEM teachers. This spring 64 teachers from across the NYC metropolitan area participated. As part of the workshop, CBB researchers led teachers through a CBB-developed, hands-on exploration of basic electrical circuits entitled “Sensible Circuits.” Teachers first explored simple electronic components and then fabricated their own Morse code machine. The teachers also brainstormed about how these activities could be modified for their classrooms.

Going Beyond the Equations with Surface Area
Students learn the equations to calculate the surface area of spheres and cubes, but they rarely appreciate the importance of these equations to everyday life. To correct this problem, CBB researchers revised an educational module to help seventh grade students at the Harlem Children’s Zone. On March 22nd the researchers used their new activities to help students understand how surface area affects chemical reactions. Students compared the time it takes to dissolve intact Alka-Seltzer tablets with those that had been crushed. They found that crushing causes a striking acceleration. To make this lesson more memorable, CBB researchers then showed that surface area also has a dramatic effect on combustion. A pile of flour will not burn, but a plume of finely dispersed flour — which has a high surface area — will ignite into a fire ball!

CBB In the News


CBB supports and encourages outreach activities and workforce development at all of its participating universities. Please contact CBBinfo@cornell.edu if you have an activity that you would like to host at your institution.


