Boston University  
Department of Electrical & Computer Engineering  

Annual Report 2009–2010  

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Design and production: Gordon Ryan  
Content: Gordon Ryan, ECE staff, and ECE faculty  

Cover: Top photo- Professor Luca Dal Negro demonstrates the principles of optical alignment in a nonlinear refractive index measurement. Bottom photo- ECE students at all levels are involved in research projects with faculty and graduate students. During the academic year, the typical student will work from 6 to 10 hours per week in addition to the regular course load.  

This report provides a description of the instructional and research activities of the Department of Electrical & Computer Engineering at Boston University during the 2009–2010 academic year. Instructional activities are reported from the Fall 2009 through Summer 2010 semesters while scholarly activities and budget information are reported from July 1, 2009 to June 30, 2010.  

Boston University’s policies provide for equal opportunity and affirmative action in employment and admission to all programs of the University.  

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Message From the Chair

By almost every measure, this was an extremely successful year for Boston University’s ECE Department. The year began with lively interactions with our Department’s Visiting Committee, followed by a successful ABET site visit review that resulted in a full six-year reaccreditation of our two degree programs. The two external site visits provided an opportunity for strong focus on our undergraduate education program and led to new initiatives to revitalize our curriculum and increase our undergraduate enrollment. In collaboration with other Engineering departments, we introduced two new undergraduate multidisciplinary concentrations, in Nanotechnology and in Energy Technologies and Environmental Engineering, that allow our undergraduates increased exposure to emerging engineering fields. Under the leadership of Mark Horenstein, we began an outreach program to increase the visibility of ECE within the BU student population and our prospective applicants, culminated by strong faculty involvement in spring recruitment activities. This led to a 30% increase in the number of new students in the College of Engineering, and a 40% increase in the percentage of incoming students enrolling in ECE.

Another outgrowth of our discussions with our Visiting Committee was the creation of a task force for curriculum reform as part of our Undergraduate Committee led by Thomas Little. The task force’s goal is to increase the flexibility of our programs to enable undergraduates to pursue specialization in different concentrations, while providing a rigorous foundation of relevant engineering science. This academic year, we are introducing new options to enable students to pursue diverse interests within ECE, including the Nanotechnology and Energy Concentrations, more flexible access to minors in other departments (Biomedical Engineering, Mechanical Engineering) and a new course in the Business of Technology Innovation, co-taught with Boston University’s School of Management. A more thorough review and revision of our core course offerings in science and engineering is underway.

The Department had an excellent year in acquiring research funding, with new grants totaling approximately $12,300,000, a 20% increase over the previous year, in addition to a sizeable pool of continuing grants. Fortunately, our graduate programs also received increased interest, leading to an incoming class of 83 MS students and 26 new PhD students to support our research mission. We also added three new degrees - Master’s of Engineering in Electrical Engineering, in Computer Engineering and in Photonics - which are one-year non-research graduate programs tailored to meet the demand from local industry for continuing education in engineering.
This year, we integrated three new faculty members into the department: Ayse Coskun, Ajay Joshi, and Siddharth Ramachandran, adding depth to our Computer Engineering and Photonics groups. We continued our aggressive recruitment and hired two very promising young faculty for next year: Doug Densmore and Bobak Nazer. Densmore’s research combines Computer Engineering principles with synthetic biology, an area of excellence in our Biomedical Engineering Department. Nazer is an expert in information theory and network coding, and will add depth to the strong group in Information Systems and Sciences, and will also contribute to the College of Engineering’s Systems Division. In addition, we added a senior faculty member who recently retired from industry, Dr. Alan Pisano, as Associate Professor of the Practice to share his valuable experiences with our undergraduates.

This past spring, we started a new Distinguished Lecture Series, hosting Susie Wee, Hewlett-Packard’s Chief Technology Officer; Tsuhan Chen, Professor and Director, School of Electrical and Computer Engineering at Cornell University; and Douglas Stone, Chairman of Applied Physics at Yale University. We have already filled our Fall 2010 Calendar with three additional Distinguished Lecturers, to complement our various technical seminar series organized by the different areas in ECE.

As I mentioned in the opening sentence, by almost every measure, this was a very successful year. Unfortunately, the department suffered three major losses due to the untimely deaths of our past Chair, Franco Cerrina, and our Computer Engineering colleague, Alexander Taubin, and the retirement of Mike Ruane to join his extended family on the West Coast. Ruane had been with Boston University since 1980, and was the College of Engineering’s Faculty Director of Outreach, as well as the director of our Senior Design Capstone course. Taubin joined Boston University in 2002, with extensive expertise in logic design and design automation for asynchronous systems, and was an important contributor to our graduate and undergraduate curriculum in Computer Engineering. Cerrina was both my successor and predecessor as Chair of ECE, joining the department in 2008 after an illustrious career at the University of Wisconsin focusing on nano-scale lithography. He was the key motivator behind ECE’s success this past year. We will miss our departed colleagues tremendously and hope to honor their memory by continuing their success in growing ECE.

In summary, our ECE Department’s growth continues to accelerate. I look forward to an even better report next year.

David A. Castañón
Department Chair ad interim
September 2010
Highlights

Faculty Awards and Honors

HATICE ALTUG received a Young Investigator Program award from the Office of Naval Research. She was also the recipient of the National Science Foundation’s Faculty Early Career Development (CAREER) award.

IRVING BIGIO was named a Boston University (BU) College of Engineering Distinguished Lecturer. He was also named an Honorary Guest Professor at the University College London.

JEFFREY CARRUTHERS was named the 2010 Professor of the Year by members of the 2010 BU College of Engineering graduating class.

AYSE COSKUN and MARTIN HERBORDT were named as BU College of Engineering Dean’s Catalyst Award recipients for their proposal to develop widely applicable, inexpensive software methods to reduce energy consumption and enable more efficient cooling in computer systems.

AYSE COSKUN also received the “Best Paper Award” at the 17th IFIP/IEEE International Conference on Very Large Scale Integration (VLSI-SoC), 2009.

LUCA DAL NEGRO was named a recipient of the National Science Foundation’s Faculty Early Career Development (CAREER) award. He also received the Early Career Research Excellence Award from the BU College of Engineering.

MARTIN HERBORDT served as the General Chair of the IEEE 20th International Conference on Application-Specific Systems,
One new PhD student was awarded the Dean’s Fellowship (DF) and matriculated in Fall 2009. This student is continuing his degree program and making excellent progress. Twelve new PhD students matriculated with Graduate Teaching Fellowships (GTFs) in the same period; ten of these students were offered Research Assistantships (RAs) for the Fall 2010 semester.

With respect to degree production, 65 and 16 students graduated with the MS and PhD degrees, respectively, during the report period. The breakdown by degree is: 50 in EE, 28 in CE, two in Photonics and one in Systems.

We experienced an excellent recruiting year for Fall 2010 admissions. After receiving more than 800 applicants to the program, we expect an incoming class of 83 MS students and 26 PhD students. With respect to fellowships and assistantships, we will be matriculating 28 new funded graduate students for the Fall 2010 semester: five Dean’s Fellows, 20 GTFs and three RAs. These numbers indicate a significant increase in the number of applicants, yield on fellowship offers, and the overall quality of the fall matriculants.

In 2009 a new curriculum was developed and proposed leading to the Master of Engineering degree in Electrical Engineering, Computer Engineering, and Photonics. This proposal has been approved by the department and college and is pending review by the provost.

The College of Engineering received a grant from the U.S. Department of Education Graduate Assistance in Areas of Na-
ional Need (GAANN) Program that will provide fellowships to Biomedical or Electrical and Computer Engineering PhD students seeking to focus on nanobiotechnology. Fellows will receive a $30,000 stipend for one to two years to pursue academic studies and research in this field.

**Graduate Student Awards**

ECE graduate students made an impressive showing in the 2010 Science and Engineering Day hosted by the University. The College of Engineering Dean’s Award was awarded to **GILBERTO BASILIO-SANCHEZ** who works under the guidance of Prof. Ted Morse. Basilio-Sanchez was also the recipient of The Office of Technology Development Award. The Center for Nanoscience and Nanobiotechnology Award was awarded to **RONAN ADATO** who works under the guidance of Prof. Hatice Altug. Adato was also the recipient of The ECE Award for having the overall best poster at the event. **IVANA STOJANOVIC** received Honorable Mention for the CISE Poster Prize.

The College of Engineering Best Dissertation award recognizes annually the most outstanding PhD research by a student completed during the year ending in April. The award was given to Dr. **ASHWIN GOPINATH** for his dissertation titled, “Electromagnetic Field Enhancement and Light Localization in Aperiodic Nanostructures.” Gopinath’s research was conducted under the guidance of advisor Prof. Luca Dal Negro in the Electro-Physics research area.

**SONAL AMBWANI** received the Best Student Poster Award at The Gordon Center for Subsurface Sensing and Imaging Systems Research and Industrial Collaboration Conference.

**Major Grants**

New research funding this year totaled approximately $12.3M in awards for research, of which $9.7M were awarded to ECE Principal Investigators (PI) and $2.6M were awarded to ECE faculty members working as Co-PI on projects outside of the Department. Of the PI awards, 37 were for new research projects, while 23 awards were for continuing projects.

**New Awards**

This year, two ECE faculty received funding from the National Science Foundation (NSF) Career Awards. **HATICE ALTUG** received $400,000 for “Nano-Plasmonic Resonances for Bio-Detection Systems” (in conjunction with the Center for Nanoscience and Nanobiotechnology (CNN)). **LUCA DAL NEGRO** received a $400,000 award for “Combined Light and Carrier Localization in High-Refractive Index Silicon Nanocrystal Structures – A novel approach for Si-based Lasers” (in conjunction with CNN).

Dal Negro also received $238,000 in funding from DoD/AFSOR for his “DURIP – 1.54mm Optical Gain in Si and Ge-Based Structures for Optical amplification and Electrically Pumped Lasers” proposal. **THEODORE MOUSTAKAS** received $150,000 in new funding from NASA/Photon Systems, Inc. for “Development of an Electron Beam Injected Laser Structure at 235nm Based on AlGaN/AIN Multiple Quantum Wells on SiC Substrates” (in conjunction with the Photonics Center) and **IOANNIS PASCHALIDIS** (PI) and Dmytro Kosakov (Co-PI) received $309,416 in new funding from PHS/NIH/NIGMS for their research into “Refinement Methods for Protein Docking Based on Exploring Multi-Dimensional Energy Funnels” (in conjunction with the Center for Information and Systems Engineering (CISE)).

**VENKATESH SALIGRAMA** (PI) and **JANUZ KONRAD** (Co-PI) received $300,000 in new funding from DoD/National Geospatial Agency for “Video Analytics: An Event Based Statistical Approach.” They also received a $507,364 award from the NSF for “Frames to Events: A Statistical Approach to Activity Analysis in Multi-Camera Systems” (in conjunction with CISE). Saligrama also received $433,430 in new funding from the NSF for “CPS-Medium: Collaborative Research: The Foundations of Implicit and Explicit Communication in Cyberphysical Systems” and $402,000 from ONR/Navy for “Smart Distributed Sensor Fields.”

**JOSHUA SEMETER** (PI) and **CLEM KARL** (Co-PI) received $775,000 in new funding from the NSF for “NR-R21: Development of Next-Generation Imaging Spectrometer Based on a Tunable Liquid Crystal Filter (in conjunction with the Center for Space Physics (CSP)). Semeter also received $250,112 in funding from the NSF for his “Investigation of Phase Coherence in Elemental Auroral Structure” (in conjunction with CSP) research.

**DAVID STAROBINSKI** (PI) and **ARI TRATCENBERG** (Co-PI) received $456,731 in new funding from the NSF for “CIF: Small: Large-Scale Software Dissemination in Stochastic Wireless Networks (in conjunction with CISE). **SELIM UNLU** received $152,971 in new funding from the NSF for “Floating Light-Activated Micro-Electrical Stimulators for Neural Prosthetics.”

**Continuing Awards with New Funding**

**CHRISTOS CASSANDRAS** received $122,792 in continuing funding for his DoD/Air Force grant, “Real Time Optimization in Complex Stochastic Environment” (in conjunction with CISE). **DAVID CASTAÑÓN** (PI) and **CLEM KARL** and **VENKATESH SALIGRAMA** (Co-Pls) received $275,000 in continued funding from DHS/NEU for the ALERT grant “Awareness and Location of Explosive-Related Threats” (in conjunction with CISE).
The NSF and Northeastern University continued to fund the multi university Engineering Resource Center (ERC) CenSSIS program which was in its tenth and final year. **David Castañón** (PI) and his team at BU received $314,518 in continued funding. **Thomas Little**, leader of the Boston University work effort for another multi university NSF ERC, received continued funding of $495,092 for the “NSF Smart Lighting Engineering Research Center” grant. Additionally, (PIs) **David Castañón, Roberto Paiella, Min-Chang Lee, Theodore Morse, and Luca Dal Negro** received continued funding from various sources in the amounts of $150,000 or greater.

### Events

**Bernard M. Gordon CenSSIS NSF Site Visit**
The Gordon-CenSSIS (Center for Subsurface Sensing and Imaging Systems) NSF Site Visit, held April 14, 2010, brought together CenSSIS researchers and students from BU, Northeastern University, Rensselaer Polytechnic Institute, and University of Puerto Rico Mayaguez; NSF evaluators; and Gordon-CenSSIS industry and institutional collaborators. The Year Ten site visit agenda included presentations on the Center’s Strategic Plan for a Sustained ERC; Generating New Knowledge; Sustainability; Advancing Technology & Achieving Technology Transfer; Educating University and Pre-College Students; Creating Student Leaders; and Diversity Accomplishments. A student poster session and an evening celebratory dinner attended by the NSF leadership and industry partners completed the day. This was the final site visit for CenSSIS. CenSSIS’ sustainable activities will continue under separate grants at the partner institutions, several in partnership with our industry colleagues; through research in our ERC testbeds (BioBED, SoilBED, MedBED, and SeaBED), through the Gordon Engineering Leadership Program (providing MS study support in sensing and imaging), and through activities of three spin-off centers: ALERT (Awareness and Localization of Explosives-Related Threats), PROTECT (Puerto Rico Testsite for Exploring Contamination Threats), and VOTERS (Versatile On-board Traffic Embedded Roaming Sensors).

**ECE Day 2010**
Initiated in 1997, ECE Day is a forum for seniors to present their capstone projects and graduate students to present their research posters. Held at the end of the Spring semester, ECE Day 2010 included 14 graduate research posters and ten senior design presentations attended by students, faculty, alumni, and industry representatives.

**Exploring the Boundaries of Smart Light Systems**
The NSF Smart Lighting Engineering Research Center (ERC) convened its first Academia-Industry Day at the Boston University Photonics Center on February 5, 2010, to explore the latest developments in the burgeoning field of low-power, high-efficiency light emitting diodes (LEDs) and other adaptive, controllable, solid-state technologies. The conference featured 12 hours of presentations and posters from faculty and students representing the ERC’s three core institutions - Rensselaer Polytechnic Institute (RPI), Boston University, and the University of New Mexico (UNM) - and observations from industry experts. Founded in 2008 by the National Science Foundation, the ERC is a multi-year, $4 million-per-year, interdisciplinary program that facilitates research, industrial collaborations and educational initiatives aimed at advancing intelligent lighting systems and a robust smart lighting industry.

**Future of Light Symposium**
On November 16, 2009, the Photonics Center held its 13th annual Future of Light Symposium, “Biophotonics Sensors and Systems: Point of Care Diagnostics,” which showcased research in biophotonic imaging and biomedical photonics. Chaired by ECE Professor Irving Bigio, the symposium highlighted the achievements of Photonics Center researchers and collaborators from academic and medical institutions in Greater Boston and across the country. ECE Professor Selim Unlu and Affiliated Professor Jerome Mertz were among the leading researchers from academia and industry to deliver talks at the symposium.

**MS Project Symposia**
The MS Project Symposia are events that give MS students who have participated in a faculty-advised Project Course an opportunity to present their completed work to peers and the faculty. Symposia are held at the end of each semester. This year’s events were August 7, 2009, December 11, 2009, and May 3, 2010.
Distinguished Lecture Series

In 2010 the ECE Department hosted its inaugural Distinguished Lecture Series, high-profile invited lectures delivered by luminaries from both academia and industry. The following are biographical sketches of this year’s Distinguished Lecturers.

Susie Wee — February 24, 2010
Chief Technology Officer, HP
“Experiences, Devices, Services, and the Cloud”

Susie Wee is the Chief Technology Officer of Client Cloud Services in HP’s Personal Systems Group. Prior to this, Susie was the founding VP of the Experience Software Business in HP’s Personal Systems Group and lab director of the HP Labs Mobile and Media Systems Lab.

Wee was the co-editor of the JPSEC standard for the security of JPEG-2000 images and the editor of the JPSEC amendment on File Format Security. She was formerly an associate editor for the IEEE Transactions on Circuits, Systems for Video Technology and for the IEEE Transactions on Image Processing. In addition to working at HP Labs, Wee was a consulting assistant professor at Stanford University. She received Technology Review’s Top 100 Young Innovators award and was named to ComputerWorld’s Top 40 Innovators under 40. She received the INCITs Technical Excellence award and was selected to be an IEEE Fellow in 2009.

Tsuhan Chen — March 24, 2010
Director, School of Electrical and Computer Engineering, Cornell University
“Beyond Face Recognition: Understanding Images of People Using Social Context”

Tsuhan Chen is Director of the School of Electrical and Computer Engineering at Cornell University. Previously, he was Associate Department Head in the Department of Electrical and Computer Engineering at Carnegie Mellon University and worked at AT&T Bell Laboratories.


He received the Charles Wilts Prize at the CIT and was a recipient of the NSF CAREER Award. He was elected to the Board of Governors and IEEE Signal Processing Society and chosen as a Distinguished Lecturer for the IEEE Signal Processing Society. He is a member of the Phi Tau Phi Scholastic Honor Society and Fellow of IEEE.

Douglas Stone — April 21, 2010
Chairman of Applied Physics and Professor of Physics, Yale University
“What is a Laser Anyway? Do We Really Understand Them After Fifty Years of Trying?”

Douglas Stone is Professor and Chairman of Applied Physics and Professor of Physics at Yale University.

Stone is a theoretical physicist with interests in solid-state and optical/laser physics. Specifically he is interested in theoretical issues relating to physics and electronics on the nanoscale and in micro-lasers and other optical devices for integrated optics, analyzed using the tools of quantum theory and non-linear dynamics (chaos theory). He is the author of more than 100 research and review articles in these areas and holds three patents for optical devices. He is a recipient of the McMillan Award of the University of Illinois at Urbana and a Fellow of the American Physical Society and the Optical Society of America. He is also a former Trustee and current Honorary General Member of the Aspen Center for Physics.

He is currently writing a popular book on the history of science, The Quest of the Valiant Swabian: Einstein and the Quantum, to be published by Princeton University Press.
Faculty and Staff

Core Faculty

**Murat Alanyali**
Associate Professor
Communication networks; performance analysis and optimization; stochastic systems
- PhD, University of Illinois, Urbana-Champaign 1996
- 2003 NSF CAREER Award
- 2004 Legacy Gift Award, College of Engineering
- Associate Editor, IEEE Control Systems Society Conference Editorial Board

**Hatice Altug**
Assistant Professor
Nano-photonic devices and sensors; photonic switches for communication and bio-sensing applications
- PhD, Stanford University, 2006
- 2010 ONR Young Investigator Award
- 2010 NSF CAREER Award
- 2009 New Investigator Award, Massachusetts Life Sciences Center
- 2008 BU Peter Paul Career Development Fellowship
- 2008 BU College of Engineering Dean’s Catalyst Award
- 2006 Best Research Paper, IEEE LEOS Conference

**Enrico Belloti**
Associate Professor
Computational electronics; semiconductor materials and device simulations; power electronics; parallel computing
- PhD, Georgia Institute of Technology, 1999
- 2005 NSF CAREER Award
- 2003 ONR Young Investigator Award

**Irving Bigio**
Professor
Medical application of optics, lasers, and spectroscopy; biophotonics; nonlinear optics; applied spectroscopy; laser physics
- PhD, University of Michigan, 1974
- Fellow - Optical Society of America, American Society for Lasers in Medicine and Surgery, American Institute for Medical & Biological Engineering
- 2010 College of Engineering Distinguished Lecturer
- 2007 Faculty Service Award
- Associate Editor, Journal of Biomedical Optics
- Associate Editor, Lasers in the Life Sciences
- Invited Nominator, 2007 Nobel Prize in Physics

**Richard Brower**
Professor
Molecular dynamics simulation for biomolecules; lattice methods for QCD and statistical mechanics; quantum field theory of strings and particles
- PhD, University of California, 1969
- A.P. Sloan Research Fellow, SLAC and MIT, 1974-1976
- Past Managing Editor, International Journal of Computational Physics

**David Campbell**
Professor & Provost
General nonlinear phenomena and complex systems; novel electronic materials; electron transport in semiconductor superlattices
- PhD, Cambridge University, 1970
- Fellow - American Physical Society, American Association for the Advancement of Science
- Editor-in-Chief, Chaos; Editor, Physics Reports

**Jeffrey Carruthers**
Associate Professor & Associate Chair for Undergraduate Studies
Wireless infrared communications; broadband communications; mobile and wireless networks
- PhD, University of California, Berkeley, 1997
- 1999 NSF CAREER Award
- Senior Member, IEEE
- 2010 College of Engineering Professor of the Year
- 2001 ECE Award for Excellence in Teaching

**Christos Cassandras**
Professor
Analysis and control of discrete event dynamic systems; stochastic control and optimization; dynamic control of computer and communication networks
- PhD, Harvard University, 1982
- Fellow, IEEE and IFAC
- IEEE Control Systems Society Board of Governors
- 1999 Harold Chestnut Prize
- IEEE Distinguished Member Award, IEEE Control Systems Society
- IEEE CSS Distinguished Member Award
- Department Editor, IEEE Transactions on Automatic Control
- IEEE Transactions on Automatic Control
- Honorary Professor, Huazhong University of Science and Technology and Wuhan University of Science and Technology

**David Castañón**
Professor
Stochastic control; estimation optimization; image understanding and parallel computation
- PhD, Massachusetts Institute of Technology, 1976
- Associate Director, CenSSIS; Co-Director, BU CISE
- Past President, IEEE Control Systems Society (CSS)
- IEEE CSS Distinguished Member Award
- Air Force Advisory Board member
- 2007 ECE Teaching Award
- Associate Editor, Computational Optimization and Applications; Past Associate Editor, IEEE Transactions on Automatic Control
FRANCO CERRINA  
Professor and Chair  
Semiconductor devices and fabrication modeling; nanolithography; nanofabrication; optics; optical systems; X-rays; synchrotrons; DNA synthesis; system and synthetic biology  
» PhD, University of Rome, 1974  
» Fellow, IEEE, Optical Society of America, American Physical Society, American Association for the Advancement of Science, SPIE

AYSE COSKUN  
Assistant Professor  
Green computing; 3D stacked architectures; multi and many-core systems; computer architecture; embedded and cyberphysical systems  
» PhD, University of California, San Diego, 2009  
» 2010 BU ENG Dean’s Catalyst Award  
» Best Paper Award, 17th IFIP/IEEE VLSI-SoC

LUCA DAL NEGRO  
Assistant Professor  
Optical amplification phenomena and laser physics; optical spectroscopy of semiconductor nanocrystals; photonic crystals, Anderson light localization and aperiodic dielectrics; nanophotonics and plasmonics  
» PhD, University of Trento, 2003  
» 2010 NSF CAREER Award  
» 2010 BU Early Career Research Excellence Award  
» Dean's Catalyst Award, 2007

ROSCEO GILES  
Professor  
Advanced computer architectures; distributed and parallel computing; computational science  
» PhD, Stanford University, 1975  
» One of the “50 Most Important Blacks in Research Science,” The Career Communications Group (CCG)  
» A. Nico Haberman Award, CRA  
» 1996 ENG Award for Excellence in Teaching

W. CLEM KARL  
Professor  
Multidimensional and multiscale signal and image processing and estimation, particularly applied to geometrically and medically oriented problems  
» PhD, Massachusetts Institute of Technology, 1991  
» 2000 ECE Award for Excellence in Teaching  
» Past Associate Editor, Tomography & MRI, IEEE Transactions on Image Processing; Past Assistant Editor, Systems Control Newsletter

MARK KARPOVSKY  
Professor  
Design of secure cryptographic devices and smart cards; routing in interconnection networks; design and protection of cryptographic devices; fault-tolerant computing; error correcting codes; testing and diagnosis of computer hardware  
» PhD, Leningrad Electrotechnical Institute, 1969  
» Fellow, IEEE

RONALD KNEPPER  
Professor  
VLSI integrated circuit technology; SiGe BiCMOS device and circuit modeling; silicon CMOS & bipolar devices; numerical device simulation; RF/analog IC design  
» PhD, Carnegie Mellon University, 1969  
» Life Fellow, IEEE  
» 1989 IBM Outstanding Innovation Award; 1988 IBM Division Award; 1983 IBM Outstanding Technical Achievement Award  
» Past Editor, Solid State Electronics

MARK HORENSTEIN  
Professor  
Applied electromagnetics; electrostatics; microelectromechanical systems  
» PhD, Massachusetts Institute of Technology, 1978  
» Editor-in-Chief, Journal of Electrostatics

ALLEY HUBBARD  
Professor  
VLSI design using analog and digital techniques in CMOS; neural net chips, smart sensor chips, and chips with biological applications; models of the peripheral auditory system  
» PhD, University of Wisconsin-Madison, 1977  
» 2002 College of Engineering Award for Excellence in Teaching

PRAKASH ISHWAR  
Assistant Professor  
Signal, image, and video processing (statistical, multiresolution, distributed); information theory and communications (network coding, computation, security)  
» PhD, University of Illinois Urbana-Champaign, 2002  
» 2005 NSF CAREER Award  
» 2007 Dean’s Catalyst Award

AJAY JOSHI  
Assistant Professor  
On-chip and off-chip communication; digital/analog circuit design; computer architecture; reliable circuits and systems; physical design  
» PhD, Georgia Institute of Technology, 2006

JANUSZ KONRAD  
Professor  
Image and video processing; compression and transmission; visual sensor networks; video analytics; stereoscopic and 3D imaging; multidimensional digital signal processing  
» PhD, McGill University, 1989  
» Fellow, IEEE  
» 2001 IEEE Signal Processing Magazine Award  
» 2004-2005 EURASIP Image Communications Best Paper Award  
» 2007 Dean’s Catalyst Award  
» Associate Technical Editor, IEEE Communications Magazine; Associate Editor, EURASIP Journal on Image and Video Processing; Past Associate Editor, IEEE Signal Processing Letters
Robert Kotiuga
Associate Professor
Electromagnetics; numerical methods for three-dimensional vector field problems; Whitney forms and the Finite Element Method; micromagnetics; nanoscale magnetics; geometric inverse problems; topological aspects of magnetic scalar potentials; helicity functionals; analysis of high performance interconnects
» PhD, McGill University, 1985
» Member, Electromagnetics Academy
» 2007 Dean’s Catalyst Award

Min-Chang Lee
Professor
Alternative energy sources and environmental impacts; radio communications; experimental plasma physics; ionospheric plasma physics
» PhD, University of California, San Diego, 1977
» 2008 BU ECE Award for Excellence in Teaching
» Past Associate Editor, AGUs Radio Science

Lev Levitin
Professor
Information theory; physics of communication and computing; complex and organized systems; bioinformatics; quantum theory of measurement; reliable communication and computing
» PhD, USSR Academy of Sciences, Gorky University, 1969
» Life Fellow, IEEE
» Member, International Academy of Informatization

Thomas Little
Professor & Associate Chair for Graduate Studies
Mobile Ad Hoc Networks (MANETs); multimedia computing; computer networking; software engineering; embedded sensor networks
» PhD, Syracuse University, 1991
» 1995 NSF CAREER Award
» 2007 Dean’s Catalyst Award
» 2009 BU College of Engineering Faculty Service Award
» Editorial Board Member, ACM/Springer Multimedia Systems, Journal of Multimedia Tools and Applications

Theodore Morse
Professor
Photonic material processing; optical fiber fabrication, lasers, and sensors; high power double clad fiber lasers
» PhD, Northwestern University, 1961
» Fulbright Fellow, Germany

Theodore Moustakas
Professor
Growth by MBE, HVPE and MOCVD of Nitride Semiconductors; Optical devices (LEDs, LDS, Optical modulators, Detectors) from deep UV to THZ
» PhD, Columbia University, 1974
» Associate Director of the Materials Science and Engineering Division
» Honorary Doctorate, Aristotle University for Excellence in Research
» Fellow, American Physical Society, Electrochemical Society
» Senior member, IEEE
» 1998 ECE Award for Excellence in Teaching
» Cited in “Technology Transfer Works: 100 Cases from research to realization.” Better World Project

S. Hamid Nawab
Professor
Cognition and brain signal processing; short-time and short-space signal processing; artificial intelligence in signal processing
» PhD, Massachusetts Institute of Technology, 1982
» 2005 College of Engineering Service Award
» 1998 College of Engineering Award for Excellence in Teaching
» 1993 Metcalf Award for Excellence in Teaching
» Fellow - American Institute for Medical & Biological Engineering

William Oliver
Associate Professor
Radar studies of the upper atmosphere and ionosphere; modeling and simulation; global change in the upper atmosphere
» PhD, University of Illinois, 1973

Roberto Paiella
Assistant Professor
Optical technologies for information processing; photonic devices based on semiconductor quantum structures, including group-III nitride quantum wells; nanoscale photonic devices and circuits; ultrafast optics
» PhD, California Institute of Technology, 1998
» Senior Member, IEEE
» 2008 BU Office of Technology Development Ignition Award
» 2009 BU College of Eng. Dean’s Catalyst Award

Ioannis Paschalidis
Associate Professor
Systems and control; networking; applied probability; optimization; operations research; computational biology; and bioinformatics
» PhD, Massachusetts Institute of Technology, 1996
» Senior Member, IEEE
» National Science Foundation CAREER Award, 2000
» 2nd Prize, George E. Nicholson paper competition
» Guest Editor, Special Issue on Wireless Sensor & Actuator Networks, IEEE Transactions on Automatic Control
» Assoc. Editor, SIAM Journal on Control & Optimization
» Past Assoc. Editor, IEEE Transactions on Automatic Control and Operations Research Letters
» Elected Full Member of Sigma Xi, 1996
Wei Qin
Assistant Professor
Tools, methods and architectures for embedded systems; synthesis and verification of programmable processors; design languages for electronic systems
» PhD, Princeton University, 2004
» 2006 ECE Award for Excellence in Teaching

Siddharth Ramachandran
Associate Professor
Optical physics of guided waves; micro- and nano-structured optical fibers; high-power fiber lasers/sensors; biomedical imaging and microscopy with optical fibers
» PhD, University of Illinois, Urbana-Champaign, 1998
» Fellow, Optical Society of America (OSA)
» Distinguished Member of Technical Staff, OFS Laboratories, 2003
» Topical Editor, Optics Letters
» Book editor, Springer-Verlag
» Guest Editor, IEEE-JSTQE

Michael Ruane
Professor
Resonant cavity imaging system; micro-magnetics modeling; optical systems; AFRL Loss Cone Imager DSX Satellite
» PhD, Massachusetts Institute of Technology, 1980
» Senior Member, IEEE
» 2010 ENG Faculty Service Award
» 2004 ASEE Outstanding Teacher Award
» 1999 ECE Award for Excellence in Teaching
» 1991 College of Engineering Faculty Service Award

Venkatesh Saligrama
Associate Professor
Information and control theory; statistical signal processing; applications to sensor networks
» PhD, Massachusetts Institute of Technology, 1997
» 2005 NSF CAREER Award
» 2003 ONR Presidential Early Career Award
» 2002 ONR Young Investigator Award

Joshua Semeter
Associate Professor
Ionospheric and space plasma physics; spectroscopy of atmospheric airglow and the aurora borealis; image processing; radar systems and radar signal processing
» PhD, Boston University, 1997
» 2004 SRI Presidential Achievement Award
» 2000 Prize Lecture, NSF Cedar Workshop
» Associate Editor, Journal of Geophysical Research
» 2006 NSF CAREER Award
» 2009 ECE Award for Excellence in Teaching
» Associate Director, BU Center for Space Physics

Alexander Sergienko
Professor
Correlation spectroscopy, field optical microscopy and spectroscopy of semiconductor materials and devices; quantum communications; remote laser sensing; laser physics; nonlinear optics; quantum optics, including quantum radiometry and metrology
» PhD, Moscow State University, 1987
» 1999 NSF CAREER Award
» Fellow, Optical Society of America
» 2001 ECE Award for Excellence in Teaching

Thomas Skinner
Associate Professor
Microprocessors; computer networks; operating systems; distributed systems
» PhD, Boston University, 1982
» 2003 Microsoft Most Valuable Professional Award
» 1997 College of Engineering Award for Excellence in Teaching

David Starobinski
Associate Professor
Wireless networking; QoS and traffic engineering; network economics; cyber security
» PhD, Technion, Israel Institute of Technology, 1999
» 2010 ECE Faculty Teaching Award
» 2009 EPFL Visiting Professor Fellowship
» 2004 Department of Energy Early Career Award
» 2002 NSF CAREER Award

Anna Swan
Associate Professor
Development of nanoscale optical self-interference microscopy; optical properties of carbon nanotubes
» PhD, Boston University, 1993
» Senior Member, IEEE

Alexander Taubin
Associate Professor
Asynchronous circuit; logic design; computer architecture; CAD; attack resistant hardware
» PhD, Electrotechnical University of St. Petersburg, 1981
» Senior Member, IEEE

Malvin Teich
Professor
Quantum optics and imaging; photonics; fractal stochastic processes; information transmission in biological sensory systems
» PhD, Cornell University, 1966
» Fellow, IEEE, American Physical Society, Acoustical Society of America, American Association for the Advancement of Science, John Simon Guggenheim Foundation, Optical Society of America
» IEEE EMBS Distinguished Lecturer
» OSA Traveling Lecturer
» Editorial Advisor, Photonics and Physical Electronics, Physics Today
Research Faculty

MALAY MAZUMDER
Research Professor
Particle technology; material engineering; electrostatic engineering

Farouk El-Baz
Research Professor and Director, Center for Remote Sensing
Remote sensing with emphasis on arid lands; surface features of solar system planets as part of comparative planetology

Affiliated Faculty

ARI TRACHTENBERG
Associate Professor
Error correcting codes; data synchronization (especially for PDAs and mobile networks); sensor-based location detection; algorithms

» PhD, University of Illinois, Urbana-Champaign, 2000
» 2002 NSF CAREER Award
» 2003 ECE Award for Excellence in Teaching
» Senior Member, IEEE
» BU Innovative Engineering Education Faculty Fellow

Selim Ünlü
Professor and Associate Dean for Research and Graduate Programs
Photodetectors; nano-optics: high-resolution and solid immersion lens microscopy; subsurface imaging of semiconductor devices and circuits; biophotonics: biosensor fabrication and biological imaging techniques

» PhD, University of Illinois, Urbana-Champaign, 1992
» 1996 NSF CAREER Award
» 2008 TUBITAK Special Award
» 2002 ECE Award for Excellence in Teaching
» Fellow, IEEE
» Associate Editor, IEEE Journal of Quantum Electronics
» 2006 College of Engineering Service Award
» 2007 Dean’s Catalyst Award
» 2007 ARCCNN Distinguished Lecturer
» 2005-2007 IEEE/LEOS Distinguished Lecturer

Ari Trachtenberg
Associate Professor
Error correcting codes; data synchronization (especially for PDAs and mobile networks); sensor-based location detection; algorithms

» PhD, University of Illinois, Urbana-Champaign, 2000
» 2002 NSF CAREER Award
» 2003 ECE Award for Excellence in Teaching
» Senior Member, IEEE
» BU Innovative Engineering Education Faculty Fellow

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Photodetectors; nano-optics: high-resolution and solid immersion lens microscopy; subsurface imaging of semiconductor devices and circuits; biophotonics: biosensor fabrication and biological imaging techniques

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» Fellow, IEEE
» Associate Editor, IEEE Journal of Quantum Electronics
» 2006 College of Engineering Service Award
» 2007 Dean’s Catalyst Award
» 2007 ARCCNN Distinguished Lecturer
» 2005-2007 IEEE/LEOS Distinguished Lecturer

Affiliated Faculty

JOHN BAILLEUL
Professor, Mechanical Engineering
Robotics; control of mechanical systems; mathematical system theory

Supriya Chakrabarti
Professor, Astronomy
Space experimentation; ultraviolet spectroscopy

Carlo De Luca
Professor, Biomedical Engineering
Motor control of normal and abnormal muscles; objective evaluation of muscle fatigue in humans; objective assessment of functional activities in humans; advanced technology for detecting and applying biosignals

Solomon Eisenberg
Professor and Chair, Biomedical Engineering
Electrically mediated phenomena in tissues and biopolymers

Farouk El-Baz
Research Professor
Remote sensing with emphasis on arid lands; surface features of solar system planets as part of comparative planetology

Theodore Fritz
Professor, Astronomy
Space plasma and magnetospheric physics; magnetosphere-ionosphere coupling; substorms; charged particles and compositions; rocket and satellite experiments

Bennett Goldberg
Professor, Physics
Room- and low-temperature, near-field microscopy of semiconductors and biological systems; magneto-optics and magneto-transport of two- and one-dimensional electron fields

William Klein
Professor, Physics
Kinetics of phase transitions, the physics of earthquakes and the study of damage in materials

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Emeritus Faculty

**John Brackett**
Professor Emeritus
Software engineering; software requirements definition; object-oriented testing; rapid prototyping of embedded systems
» PhD, Purdue University, 1963

**Thomas Kincaid**
Professor Emeritus
Signal and image processing; neurodynamics; non-destructive testing
» PhD, Massachusetts Institute of Technology, 1965

**David Perreault**
Professor Emeritus
Nonlinear networks; computer-aided design; microprocessors; distributed digital networks
» PhD, Purdue University, 1968

**Bahaa E.A. Saleh**
Professor Emeritus
Quantum optics; nonlinear optics; image processing
» PhD, Johns Hopkins University, 1971

**Richard Vidale**
Professor Emeritus
Modeling and simulation, software engineering
» PhD, University of Wisconsin-Madison, 1964

Adjunct Faculty

**John Brackett**
EC728 (Fall 2009) & EC518 (Spring 2010)
» PhD, Purdue University, 1963

**Vladimir Kleptsyn**
EC578 (Fall 2009)
» PhD, Moscow Lomonosov’s Institute of Fine Chemical Technology, 1983

**Babak Kia Montazam**
EC327 (Fall 2009)
» MS, Boston University, 1996

**Alan Pisano**
SC463 (Fall 2009) & SC402 (Spring 2010)
» PhD, Northeastern University, 1974
In Memoriam

It was with great sadness that the Department of Electrical & Computer Engineering mourned the passing of two outstanding colleagues this year. We are grateful for the years of service, scholarship, and friendship these professors graced us with.

Franco Cerrina

Though it had only been two years since Professor Franco Cerrina joined ECE as Chair, his impact will be long-lasting.

Cerrina passed away Monday, July 12, and he will be remembered for his commitment to showing a new generation of students how exciting engineering could be.

At BU, Cerrina started the Nano-DNA lab in hopes of integrating bio-molecules like DNA, RNA and proteins into existing nanotechnology. He worked with students like Anu Thubagere (ECE ’12), who said that her professor always encouraged outside collaborations and was extremely approachable.

“Above all else, he was a tower of support for all of us in the lab,” Thubagere said. “He treated us as an extension of his family.”

Cerrina joined the department at a critical time as the College of Engineering was undergoing major restructuring. He recruited four young faculty members to BU, helping rejuvenate the computer engineering program, and led the ECE department through a successful reaccreditation last year.

Over the years, Cerrina received over $45 million in grants, wrote more than 300 reviewed publications and was a fellow of the American Physical Society, the Optical Society of America and the Institute of Electrical and Electronics Engineers (IEEE).

Before joining the BU faculty, he spent 24 years at the University of Wisconsin-Madison. There, he was director of the university’s Center for NanoTechnology.

Alexander “Sasha” Taubin

Sasha Taubin joined the Department in January 2002. He was an excellent teacher who was active in computer systems research. Prior to ECE, he held academic and professional positions in industry and universities in Japan, Russia, and the United States.

He was a devoted teacher who placed an emphasis on providing a solid education to both graduate and undergraduate students.

His research interests included asynchronous circuits, logic design, computer architecture, CAD, and attack-resistant hardware. He co-authored three books, published more than 60 journal and conference papers and was a senior member of the IEEE.

His contributions and dedicated service to the ECE Department, College of Engineering, and Boston University will be greatly missed.
Staff

Administrative Staff

WAYNE RENNIE
Director

CARLY MARCHIONI
Assistant Director

JULIE GUTHRIE
Academic Programs Manager

AUSTIN ALEXANDER
Senior Programs Coordinator

BECKY BELL
Assistant to the Chair

RYAN FLAMENT
Financial Administrator

DANDEL DELAKAS
Grants Administrator

RACHEL HARRINGTON
Publications, New Media, and Promotions Administrator

GORDON RYAN
Marketing Communications Consultant

JAMES GOEBEL
Manager, Systems Support, ENG

ILYAS HAMDI
Manager, Instruction Labs

ALEXEY NIKIFOROV
MBE Laboratory Manager

VLADIMIR KLEPSYN
Electronic/Circuits Lab Manager
# Research Staff

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Advisor</th>
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<tbody>
<tr>
<td>Bertazzi, Francesco</td>
<td>Visiting Researcher</td>
<td>Bellotti</td>
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<td>Boriskina, Svetlana</td>
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<td>Goto, Maso</td>
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<td>Ramachandran</td>
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<td>Semeter</td>
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<td>Mohan, Nishant</td>
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<td>Teich</td>
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<td>Mustafa, Mehmet</td>
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<td>Karpovsky</td>
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<td>Nasr, Magued</td>
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<td>Park, Jin</td>
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<td>Thomidis, Christos</td>
<td>Research Fellow</td>
<td>Moustakas</td>
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<td>Vegni, Anna Maria</td>
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<tr>
<td>Yanik, Ahmet Ali</td>
<td>Research Associate</td>
<td>Altug</td>
</tr>
</tbody>
</table>
Department Administration and Committees

The Operations and Scheduling Committee directs strategic planning and is involved in all strategic decisions for the Department. It plans the annual ECE Day and ECE Retreat and also recommends the scheduling of courses and the assignments of instructors. The Committee is composed of three research area coordinators, the Associate Chairs for undergraduate and graduate programs, the Department Chair, and a representative from the College of Engineering (ENG). Cerrina (Chair), Little (Associate Chair, Grad), Carruthers (Associate Chair, Undergrad), Herbordt (CSE), Castañón (ISS), Sergienko (EP), Rennie (Director), Ünlü (ENG), Marchioni, Bell

The Undergraduate Committee is responsible for all aspects of the undergraduate program, including program and curricular changes; new courses; evaluation of instruction and student advising; and recommendations for fellowships, scholarships, and awards. It is in charge of closing the ABET planning feedback loop and preparing for the ABET visit. A subcommittee makes recommendations for the ECE Teaching Excellence Award. Carruthers (Chair), Castañón, Horenstein, Ishwar, Ruane, Semeter, Guthrie, Alexander

The Graduate Committee is responsible for all aspects of the graduate programs, including program and curricular changes; new courses; recruitment of new graduate students; making recommendations for fellowships, scholarships, and awards; evaluating Graduate Teaching Fellows; assignment of theses committees; and coordination of poster presentations on ECE Day. Little (Chair), Alanyali, Altug, Bellotti, Coskun, Dal Negro, Ishwar, Joshi, Swan, Taubin, Trachtenberg, Guthrie, Alexander

The Search Committee is responsible for the recruitment of new faculty. It coordinates advertisements, interviews of candidates, and makes recommendations to the faculty for new appointments. Cerrina (Chair), Herbordt, Karl, Saligrama, Swan, Trachtenberg, Rennie, Bell

The APT Committee makes recommendations on appointments of tenure-track, non-tenure-track, and affiliate faculty; promotion and tenure of tenure-track faculty; and promotion to Full Professor. Cerrina (Chair), Alanyali, Brower, Karl, Levitin, Paiella, Sergienko, Rennie, Bell

The Publicity, Special Events, and Seminars Committee makes strategic recommendations for the Department’s website, brochures, reports, exhibits, and all media events aimed at promoting the Department and enhancing its visibility at the local, national and international level. It is also in charge of the ECE Distinguished Lectures, Colloquiums, Seminars, and other ad hoc research talks. Konrad (Chair), Dal Negro, Joshi, Kotiuga, Little, Moustakas, Paschalidis, Rennie

The Industrial and Alumni Relations Committee is in charge of promoting relations to local and national industry, recruitment of members of the Industrial Advisory Council (IAC), and planning IAC meetings. It helps promote strong relations to alumni by coordinating alumni visits on special events such as ECE Day and others. Cerrina (Chair), Horenstein, Hubbard, Knepper, Little, Pisano, Ruane, Rennie, Marchioni, Bell

The Information Technology Committee is tasked with maintaining, upgrading, and improving the information technology infrastructure of the Department. Starobinski (Chair), Altug, Brower, Hubbard, Ishwar, Konrad, Semeter, Rennie, Goebel, Hamdi

The Awards Committee is responsible for researching awards and other recognition opportunities for department faculty members and developing strategies to strengthen the candidacies of faculty who are considered for recognition. Teich (Chair), Bigio, Brower, Cassandras, Castañón, Giles, Levitin, Moustakas
Undergraduate Program

The Department of Electrical & Computer Engineering continues to pride itself on developing a strong laboratory curriculum to complement our classroom teaching for undergraduates. Our labs are stocked with up-to-date equipment and we encourage undergraduates to become involved with research and development efforts through UROP (Undergraduate Research Opportunity Program), work study, and student employment. Engineering is an applied science, and we believe it is important to start applying what is learned in the classroom as soon as possible.

Central to this philosophy, the capstone design project provides our graduating seniors with real engineering experience and the student projects have continued to be outstanding, with several projects receiving awards.

We are dedicated to improving our undergraduate programs and this year exemplified that commitment. Through careful examination of student surveys, student feedback forums, and faculty review of courses and outcomes, ECE has implemented a number of curriculum changes aimed at enhancing the undergraduate experience.

<table>
<thead>
<tr>
<th>Fall 2009 Enrollment</th>
<th>Electrical</th>
<th>Computer Systems</th>
<th>Computer**</th>
<th>Total</th>
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<tr>
<td>Freshmen*</td>
<td>17</td>
<td>13</td>
<td>30</td>
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<tr>
<td>Sophomores*</td>
<td>23</td>
<td>17</td>
<td>3</td>
<td>43</td>
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<td>Juniors</td>
<td>37</td>
<td>16</td>
<td>4</td>
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<td>Seniors</td>
<td>33</td>
<td>11</td>
<td>11</td>
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<tr>
<td>Total</td>
<td>110</td>
<td>44</td>
<td>31</td>
<td>185</td>
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</table>

* ENG Students are not required to declare a major until their Junior year.
** “Computer Systems Engineering” has been renamed “Computer Engineering.” For current students, the degree name change is optional, but all new declared majors will be Computer Engineering.

Undergraduate Degrees Awarded

<table>
<thead>
<tr>
<th>Major</th>
<th>Degree Recipients</th>
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</thead>
<tbody>
<tr>
<td>Computer Engineering</td>
<td>13</td>
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<td>Computer Systems Engineering</td>
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<tr>
<td>Electrical Engineering</td>
<td>30</td>
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<tr>
<td>Total</td>
<td>51</td>
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</table>

Course and Program Development

The focus for this academic year were the dual visits of the ABET program review and the Departmental Visiting Committee. Both visits were productive and thought provoking. The Department anticipates continued evolution of our programs in the coming years based on this feedback, discussions among the faculty, as well as feedback from students and alumni.

In the spring of 2010, we streamlined the college’s double major requirements. Previously, between 168 and 184 credits would be required depending on the two programs chosen. The new double-major requirements allow for the completion of a single capstone design experience and 162 total credits.

Finally, as part of the OneBU project, we are now allowing students to complete their 24 credit general education requirement through the College of Arts and Sciences Core Curriculum program.
## Undergraduate Courses

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Fall '09</th>
<th>Spring '10</th>
<th>Summer '10</th>
</tr>
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<tbody>
<tr>
<td>EC311</td>
<td>INTRO TO LOGIC DESIGN</td>
<td>Karpovsky</td>
<td>Taubin</td>
<td>Karpovsky</td>
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<tr>
<td>EC327</td>
<td>INTRO TO SOFTWARE ENGINEERING</td>
<td>Montazam</td>
<td>Trachtenberg</td>
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<tr>
<td>EC330</td>
<td>APPLIED ALGORITHMS FOR ENGINEERS</td>
<td>Brower</td>
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<tr>
<td>EC381</td>
<td>PROBABILITY THEORY IN ELECTRICAL AND COMPUTER ENGINEERING</td>
<td>Alanyali</td>
<td>Alanyali</td>
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<tr>
<td>EC401</td>
<td>SIGNALS AND SYSTEMS</td>
<td>Ishwar</td>
<td>Karl</td>
<td>Carruthers</td>
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<td>EC402</td>
<td>CONTROL SYSTEMS</td>
<td>Pisano</td>
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<tr>
<td>EC410</td>
<td>INTRO TO ELECTRONICS</td>
<td>Unlu</td>
<td>Lee</td>
<td>Kleptsyn</td>
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<tr>
<td>EC412</td>
<td>ANALOG ELECTRONICS</td>
<td>Sergienko</td>
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<td>EC413</td>
<td>COMPUTER ORGANIZATION</td>
<td>Herboldt</td>
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<td>EC415</td>
<td>COMMUNICATION SYSTEMS</td>
<td>Carruthers</td>
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<td>EC416</td>
<td>INTRO TO DIGITAL SYSTEMS</td>
<td>Konrad</td>
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<td>EC440</td>
<td>INTRO TO OPERATING SYSTEMS</td>
<td>Starobinski</td>
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<td>EC441</td>
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<td>EC447</td>
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<td>Giles</td>
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<td>EC450</td>
<td>MICROPROCESSORS</td>
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<td>EC455</td>
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<td>EC456</td>
<td>ELECTROMAGNETIC SYSTEMS II</td>
<td>Lee</td>
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<td>EC463</td>
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<td>PHYSICS OF SEMICONDUCTOR DEVICES</td>
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<td>FUNDAMENTALS OF NANOMATERIALS AND NANO-TECHNOLOGY</td>
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<td>SPECIAL TOPICS IN ELECTRICAL AND COMPUTER ENGINEERING</td>
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<td>EC501</td>
<td>STATE SPACE CONTROL</td>
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<td>EC504</td>
<td>ADVANCED DATA STRUCTURES</td>
<td>Trachtenberg</td>
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<td>EC505</td>
<td>STOCHASTIC PROCESSES</td>
<td>Karl</td>
<td>Saligrama</td>
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<td>EC512</td>
<td>ENTERPRISE CLIENT-SERVER SOFTWARE SYSTEMS DESIGN</td>
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<td>SOFTWARE PROJECT MANAGEMENT</td>
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<td>EC524</td>
<td>OPTIMIZATION THEORY AND METHODS</td>
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<td>SUSTAINABLE POWER SYSTEMS: PLANNING, OPERATION AND MARKETS</td>
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<td>ADVANCED DIGITAL DESIGN WITH VERILOG AND FPGA</td>
<td>Taubin</td>
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<td>INTRO TO PHOTONICS</td>
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<td>Paiella</td>
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<td>ERROR CONTROL CODES</td>
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<td>Starobinski</td>
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<td>Kotuiga</td>
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<td>MET EK318</td>
<td>ELECTRIC CIRCUIT THEORY II</td>
<td>Lee</td>
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Instructional Laboratories

Control Systems Laboratory
Faculty: Pisano
This laboratory houses four ECP model 220 Industrial Plant Emulators for studying the control of practical systems. These systems consist of an electromechanical apparatus including an adjustable mechanical mechanism with actuators and sensors. Various types of controllers (PID, State Feedback, LQR) can be designed and implemented in either continuous or discrete time formulations using a DSP-based real-time controller with a graphical interface. Non-ideal conditions that are often present in real-world applications can be studied. Integrated with the systems are MATLAB and SIMULINK design tools, which can be used to design control systems that can then be implemented in the hardware. Analytical models of both the “plant” and the “controller” can be validated with actual hardware responses.

Electronic Design Automation/VLSI Laboratory
Faculty: Herboldt, Hubbard, Joshi, Knepper, Taubin
The VLSI Laboratory is involved in almost all aspects of digital design. It has a wide range of CAD tools available for student use, including Cadence, Synopsys, and the NCSU Design Toolkit.

Electronics Teaching Laboratory
Faculty: Carruthers, Horenstein, Knepper, Lee, Ruane, Sergienko
The Electronics Teaching Laboratory supports the laboratory component of the core courses EK307 – Electric Circuit Theory, EC410 – Introduction to Electronics, and EC412 – Analog Electronics. In addition, several modules of EK 131/132 – Introduction to Engineering - make use of the facility. Staffed by a full-time technician, each of the 36 lab benches includes fully digital, PC-linked oscilloscopes, power supplies, multimeters, and function generators. Each networked PC is loaded with OrCAD, PSpice, schematic capture, PCB layout, and LabView software. Some stations are equipped with National Instruments data acquisition hardware. A variety of common electronic parts are available for sale at the equipment window. When not in use by scheduled lab sections, the facility is available for open use by all ECE students. A handicapped-accessible lab station is available.

High Performance Computing Laboratory
Faculty: Brower, Giles
The High Performance Computing Laboratory was created with support from the National Science Foundation to support development of undergraduate courses in parallel and high performance computing. The courses offered at Boston University serve as a national model for computational science education. The lab features a network of multimedia graphics workstations linked to supercomputers at the Center for Computational Science and the Scientific Computing and Visualization Lab.

High Tech Tools and Toys Laboratory
Faculty: Ruane
HTTTL is the instructional laboratory associated with Boston University’s NSF-funded Engineering Research Center for Subsurface Sensing and Imaging Systems (CenSSIS). The laboratory houses a variety of PC-based imaging camera systems, machine vision systems, and acoustic imaging systems. Software for imaging includes MATLAB, Image Processing Toolbox, Image Builder, ENVI, and LabVIEW. The HTTTL supports freshman EK31/132 modules in imaging and subsurface imaging, senior design capstone projects in imaging, and experiments in senior level electives related to imaging. The lab also hosts summer research through UROP, REU, RET, and High School Honors programs. Some undergrads are supported during the academic year to work on improving stations in the HTTTL.

Microprocessor and PC Laboratory
Faculty: Giles, Skinner, Taubin, Toffoli
This lab features instruction in the programming and interfacing of microcomputers and digital controllers. Higher-level courses emphasize the design of systems using microprocessors. Various simulators, and analysis packages are available.

Senior Project Laboratory
Faculty: Knepper, Pisano, Ruane
This lab supports our senior design teams, serving real-world customers such as NASA, Analog Devices, Boston public schools, social service agencies, artists, and small businesses, as well as faculty and staff across the University. Each team has twenty-four hour access to a permanent bench setup with a networked PC, benchtop GPIB-based HP test equipment, and software for schematic design, simulation, and PCB layout. Electronics and shop support is provided. Shared tools include high speed scopes, logic analyzers, spectrum analyzers, E-prom, PLA and FPGA burners, and various compilers and crosscompilers for DSP, and micro-controller development. Software from MS-DNAA is available for all teams.
**Signals and Networks (SIGNET) Laboratory**  
**Faculty:** Carruthers, Konrad, Nawab  
This laboratory provides instructional facilities for courses in the areas of signal processing and communication networks. The lab houses numerous workstations for digital signal processing, image processing, and various real-time applications covering the complete audio frequency spectrum. Equipment includes Linux-based workstations, microphones, DSP boards, speakers, amplifiers, digital cameras, and software packages such as MATLAB and Hypercept. The courses served by this laboratory include EC401 (Signals and Systems), EC415 (Communication Systems), EC416 (Intro to Digital Signal Processing), and some ECE modules in EK131/132 (Introduction to Engineering). On the communications side, experiments involving data communication links, local-area networks, and wide-area networks are supported. Powerful computer-based simulation and analysis tools are available to compare and evaluate network designs. Facilities are also provided for experimentation with local-area network switching and routing hardware.

**Software Engineering Laboratory**  
**Faculty:** Brackett, Herboldt, Skinner, Taubin, Toffoli, Trachtenberg  
An instructional and research lab, the Software Engineering Laboratory (SEL) supports courses and research on the economical design of reliable software for large-scale and embedded computer-based systems. The lab is comprised of more than 25 networked workstations, four Motorola embedded computer development systems, and state-of-the-art development and modeling tools for the design, implementation, and testing of distributed software systems.

<table>
<thead>
<tr>
<th>Instructional Lab Expenditures</th>
<th>Approx. Cost</th>
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<tr>
<td>Microprocessor and Software Engineering Labs</td>
<td>$10,195.65</td>
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<tr>
<td>VLSI and Signals/Networks Lab</td>
<td>$17,170.82</td>
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<tr>
<td>Electronics Lab</td>
<td>$22,234.15</td>
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<tr>
<td>Senior Projects Lab</td>
<td>$4,353.57</td>
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<td>Other (includes materials and equipment for courses not assigned to a specific lab)</td>
<td>$11,596.07</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$65,550.26</strong></td>
</tr>
</tbody>
</table>
2010 ECE Award for Excellence in Teaching

Professor David Starobinski was the winner of the 2010 ECE Award for Excellence in Teaching. He received the award for his outstanding record of teaching and developing courses in computer networks: from an introduction to engineering module EK131 on wireless networks to a core computer networking course EC441, in addition to graduate courses in the field.

The Department instituted this award during the 1997-98 academic year to recognize innovation and excellence in teaching among its faculty. The award, based on nominations from College of Engineering students, faculty, and staff, carries with it a $1,000 prize to be used toward instructional activities. A committee of ECE professors and students evaluate the nominees, using teaching statements, classroom material, and student comments.

IEEE Student Branch

The ECE supported BU student chapter of the IEEE had another year of intense activity, under the direction of President Clara De Paolis, Vice President Joshua Mendez, and Secretary and Webmaster Juan Jhong (see blogs.bu.edu/ieee). Key events in 2009-10 included the following:

- Student Groups Fair, September 18, 2009, Photonics Building.
- Soldering tutorial, November 6, 2009, Electronics Lab.

Senior Design

All ECE seniors complete a team-based, two semester capstone senior design project. Teams must design and prototype a product, electronic device, or software system for real-life customers, who are drawn from industry, small businesses, community groups, and faculty and staff. Students learn design methods, project management, team dynamics, communication skills, and legal and ethical standards for design. A substantial first-deliverable milestone and oral presentation complete the first semester.

The second semester is spent in the Senior Project Laboratory. Students must make presentations to their customer, write inter- and intra-office memos, design their project to meet customer specifications, manage the project budget, and deliver their working prototype, including a detailed instruction manual. Project records are maintained in personal design logbooks. Teams have 24/7 access to their dedicated, fully-equipped laboratory bench, and can use professional CAD and prototyping tools for circuits, embedded systems, and software development. The year culminates in student project presentations on ECE Day to faculty, industry representatives, and fellow students. On May 3, 2010, ten teams presented their projects and a Best Presentation award was presented at a luncheon for faculty, customers, and seniors. The PT Hsu Award for best project was awarded at commencement.
Notable Senior Design Projects

nanoTrack
It’s not every day that an international company leading in engineering development asks five seniors to not only test out software but develop new hardware, too.

But Altium Limited, an Australian based software company that creates PC-based electronics design software for engineers, asked seniors Tunde Agboola (CE), Schuyler Eldridge (EE), Nickvash Kani (CE), Mohammed Rahbini (EE), and Daniel Ryan (EE) to do just that as part of their senior project.

Specifically, the team was asked to develop a peripheral board for Altium’s line of NanoBoards which are used to enhance an engineer’s ability to design, implement, and debug an entire FPGA (field programmable gate array)-based system design. At Altium’s request, the new peripheral board also had to perform some basic video and image processing.

“The project really required a broad skillset,” said Eldridge. “Individually, we probably wouldn’t have been able to complete the task—it definitely taught us how to work as a team.”

To demonstrate their work, the seniors developed an object tracking system that used color thresholding.

By the end of the semester, Team nanoTRACK had completed their task and ultimately expanded upon the functionality of Altium’s NanoBoard. Additionally, they showed the effectiveness of Altium’s software and hardware when confronted with real world engineering challenges.

Trafflack
What if cars could talk to each other?

That is to say, what if they could communicate with each other, letting drivers know about upcoming traffic or icy roads?

That was the idea behind Trafflack, the senior project of Matt Figueroa (CE), Aaron Ganick (EE), Jonathan Lobo (EE), Travis Rich (EE), and Peter Schimitsch (CE).

Working with Professor Thomas Little, Team Trafflack created an in-car observation and collaborative system that lets vehicles exchange valuable information that can cause a driver’s experience to be more safe and convenient.

As opposed to radio frequency (RF) communication, which can be unreliable during traffic jams or any other time when there is a high density of cars in one area, the seniors decided to use light from headlights and tail lights to enable the cars’ “conversations.” The plan came about after several of them worked together in the Smart Lighting Engineering Research Center.

“We had made a light bulb that could essentially talk,” Rich said. “From there we thought, why couldn’t we use that same technology to make cars communicate?”

They used four transceivers per car, or node, and matching software that could collect data not just from the car immediately in front but from cars down the road, too.

Their hard work paid off. Not only did the team win at ECE Day, they also took away the MobiSys 2010 Best Poster award in San Francisco.
NightHawk NVS

Driving on Comm Ave. late at night is a perilous business. A driver must avoid hitting other drivers, as well as bicyclists who think black is an appropriate color for night riding, pedestrians who don’t look (or hesitate) before stepping from the curb, and the occasional skateboarder who subscribes to no rules of the road. But now, that drive and many others may become much safer, thanks to the work of some recent College of Engineering alums.

The group has designed a night vision driver assistance program that displays “threats,” such as pedestrians, obstacles and road signs on a dashboard-mounted touch screen, and warns drivers of their presence with a beep. Called NightHawk NVS, the system was developed as an electrical and computer engineering senior design project by Luis Carrasco (ENG’10,’11), Sehrish Abid (ENG’10), Andrew Sarratori (ENG’10), York Chan (ENG’10), and Wesley Griswold (ENG’10).

The idea of building such a system came from Mikhail Gurievich (ENG’07), an entrepreneur and director of ZepFrog, an internet startup. Rather than trying to build the system himself, Gurievich turned the idea over to the department of electrical and computer engineering students, hoping they could bring it to fruition.

“Many engineering students have tried to do this project,” says Carrasco. “This year, we succeeded. Our system was both accurate enough and fast enough to be helpful, whereas teams in the past could not do this.”

Central to the system is a high-quality night vision camera mounted on the outside of the car. The camera collects real-time information about objects that have a high likelihood of entering a vehicle’s path. The system is intended to run at 30 miles per hour and has been successfully tested at 70 miles per hour. The project took over 1,000 hours to complete, and 2,500 lines of code were written to program it.

“Integrated with a GPS, the system could serve as an augmented reality navigation system,” says Carrasco, who imagines that a future iteration will use infrared cameras and will display visual information on a car’s windshield.

At this point, the system exists only on one laptop, but Carrasco says at least one company has expressed interest in taking it to market. He estimates that the system would cost about $500 to manufacture and could be an option in new cars for as much as $3,000. He has heard that GM, Ford, and Audi are working on similar programs, but he says their products were tested on unrealistically perfect roadways.

“We tested our system on the craziest roads in America,” he says. “In Boston.”
Graduate Program

Recruitment

For the Fall 2009 cycle, one new PhD student was awarded the Dean’s Fellowship (DF) and matriculated. Twelve PhD students matriculated with Graduate Teaching Fellowships (GTFs) in the same period; ten of these students were picked up as Research Assistantships (RAs) for the Fall 2010 semester.

For the Fall 2010 cycle, we received 810 applications for Fall matriculation, up from 565 in Fall 2009, and up from 650 in Fall 2008. We offered admission to a total of 491 students; 443 of which were to the MS program (154 of these applied for the post-BS PhD program). Twenty-six students were offered admission as post-BS PhDs and 22 as post-MS PhDs. This is in comparison to Fall 2009, which had a total of 300 admits with 249 for the MS (84 of these applied for the post-BS PhD program), 34 for the post-BS PhD, and 17 for the post-MS PhD.

With respect to financial aid offers, we recruited 28 new funded graduate students: five Dean’s Fellows, 20 GTFs and three RAs for Fall 2010 matriculation.

These numbers indicate a significant increase in the number of applicants, yield on fellowship offers, and the overall quality of the fall matriculants. This continues the trend of securing a class of funded students of increasing quality amidst a growing pool of candidates interested in our degree programs in ECE.

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<th>Female</th>
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<th>GTF</th>
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<td>4</td>
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Fall 2009 Mean GRE Scores

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<td>90</td>
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Spring 2010 Mean GRE Scores

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<th>An. Writing</th>
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Graduate Enrollment

### MS Degree Enrollment

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### PhD Degree Enrollment

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Graduate Degrees

### MS Degrees Awarded

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<td>Computer Systems Engineering</td>
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<td>Electrical Engineering</td>
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<td>Photonics</td>
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### PhD Degrees Awarded

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<td>Computer Engineering</td>
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<td>Electrical Engineering</td>
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<tr>
<td><strong>Total</strong></td>
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Course and Program Development

The ECE Department continues to refine the graduate curriculum. In 2009 a new curriculum was developed and proposed leading to the Master of Engineering degree in Electrical Engineering, Computer Engineering, and Photonics (described below). This proposal has been approved by the department and college and is pending review by the provost. In Spring 2010, one new course was developed and offered: EC500 - High Performance Programming with Multicore GPUs and FPGAs by Prof. Martin Herbordt.

#### Proposed Master’s of Engineering

Focus of program: The new Master’s of Engineering program targets students that wish to pursue practical application of an advanced graduate degree in contrast to the more research oriented focus of the existing MS program in the department. Students pursuing the Master’s of Engineering, typically students in local industry, will gain valuable training to enhance their careers as practitioners. Courses included in the new curriculum will enhance their engineering discipline with topics including entrepreneurship, project management, leadership, and finance. In addition, students will be provided greater flexibility to enroll in complementary courses in other departments (e.g., computer science) and will be provided an opportunity to complete their degrees more quickly to minimize time away from full time employment.

Need for Program: Under the existing degree program there is a significant gap in the ability to serve the large population of students wishing to augment their training at the gradu-
ate level without continuation toward the PhD. With a strong focus on PhD education and research outcomes the department has downplayed a focus on this population. Under the proposed Master’s of Engineering, the department expects to serve this community, create and sustain a targeted curriculum based on their needs, and significantly grow the new population as supported by the vibrant local high tech industry in the Boston area. The proposed Master’s of Engineering also provides an immediate option for existing BU students to contemplate a finishing program prior to seeking employment in industry.

**Relation to Existing Programs:** The Department of Electrical and Computer Engineering currently has Master’s of Science (MSc) degrees in Electrical Engineering, Computer Engineering, and Photonics. These degrees are largely designed as pathways to the PhD and have a strong research flavor. They’re designed to train students toward careers in academic and industrial research. The proposed Master’s of Engineering is designed as a terminal degree program intended to produce and finish practitioners that come from, or are immediately employed by, industry. The benefits to such a program are in career enhancement and the development of world-class engineers. The creation of the Master’s of Engineering for Electrical, Computer, and Photonics is consistent with the efforts of the College of Engineering to provide equivalent degrees in each department.

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**PhD Student Progress**

The number of PhD graduates per year is an important measure of the strength of the graduate programs. In prior years, we saw the results of the procedural improvements to keep the progress of the PhD students on track. Our requirement that students must pass the PhD prospectus within two years of PhD candidacy is intended to guide the students to identify dissertation topics, focus on their research, and reach their degrees in a timely manner. The chart below shows the number of PhD students achieving candidacy, completing their prospectus defense, and graduating over the last eight academic years.
Graduate Teaching Fellows and Research Assistants

<table>
<thead>
<tr>
<th></th>
<th>Summer 2009</th>
<th>Fall 2009</th>
<th>Spring 2010</th>
<th>Total</th>
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<tbody>
<tr>
<td>Graduate Teaching Fellows</td>
<td>3</td>
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<tr>
<td>Research Assistants</td>
<td>83</td>
<td>102</td>
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</table>

PhD Dissertations

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Dissertation Advisor</th>
<th>Dissertation Title</th>
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<tbody>
<tr>
<td>David Voss</td>
<td>Theodore Fritz</td>
<td>A novel spacecraft standard for a modular nanosatellite bus in an operationally responsive space environment</td>
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<tr>
<td>Konstantin Aizikov</td>
<td>Peter O’Conner</td>
<td>Novel Computational and Instrumentation Methodologies for Biological Fourier-Transform Ion Cyclotron Resonance Mass Spectrometric (FT-ICR MS) Imaging</td>
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<tr>
<td>Ashraf Al Daoud</td>
<td>Murat Alanyali</td>
<td>On Revenue from Secondary Spectrum Use in Wireless Cellular Networks</td>
</tr>
<tr>
<td>Weiyou Xiao</td>
<td>David Starobinski</td>
<td>Reliable Data Dissemination in Dense Wireless Networks</td>
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<tr>
<td>Danilo D’Orogrna</td>
<td>Enrico Bellotti</td>
<td>Numerical Simulation Models and Stress Measurements for HgCdTe Infrared Detectors</td>
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<tr>
<td>Erhan Ermis</td>
<td>Venkatesh Saligrama</td>
<td>Geometry Independence in Information Processing for Heterogeneous Camera Networks</td>
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<tr>
<td>Huseyin Mutlu</td>
<td>David Starobinski</td>
<td>Spot Pricing of Secondary Access to Wireless Spectrum</td>
</tr>
<tr>
<td>Ashvin Gopinath</td>
<td>Luca Dal Negro</td>
<td>Electromagnetic field enhancement and light localization in aperiodic nanostructures</td>
</tr>
<tr>
<td>Douglas Carssow</td>
<td>Allyn Hubbard</td>
<td>Design of a Space Flight Qualified Data Processing Unit and the Simulation of Single Event Transients on its Logic Circuitry</td>
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<tr>
<td>Fatih Hakan Koklu</td>
<td>Selim Unlu</td>
<td>High Numerical Aperture Subsurface Imaging</td>
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<tr>
<td>Marianne Nourzad</td>
<td>Allyn Hubbard</td>
<td>An Adaptive Digital Implementation of a Biomimetic Processing Scheme for Sound Source Localization and Characterization</td>
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<tr>
<td>Rui Li</td>
<td>Luca Dal Negro</td>
<td>Energy Transfer Phenomena and Radiative Processes in Sinx-Based Materials for On-Chip Photonics Applications</td>
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<tr>
<td>Ashish Agarwal</td>
<td>Thomas Little</td>
<td>Multihop Communications in Vehicular Networks</td>
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<tr>
<td>Karen Jenkins</td>
<td>David Castañón</td>
<td>Adaptive Sensor Management for Feature-Based Classification</td>
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<td>Darin Hitchings</td>
<td>David Castañón</td>
<td>Adaptive Multi-Platform Search and Exploitation</td>
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<tr>
<td>Yitao Liao</td>
<td>Theodore Moustakas</td>
<td>Development of Efficient Deep Ultraviolet Light Emitting Diodes</td>
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### Graduate Courses

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<thead>
<tr>
<th>Course Number and Title</th>
<th>Fall '09</th>
<th>Spring '10</th>
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<tr>
<td>EC500 SPECIAL TOPICS IN ELECTRICAL AND COMPUTER ENGINEERING</td>
<td></td>
<td>Herbordt</td>
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<td>EC501 STATE SPACE CONTROL</td>
<td>Li</td>
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<td>EC504 ADVANCED DATA STRUCTURES</td>
<td>Trachtenberg</td>
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<td>EC505 STOCHASTIC PROCESSES</td>
<td>Karl</td>
<td>Saligrama</td>
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<td>EC512 ENTERPRISE CLIENT-SERVER SOFTWARE SYSTEMS DESIGN</td>
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<td>EC513 COMPUTER ARCHITECTURE</td>
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<tr>
<td>EC514 SIMULATION</td>
<td>Vakili</td>
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<td>EC515 DIGITAL COMMUNICATION</td>
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<td>EC516 DIGITAL SIGNAL PROCESSING</td>
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<td>EC517 INTRODUCTION OF INFORMATION THEORY</td>
<td>Ishwar</td>
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<td>EC518 SOFTWARE PROJECT MANAGEMENT</td>
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<td>EC533 ADVANCED DISCRETE MATHEMATICS</td>
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<td>EC535 INTRODUCTION TO EMBEDDED SYSTEMS</td>
<td>Coskun</td>
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<td>EC541 COMPUTER COMMUNICATION NETWORKS</td>
<td>Alanyali</td>
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<tr>
<td>EC543 SUSTAINABLE POWER SYSTEMS: PLANNING, OPERATION, AND MARKETS</td>
<td>Caramanis</td>
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<td>EC544 NETWORKING THE PHYSICAL WORLD</td>
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<td>EC551 ADVANCED DIGITAL DESIGN WITH VERILOG AND FPGA</td>
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<td>EC560 INTRODUCTION TO PHOTONICS</td>
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<td>Paiella</td>
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<td>EC561 ERROR-CONTROL CODES</td>
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<td>EC565 LASERS</td>
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<td>EC575 SEMICONDUCTOR DEVICES</td>
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<td>EC577 ELECTRICAL, OPTICAL, AND MAGNETIC PROPERTIES OF MATERIALS</td>
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<td>EC578 FABRICATION TECHNOLOGY FOR INTEGRATED CIRCUITS</td>
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<td>EC701 OPTIMAL AND ROBUST CONTROL</td>
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<td>EC702 RECURSIVE ESTIMATION AND OPTIMAL FILTERING</td>
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<td>EC707 RADAR REMOTE SENSING</td>
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<td>EC710 DYNAMIC PROGRAMMING AND STOCHASTIC CONTROL</td>
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<td>EC715 WIRELESS COMMUNICATIONS</td>
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<td>EC725 QUEUEING SYSTEMS</td>
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<td>EC726 PERSONAL KNOWLEDGE ENGINEERING</td>
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<td>EC728 DESIGN AND TESTING FOR DISTRIBUTED SOFTWARE: INTENSIVE SYSTEMS</td>
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<td>EC730 INFORMATION-THEORETICAL DESIGN OF ALGORITHMS</td>
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<td>EC733 DISCRETE EVENT AND HYBRID SYSTEMS</td>
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<td>EC751 DESIGN OF ASYNCHRONOUS CIRCUIT AND SYSTEMS</td>
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<td>EC764 OPTICAL MEASUREMENT</td>
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<td>EC770 GUIDED-WAVE OPTOELECTRONICS</td>
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<td>EK 500 PROBABILITY WITH STATISTICAL APPLICATIONS</td>
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<tr>
<td>EK501 MATHEMATICAL METHODS I</td>
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<td>Kotiuga</td>
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</table>

Tsuhan Chen, Director, School of Electrical and Computer Engineering, Cornell University, speaking with BU ECE grad students.
Instructional Laboratories

**IMSIP Instructional Laboratory**  
**Faculty:** Karl, Konrad, Nawab, Oliver  
This laboratory serves the graduate instructional needs of the Department in the areas of multidimensional signal processing (including image and video processing), statistical signal processing, pattern recognition, and earth and space sciences. The laboratory provides advanced computational resources and associated software packages. Fast, dual-processor workstations connected through a gigabit network form a computational backbone, while high-capacity printers serve the hardcopy needs. State-of-the-art processing and optimization software is available. This laboratory was developed with funds from the National Science Foundation, and is currently being upgraded with departmental funds.

**Photonics Laboratory**  
**Faculty:** Bigio, Morse, Paiella, Ruane, Teich, Ünlü  
This lab supports introductory and intermediate level courses in the MS in Photonics program. Four stations have vibration isolated optical tables, HeNe and semiconductor lasers, fiber components and systems, electronic test equipment, and GPIB-connected PCs for LabVIEW data logging and instrument control. Shared equipment exists for experiments and demonstrations in interferometry, spectrometry, diffraction, holography, acoustic and electro-optic modulation, and optical spectrum analysis. A secure annex room houses two additional isolated tables, electronics, and optical equipment to support thesis and senior design projects that require long-term setup of apparatus.

**RF Measurements Lab**  
**Faculty:** Knepper  
The RF Measurements Lab provides an opportunity to train students in advanced radio frequency experimental techniques. The lab contains up-to-date high frequency equipment for testing RF printed circuit boards, MMICs, and other high frequency components in the frequency range 100 MHz to 26 GHz. The lab is used for both undergraduate and graduate instruction for courses SC580 and SC582, as well as for research in coupled electrical substrate noise effects in RF/mixed-signal IC technology. Included in the RF Measurements Lab are recent Agilent high frequency tools: a 26 GHz vector network analyzer, 26 GHz spectrum analyzer, high frequency oscilloscope, and RF signal generator. Students use the equipment to learn the basics of S-parameter measurements, as well as characterization of RF mixers, VCOs, amplifiers, and other components.
Colloquia & Seminars

The Colloquium and Seminar series continued for another successful year. This year we also introduced a high-profile Distinguished Lecture Series (noted in **bold**). Prominent speakers from inside and outside the University delivered engaging research talks on current issues to graduate students, faculty, and other students and guests from the greater Boston area.

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker</th>
<th>Title</th>
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<tbody>
<tr>
<td>9/9/2009</td>
<td>Prakash Ishwar Electrical &amp; Computer Engineering Boston University</td>
<td>An Information Processing Tour of Sensor Networks</td>
</tr>
<tr>
<td>9/10/2009</td>
<td>Anna Swan Electrical &amp; Computer Engineering Boston University</td>
<td>Carbon: World’s oldest and newest material</td>
</tr>
<tr>
<td>9/15/2009</td>
<td>Alberto Sangiovanni Vincentelli Electrical Engineering University of California at Berkeley</td>
<td>Collaboration for Innovation in Electronic System Design</td>
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<tr>
<td>9/16/2009</td>
<td>Charles A. Bouman Electrical and Computer Engineering Purdue University</td>
<td>Model Based Imaging: In Search of the Free Lunch1</td>
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<tr>
<td>10/13/2009</td>
<td>Andrei Khrennikov Applied Mathematics University of Vaxjo, Sweden</td>
<td>Can Fluctuations of Classical Random Field Produce Quantum Correlation?</td>
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<tr>
<td>10/14/2009</td>
<td>Michael Goldstein Senior Principal Physicist Intel Corporation</td>
<td>Nanolithography: Optics and Adjacent Research Opportunities</td>
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<tr>
<td>10/21/2009</td>
<td>Farzad Kamalabadi Electrical and Computer Engineering University of Illinois at Urbana-Champaign</td>
<td>Spatiotemporal Image Reconstruction: A Computationally Efficient State Space Approach</td>
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<td>11/6/2009</td>
<td>Gennady Shvets Physics University of Texas at Austin</td>
<td>Negative Index Metamaterials and Their Applications to Subdiffraction Imaging and Infrared Light Harvesting</td>
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<tr>
<td>11/30/2009</td>
<td>Samarjit Chakraborty Institute for Real-Time Computer Systems TU Munich, Germany</td>
<td>Multimedia Power Management on a Platter: From Audio, to Video and Games</td>
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<tr>
<td>12/1/2009</td>
<td>Stefan Maier Centre for Plasmonics &amp; Metamaterials Imperial College London</td>
<td>New Concepts in Nanoplasmonics &amp; Plasmonic Metamaterials</td>
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<tr>
<td>2/1/2010</td>
<td>Douglas Densmore Synthetic Biology Engineering Research Center UC Berkeley</td>
<td>Platform-Based Design: From Cruise Control to Cancer Killer</td>
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<tr>
<td>2/3/2010</td>
<td>Alex Sherman Computer Science Columbia University</td>
<td>Improving Performance in P2P File-Sharing and Streaming Systems Through Fairness</td>
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<td>2/17/2010</td>
<td>Walter R. Buchwald Air Force Research Laboratory Hanscom AFB</td>
<td>Active and Passive Plasmonic Components for Advanced Sensing and Photonic Applications</td>
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<tr>
<td>Date</td>
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<td>2/24/2010</td>
<td>Susie Wee, Chief Technology Officer HP</td>
<td>Experiences, Devices, Services, and the Cloud</td>
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<td>2/26/2010</td>
<td>Junshan Zhang, School of ECEE, Arizona State University</td>
<td>Fundamental Tradeoffs between Probing and Channel-Aware Scheduling in Future Wireless Networks</td>
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<td>3/4/2010</td>
<td>Ivan Celanovic, Institute for Soldier Nanotechnologies, Massachusetts Institute of Technology</td>
<td>Towards efficient solid state energy conversion</td>
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<tr>
<td>3/15/2010</td>
<td>Sam Hasinoff, Computer Science and Artificial Intelligence Laboratory, Massachusetts Institute of Technology</td>
<td>Rich Photography on a Budget</td>
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<td>3/19/2010</td>
<td>Lorenzo Pavesi, Nanoscience Laboratory, Department of Physics, University of Trento, Italy</td>
<td>Nanosilicon Photonics</td>
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<td>3/22/2010</td>
<td>Xiaotong Zhuang, T.J. Watson Research Center, IBM</td>
<td>Code Optimizations in the Heterogeneous Multicore Era</td>
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<td>3/23/2010</td>
<td>Vinod Prabhakaran, Coordinated Science Laboratory, University of Illinois at Urbana-Champaign</td>
<td>Information Theory in the Crowd: Interference and Privacy</td>
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<td>3/24/2010</td>
<td>Tsuhan Chen, School of Electrical and Computer Engineering, Cornell University</td>
<td>Beyond Face Recognition: Understanding Images of People Using Social Context</td>
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<tr>
<td>3/25/2010</td>
<td>Bobak Nazer, Electrical and Computer Engineering, University of Wisconsin, Madison</td>
<td>Harnessing Interference for Reliable Computation and Communication</td>
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<tr>
<td>3/26/2010</td>
<td>Damian Schimpf, Institute of Applied Physics, Friedrich Schiller University of Jena, Germany</td>
<td>Recent developments in femtosecond fiber lasers: Opening up new directions in science and technology</td>
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<tr>
<td>4/1/2010</td>
<td>Paolo Minero, Electrical and Computer Engineering, University of California at San Diego</td>
<td>Large wireless networks: fundamental limits and design issues</td>
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<tr>
<td>4/5/2010</td>
<td>Andreas Savvides, Electrical Engineering, Yale University</td>
<td>Estimating Consumption Breakdowns through Binary Sensing of ON/OFF States</td>
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<tr>
<td>4/7/2010</td>
<td>Venu Veeravalli, Electrical and Computer Engineering, University of Illinois at Urbana-Champaign</td>
<td>Understanding and Managing Interference in Wireless Networks</td>
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<td>4/8/2010</td>
<td>Sewoong Oh, Electrical Engineering, Stanford University</td>
<td>Matrix completion: Learning matrices from incomplete data</td>
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<tr>
<td>Date</td>
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<td>4/15/2010</td>
<td>David Choffnes &lt;br&gt; Electrical Engineering and Computer Science &lt;br&gt; Northwestern University</td>
<td>Crowdsourcing Network Event Monitoring</td>
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<tr>
<td>4/21/2010</td>
<td>Douglas Stone &lt;br&gt; Applied Physics &lt;br&gt; Yale University</td>
<td>What is a Laser Anyway? Do We Really Understand Them After Fifty Years of Trying?</td>
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<tr>
<td>4/26/2010</td>
<td>Lee E. Goldstein &lt;br&gt; Biomedical Engineering and School of Medicine &lt;br&gt; Boston University</td>
<td>Laser-Based Molecular Diagnostic Technology for Early Detection of Alzheimer’s Disease</td>
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<tr>
<td>4/28/2010</td>
<td>John P. Kaufhold &lt;br&gt; Technology and Advanced Systems Business &lt;br&gt; SAIC</td>
<td>Automated neuroanatomical microvessel segmentation, vectorization, nuclei labeling, and geometric computations with 3D two photon laser scanning microscopy</td>
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<tr>
<td>5/5/2010</td>
<td>Luca Dal Negro &lt;br&gt; Electrical &amp; Computer Engineering &lt;br&gt; Boston University</td>
<td>Engineering Aperiodic Order In Nanophotonics Past Present and Future Opportunities</td>
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<tr>
<td>5/18/2010</td>
<td>David Atienza &lt;br&gt; Embedded Systems Laboratory &lt;br&gt; EPFL, Switzerland</td>
<td>Thermal Modeling and Active Cooling Management for 3D MPSoCs</td>
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<tr>
<td>5/19/2010</td>
<td>Leon Chua &lt;br&gt; Electrical Engineering &lt;br&gt; UC Berkeley</td>
<td>Memristor: Past, Present, and Future†</td>
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<td>5/20/2010</td>
<td>Markus A. Schmidt &lt;br&gt; Max Planck Institute &lt;br&gt; University Erlangen-Nuremberg, Germany</td>
<td>From Plasmonics to Supercontinuum Generation – Nanoscale Devices Based on Hybrid Photonic Crystal Fibers</td>
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</table>

†ECE Colloquium Series
Research

ECE is a multidisciplinary department with a strong systems perspective. There are three overlapping areas of research and instruction: Electro-Physics, which includes photonics, solid state materials and devices, and electromagnetics and space physics; Information Systems and Sciences, which includes signal and image processing, control and communication systems, and networks; and Computer Systems Engineering, which includes hardware, software applications, and computer networks.

External Research Funding

Research funding has grown significantly in the last decade. Total annual new research funding in the last five years averaged to approximately $9.1M, compared to $7.3M in the 2001-2005 period, and $5.3M in 1996-2000.

The following tables delineate the new and continuing grants awarded over the 2009 fiscal year. The funding level for new grants, where an ECE faculty member is the Principal Investigator (PI) is approximately $9.7M. ECE faculty members were also Co-PIs on grants with PIs from other departments, as noted in the table. Their share of the funding for new grants awarded is approximately $2.6M. The total of new grants is therefore approximately $12.3M.

History of External Research Funding (millions of dollars)
# New Grants with ECE Principal Investigators

<table>
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<tr>
<th>Recipient</th>
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<tr>
<td>Altug, Hatice</td>
<td>CAREER: Nano-Plasmonic Resonances for Bio-Detection Systems (In Conjunction with the Center for Nanoscience and Nanobiotechnology)</td>
<td>NSF</td>
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<td>High-Performance NanoPlasmonic Sensors for Biological Warfare Detection</td>
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<td>Development of Multiplexed, Ultra-Sensitive, Label-Free and Rapid Biosensing Technologies for Proteomics and Virus Detection Applications</td>
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<td>Bellotti, Enrico</td>
<td>Photon-Trap Structures for Quantum Advanced Detectors (PT-SQUAD) (In Conjunction with Photonics Center)</td>
<td>DoD/DARPA/BAE Systems</td>
<td>8/18/09</td>
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<td>Real-Time Optimization in Complex Stochastic Environment (In Conjunction with the Center for Information and Systems Engineering)</td>
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<td>Castañón, David</td>
<td>MANERVA: Mission Assessment of Non-Manned Entities for Rating the Validation of Autonomy</td>
<td>DoD/Army/Charles River Analytics</td>
<td>5/10/10</td>
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<td>Castañón, David</td>
<td>ALERT: Awareness and Location of Explosive-Related Threats (In Conjunction with the Center for Information and Systems Engineering) ($314,518)</td>
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<td>MURI: Fusion and Sensor Management for Automatic Target Exploitation ($249,999)</td>
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<td>Deterministic Aperiodic Structures for On-Chip Nanophotonics and Nanophotonic Device Applications</td>
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<td>DURO - 1.54 mm Optical Gain in Si and Ge-Based Structures for Optical Amplification and Electrically Pumped Lasers</td>
<td>DoD/AFOSR</td>
<td>6/1/10</td>
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<td>Silk Based Optical Food Sensors ($100,000)</td>
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<td>Dal Negro, Luca</td>
<td>CAREER: Combined Light and Carrier Localization in High-Refractive Index Silicon Nanocrystal Structures - A Novel Approach for Si-based Lasers (In Conjunction with the Center for Nanoscience and Nanobiotechnology)</td>
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<td>Aperiodic Photonic-Plasmonic Structures with Broadband Field Enhancement for Optical Limiting Applications</td>
<td>DoD/Army/Batelle</td>
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<td>MURI: Electrically-Pumped, Silicon- Based Lasers for Chip-Scale Nanophotonic Systems (In Conjunction with the Center for Information and Systems Engineering)</td>
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<td>FPGA-Based High-Performance Computing</td>
<td>PHS/NIH/NCRR</td>
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<td>Horenstein, Mark</td>
<td>Compact Low-Power Driver for Deformable Mirror Systems</td>
<td>NASA/Boston Micromachines Corp.</td>
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<td>7/28/10</td>
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<td>Ishwar, Prakash</td>
<td>CAREER: Information-Scaling Laws, “Bit-Conservation” Principles, and Robust Coding Architectures in Sensor Networks (In Conjunction with the Center for Information and Systems Engineering)</td>
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<td>A Biomedical Imaging Acceleration Testbed (In Conjunction with the Center for Information and Systems Engineering)</td>
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<td>Lee, Min-Chang</td>
<td>Investigation of Ionospheric Turbulence and Whistler Wave Interactions with Space Plasmas</td>
<td>DoD/Air Force</td>
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<td>Little, Thomas Altug, Hatice Carruthers, Jeffrey Ünlü, M. Selim</td>
<td>NSF Engineering Research Center for Smart Lighting - Administration ($495,092)</td>
<td>NSF/Rensselaer Polytechnic Institute</td>
<td>9/1/08</td>
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<td>Little, Thomas Ishwar, Prakash Konrad, Janusz</td>
<td>NeTS-NOSS: Localized Computation and Network Path Formation to Enable Pervasive Video Sensing (REU Supplement) (In Conjunction with Center for Information and Systems Engineering) ($16,000)</td>
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<td>Mazumder, Malay</td>
<td>Electrostatic Dry Powder Inhaler for Constant Dose Respiratory Drug Delivery</td>
<td>DoD/Army/WH</td>
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<td>Mazumder, Malay</td>
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<td>Morse, Theodore</td>
<td>Double Clad Fiber with Single Mode Core</td>
<td>PHS/NIH/NCI / MGH</td>
<td>12/1/09</td>
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<td>Morse, Theodore</td>
<td>Higher Order Mode (HOM) Fibers for Blue Laser Application</td>
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<td>A New Approach to High-Power, Eye-Safe, Laser Technology Applications</td>
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<td>Moustakas, Theodore</td>
<td>Development of an Electron Beam Injected Laser Structure at 235nm Based on AlGaNPIN Multiple Quantum Wells on SiC Substrates (In Conjunction with the Photonics Center)</td>
<td>NASA/Photon Systems, Inc.</td>
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<td>Oliver, William</td>
<td>CEDAR: Comprehensive Use of Incoherent Scatter Radar Data to Study the Equatorial Midnight Plasma and Neutral Temperature Maxima (MTM) (In Conjunction with the Center for Space Physics) ($104,500)</td>
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<td>Martinez, Carlos</td>
<td>Plasmonic Nanostructures Integrated with Semiconductor Light Emitting Materials for Enhanced Efficiency and Functionality</td>
<td>DOE</td>
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<td>Paiella, Roberto</td>
<td>Collaborative Research: Quantum-Cascade-Laser Active Materials Based on Silicon-Germanium Nanomembranes</td>
<td>NSF</td>
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<td>Paschalidis, Ioannis</td>
<td>Refinement Methods for Protein Docking Based on Exploring Multi-Dimensional Energy Funnels (In Conjunction with the Center for Information and Systems Engineering) ($309,416)</td>
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<td>Distributed Wireless Sensor Networks for Long-Term Deployments (In Conjunction with the Center for Information and Systems Engineering) ($360,000)</td>
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<td>Statistical Techniques for Detecting Internet Traffic Anomalies (In Conjunction with the Center for Information and Systems Engineering)</td>
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<td>Rendezvous Finite State Machine: Where TLM Meets RTL</td>
<td>Semiconductor Research Corp.</td>
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<td>REU Site: Research Experience for Undergraduates in Photonics ($12,681)</td>
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<td>CPS-Medium: Collaborative Research: The Foundations of Implicit and Explicit Communication in Cyberphysical Systems</td>
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<td>Investigation of Phase Coherence in Elemental Auroral Structure (In Conjunction with the Center for Space Physics)</td>
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<td>MR-R2I: Development of Next-Generation Imaging Spectrometer Based on a Tunable Liquid Crystal Filter (In Conjunction with the Center for Space Physics) ($775,000)</td>
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<td>Faust: Finite-Field Algebra for Unbeatable Situational-Awareness in Tactical-Networks ($6,000)</td>
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<td>Ünlü, M. Selim</td>
<td>Floating Light-Activated Micro-Electrical Stimulators for Neural Prosthetics</td>
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## New Grants with ECE co-PIs

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<td>Altuğ, Hatice</td>
<td>RESONANT Optical Virus Reader (ROVR) Phase II ($350,000)</td>
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<td>Brower, Richard</td>
<td>Collaborative Research: National Computational Infrastructure for Lattice Gauge Theory ($198,000)</td>
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<td>Belia, Calin</td>
<td>MURI - Smart Adaptive Reliable Teams for Persistent Surveillance ($290,000)</td>
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<td>Bailieul, John</td>
<td>Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (MURI-07) ($727,744)</td>
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<td>Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (MURI-07) ($814,562)</td>
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<td>Dal Negro, Luca</td>
<td>Chemically Enhanced Photonic - Plasmonic Crystals for Explosive Vapor Detection Phase II ($260,000)</td>
<td>ARL</td>
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<td>Rationally Designed Plasmonic Nanostructures for Rapid Bacteria Detection and Identification ($180,700)</td>
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<td>Holmes, Raquelle</td>
<td>Collaborative Research: BPC-AE Strengthening and Expanding the Empowering Leadership Alliance</td>
<td>NSF</td>
<td>2/1/10</td>
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**Subtotal Grants With ECE PIs**: $9,718,436
## Continuing Grants

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<td>Bellotti, Enrico</td>
<td>Theoretical Investigation Of Optoelectronic Devices Based On The ZNO Material System</td>
<td>NSF</td>
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<td>Bellotti, Enrico</td>
<td>CAREER: Theoretical Investigation Of Single Photon Detection For Quantum Technology: A Nano-Structure Devices Approach ($400,000)</td>
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<td>Castañón, David</td>
<td>Distributed Mission Control For Unmanned Air Vehicles In Stochastic Environments ($461,717)</td>
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<td>EFRI-ARESCI: Event-Driven Sensing For Enterprise Reconfigurability And Optimization ($1,980,349.04)</td>
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<td>Dal Negro, Luca</td>
<td>Nanoarray-Assisted Wavelength Shifting Films For Solar Applications</td>
<td>Lightwave Power, Inc.</td>
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<td>Herboldt, Martin</td>
<td>FPGA-Based High Performance Computing</td>
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<td>Ishwar, Prakash</td>
<td>CIF: Small: Collaborative Research: Towards A Paradigm Shift In Distributed Information Processing: Harnessing Group-Structure</td>
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Subtotal Grants With ECE co-PIs: $2,573,053

**Grand Total**: $12,291,489
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<td>Little, Thomas</td>
<td>NETS-NOSS: Localized Computation And Network Path Formation To Enable Pervasive Video Sensing ($450,000)</td>
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<td>Conrad, Janusz</td>
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<td>Morse, Theodore</td>
<td>Miniature Laser Therapy Endoscope</td>
<td>PHS/NIH/NIBIB</td>
<td>8/1/07</td>
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<td>Moustakas, Theodore</td>
<td>Ultraviolet Electroabsorption Modular Based On III-Nitride Quantum Wells ($294,337)</td>
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<td>Paiella, Roberto</td>
<td>GAN-Based Quantum-Structure Devices For THz Light Emission And Photodetection ($399,967)</td>
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<td>Paiella, Roberto</td>
<td>Intersubband All-Optical Switching And Optically-Pumped Light Emission With III-Nitride Quantum Wells ($270,000)</td>
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<td>Semeter, Joshua</td>
<td>Phase Coherence In Elemental Auroral Structure</td>
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<td>Starobinski, David</td>
<td>WN: Collaborative Research: Management Of Secondary Markets In Deregulated Wireless Network ($200,000)</td>
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<td>Self-Forming Extensible Lunar Extravehicular Activity Network (SELENE)</td>
<td>NASA/Scientific Systems, Inc.</td>
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<td>Trachtenberg, Ari</td>
<td>CIF: Small: Large-Scale Software Dissemination In Stochastic Wireless Networks ($456,731)</td>
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<td>Swan, Anna</td>
<td>Vibrational And Electronic Aspects Of Carbon Nanotubes And Their Interactions</td>
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<td>Swan, Anna</td>
<td>REU Supplement: Vibrational And Electronic Aspects Of Carbon Nanotubes And Their Interactions</td>
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<td>Trachtenberg, Ari</td>
<td>A Theory Of Monitoring Based On Identifying Codes And Their Variants ($280,000)</td>
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<td>Ünlü, M. Selim</td>
<td>High Speed Diagnostic Of Temperature And Intensity Variation Of Diode-Laser Facets</td>
<td>Science Research Laboratory, Inc.</td>
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<td>IRES: US-Turkey-Switzerland Collaboration On Resonant Structures For Biosensing And Imaging ($15,120)</td>
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<td>IRES: US-Turkey-Switzerland Collaboration On Resonant Structures For Biosensing And Imaging, Participant Support ($134,880)</td>
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<td>Ramachandran, Siddharth</td>
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Faculty Publications

Books


Book Chapters


T. Toffoli, “Probability is a lot of logic at once (or, if you don’t know which one to pick, take ’em all),” in Randomness through Computation, H. Zenil (editor), World Scientific, Spring 2010.


Journal Articles


Y. Rykalova, **L. Levitin**, and R. Brower, “Critical phenomena in


Conference Papers


A. Joshi, C. Batten, Y. Kwon, S. Beamer, I. Shamim, K. Asanovic, and V. Stojanovic, “Designing Manycore Processor Networks us-
ing Silicon Photonics,” *Proceedings of the IEEE/Photonics Society Annual Meeting*, October 2009.


M. C. Lee, “Controlled study of ionospheric plasma turbulence in radio-wave injection experiments,” Turbulent Mixing and Beyond International Conference and Advanced School, July-August 2009.


T. Moustakas and A. Bhattacharyya, “AlGaN Quantum Wells emitting below 250 nm with Internal Quantum Efficiency as high as 50%,” North America Molecular Beam Epitaxy meeting, August 2009.


Mark Harrah and A. SWAN, “Monte Carlo dynamic study of ex-


F. H. Koklu and M. S. ÜNLÜ, “Focusing Anomalies in the Vicin-


Invited Lectures


I. BIGIO, “Scattering spectroscopy monitors cellular and tissue changes before they can be seen microscopically,” April 2010.


R. BROWER, “Technicolor and the QCD String, Numerical approaches to AdS/CFT, large N and gravity,” Imperial College, September-October 2009.


F. CERRINA, “Patterning at the Nanoscale: From Silicon to DNA,” Distinguished Lecture at Colorado State University’s ISTeC (Information Science & Technology Center), October 2009.


A. COSKUN, “Efficient Thermal Management for Multiprocessors and 3D Stacked Architectures,” Sabanci University, Faculty of Engineering and Natural Sciences, December 2009.


M. Karpovsky, “Design of cryptographic devices resistant to side-channel attacks,” Tel-Aviv University.


M. Karpovsky, “New Error Detecting Codes for design of reliable and secure cryptographic devices,” ECNST.


M. C. Lee, “Turbulent Mixing and Beyond, Second International Conference and Advanced School,” The Abdus Salam International Centre for Theoretical Physics, July-August 2009.


T. Little, “LED Lighting for Ubiquitous Communications,” Solid-State Lighting (R-SSL) and Materials Science Central Research and Service Laboratory (CRSL), Osram Sylvania, November 2009.


M. Teich, “Multi-Photon and Entangled-Photon Imaging and Li-


**Patents and Patent Disclosures**


S. Ramachandran, “Production of optical pulses at a desired wavelength utilizing higher-order-mode (HOM) fiber,” U. S. patent no. 20100054661, March 2010.


Prof. Michael Ruane discusses research results at a MS symposium.
Research Areas and Laboratories

The ECE Department has three overlapping areas of research:

- **Electrophysics**: photonics, solid state materials and devices, and electromagnetics and space physics;
- **Information Systems & Sciences**: signal and image processing, and control and communication systems;
- **Computer Systems Engineering**: hardware, software applications, and computer and communication networks.

**Applied Electromagnetics**

**Horenstein, Mazumder**

This laboratory is devoted to problems in experimental electromagnetics with a primary focus on medical and industrial electrostatics, micro-electromechanical systems (MEMS), and sensors. Current projects include transdermal injection of medicinal nanoparticles via pulsed electric fields, development of a passive laser communication node using a MEMS retro-reflective mirror, the design of a “smart-joint” variable-stiffness endoscope, the use of an electrodynamic screen to remove dust particles from solar electric installations, and the development of a new type of electrostatic-based, dry power inhaler.

**Biological Sensing and Imaging**

**Ruane, Ünlü**

The Biological Sensing and Imaging Laboratory develops optical, electrical, and computational methods to study biological problems. Researchers develop sensing and imaging devices that emphasize label-free, high throughput data collection on extremely small quantities of biomaterials. Applications include disease and biohazard detection, drug discovery, and equipment development. Projects include the Resonant Cavity Imaging Biosensor which applies hyperspectral IR imaging of transmissive and reflective resonant optical cavities for DNA and protein measurements; the Fabricator—a mask-free optical synthesizer for bio-arrays (the “Fabricator” project) used in RCIB and other biochip systems, and self-interference microscopy. The group is interdisciplinary, with engineers, physicists, chemists, and biologists, and encourages undergraduate researchers.

**Biomedical Optics and Biophotonics**

**Bigio**

The focus of research in the Biomedical Optics and Biophotonics Laboratory is the development of minimally-invasive diagnostics and therapeutics based on optical and photonic technologies. Faculty often collaborate with clinical researchers who test the new technologies on animals or human subjects. With noninvasive optical measurements, there is minimal risk to the patient, but significant medical benefits are possible. Some of the ongoing projects include:

- “Optical biopsy”: development of fiber-optic probes that perform spectroscopic measurements on tissue in vivo and noninvasively to instantly diagnose cancer and other pathologies in specific organ areas.
- “Optical pharmacokinetics”: fiber-optic probes designed to measure drug concentrations in tissue, dramatically reducing the number of animals required for drug studies. This can also be used to determine the optimum type and dosage of novel (light-activated) chemotherapy agents for individual patients.
- Sensors to monitor the response of tumors to specific treatments.
- Optical methods for noninvasive imaging of neuronal activation and brain function.
- Optical methods for identifying different types of infectious agents.

**Broadband Wireless Communications**

**Carruthers**

This laboratory supports research projects on the design, theory, and prototyping of broadband wireless communication systems. The major focus is on the use of light as the transmission medium for high-data rate indoor wireless local-area networks. The laboratory includes facilities for the fabrication and testing of experimental prototypes as well as computing resources for system design and analysis.

**Complex BioSignal Processing**

**Nawab**

Complex Signal Processing is an umbrella term used to describe processes that act upon signals in order to achieve desired objectives. The term is purposely meant to subsume what is traditionally meant by signal processing, signal analysis, signal modeling, signal classification, and signal recognition, but it is also meant to be inclusive of signal interpretation, signal understanding, signal data mining, signal forensics, signal visualization, etc. Complex signal processing research at ECE encompasses the conceptualization, formalization, implementation, and evaluation of signal computing with an emphasis on applied artificial intelligence and biosignal applications.
Computational Electronics
Bellotti
The Computational Electronics group develops software to study semiconductor materials and to perform electronics and optoelectronics device simulation. The group also uses commercial simulation software to simulate for technologically mature semiconductor devices. The laboratory is equipped with state-of-the-art computing and software tools, including two computer clusters, one SGI ALTIX 350 (16 CPUs, 64GB of memory and 1TB disk array) running Red Hat Linux, and an AMD Opteron Cluster (32 CPUs and a 6TB disk array) running Gentoo Linux. The lab also operates high performance PCs and printers.

Computer Architecture and Automated Design
Herbordt, Coskun
Work focuses on experimental computer architecture, particularly on the application of emerging technology to computationally intensive applications. Projects include developing design tools for application specific coprocessors, designing MPP router switches, vision computers, and the application of configurable computing to bioinformatics.

Control of Discrete Event Systems
Cassandras
The Control of Discrete Event Systems (CODES) Laboratory involves faculty and graduate students from the Division of Systems Engineering and operates within the Center for Information and Systems Engineering (CISE). Members of CODES conduct research on modeling, design, analysis, performance evaluation, control, and optimization of a variety of discrete event and hybrid systems including communication and sensor networks, manufacturing, transportation, and command/control. CODES research activities cover a wide spectrum, from basic research to the development of software tools. These activities include:

- Design and real-time control of communication and sensor networks, manufacturing systems, and transportation systems
- Decision support systems for quality-of-service guarantees or optimal performance
- Software testing and verification
- Strategic planning: getting information to decision makers fast and in a comprehensive form
- Developing a new generation of concurrent and parallel simulation tools
- New methods for cooperative control of wirelessly networked devices
- Autonomously reconfigurable systems

Embedded and Cyberphysical Systems
Coskun, Little
Research in embedded and cyberphysical systems covers low power design, energy and thermal management, performance analysis and improvement methods, real time operating systems, vehicular automation, and wireless sensor networks topics such as wireless healthcare, safety, and environmental monitoring applications.

Functorial Electromagnetic Analysis
Kotiuga
The Functorial Electromagnetic Analysis laboratory considers the difficulties encountered in the finite element analysis of three-dimensional electromagnetic fields that cannot be anticipated through experience with two-dimensional simulations. The lab has focused its efforts in the development of Whitney form techniques, homology calculations, algorithms for total magnetic scalar potentials in multiply-connected regions, helicity functional techniques, and data structures based on semi-simplicial objects. Torsion invariants of complexes and rational homotopy theory are currently being exploited in the context of direct and inverse three-dimensional problems such as impedance tomography and magnetic field synthesis.

Imaging Science
Mendillo, Semeter
Affiliated with the Boston University Center for Space Physics, the ISL applies state-of-the-art optical imaging technology to the study of the earth, moon, planets, and comets. Activities include equipment design and fabrication, field campaigns to observe sites worldwide, and digital signal processing.

Integrated Circuits and Systems Lab
Joshi
Our research focuses on various aspects (power, performance, area, and reliability) of designing modern-day VLSI systems. We adopt a level-transparent approach, where we jointly optimize across the various levels in the design hierarchy. In particular, at the device level our group is exploring novel carbon-based and plasmonics-based devices. At the circuit level, we are investigating both digital and analog circuit design techniques, while at the system level we are focused on developing many-core system architectures.

Integrated Nanophotonics and Biosensing Systems
Altug
The capability to confine and manipulate photons at nanometer-
length scales can open up unprecedented opportunities in both the fields of classical and quantum information processing, as well as in fundamental life sciences. The Integrated Nanophotonics and Biosensing group is developing nanophotonic devices for optical communications and on-chip biosensing. For communication applications, researchers are developing ultrafast lasers, ultra-efficient light emitting diodes and photonic crystal devices that can slow down light. For biotechnology applications, plasmonic nanostructures and photonic crystal cavities are being used for realization of high-throughput, ultra sensitive, and label free biosensors. To accomplish the group’s goals, new computational modeling and advanced nanofabrication techniques are being developed, including nano/bio-patterning and microfluidics. Its biosafety level-2 lab is capable of cell culturing and includes a modified AFM for surface functionalization. The lab also houses state-of-the-art optical measurement equipment and computational clusters.

**Lightwave Technology**

**Morse**

One of the few university laboratories capable of designing, fabricating, and characterizing silica optical fibers, Lightwave Technology research focuses on developing new processing techniques for optical fibers, high-power optical fiber lasers, and a variety of optical fiber sensors. Researchers are developing a new technique for combining multimode pump radiation into double clad fibers. The facility consists of a fabrication laboratory with three glass lathes including a Nextrom MCVD system, an optical laboratory with numerous pump lasers for fiber lasers, five isolation tables, and an 8m optical fiber draw tower, outfitted with Nextrom widening and control equipment. In addition, there is a CVD laboratory for studies of thin films.

**Multi-Dimensional Signal Processing**

**Karl**

The MDSP lab conducts research in the areas of multidimensional and multiresolution signal and image processing and estimation, and geometric-based estimation. The applications that motivate this research include, but are not limited to, problems arising in automatic target detection and recognition, geophysical inverse problems (such as finding oil and analyzing the atmosphere), and medical estimation problems (such as tomography and MRI). The general goal is to develop efficient methods for the extraction of information from diverse data sources in the presence of uncertainty. The lab’s approach is based on the development of statistical models for both observations, prior knowledge, and the subsequent use of these models for optimal or near-optimal processing.

**Multi-Dimensional Signal Processing**

**Multimedia Communications**

**Little**

The Multimedia Communications Laboratory (MCL) focuses on topics in ubiquitous distributed computing. Current research includes the investigation and development of low-power wireless video camera networks, applications in ecological monitoring using remote cameras, the exploitation of mobility in vehicular networks, visual light communications—communications using LED lighting as the network substrate, and body area networking using multi-tier networking components.

**Nano-DNA**

**Cerrina**

DNA is the molecule that encodes the “blueprint” of living organisms. Research in the Nano-DNA laboratory looks at the creation of synthetic DNA by using a combination of techniques from the semiconductor industry, chemistry, and biology. Thus, the work is highly interdisciplinary. Broadly speaking, researchers work in both Nanotechnology and Synthetic Biology. The DNA synthesized can be used to replace natural DNA entirely or in bits and pieces, to create altogether new biological functions and also to create novel nanostructures, where DNA can be used as “smart” construction material. Nanotechnology is based on the ability to fabricate smaller and smaller devices and structures, and the lab studies methods and techniques to push patterning (lithography) to the true nanometer region. For this, beams of electrons or X-rays are used, and the group collaborates closely with the semiconductor industry. Both experimental work (especially in the DNA area) and theoretical studies (in lithography) are conducted.

**Nano-spectroscopy**

**Swan**

Research in the Nano-spectroscopy Lab uses both elastic and inelastic light scattering to probe properties of nanoparticles, with the largest research effort focused on individual carbon nanotubes. Optical techniques include resonant Rayleigh scattering, interference techniques, resonant Raman scattering, and photo luminescence.

**Nanostructured Fibers and Nonlinear Optics**

**Ramachandran**

Light beams in free space travel at the “speed of light,” and tend to diverge (diffract). Complex, nano-structured fibers and waveguides can be used to slow light (confining photons in time) and counteract diffraction (by confining photons in space). Some confinement geometries lead to spatially complex beams that possess intriguing properties such as the ability of optical vor-
Optical Characterization and Nanophotonics
Goldberg, Ünlü, Swan
Nanophotonics addresses a broad spectrum of optics on the nanometer scale covering technology and basic science. Compared to the behavior of isolated molecules or bulk materials, the behavior of nanostructures exhibit important physical properties not necessarily predictable from observations of either individual constituents or large ensembles. Researchers in this lab develop and apply advanced optical characterization techniques to the study of solid-state and biological phenomena at the nanoscale. Current projects include development of high-resolution subsurface imaging techniques based on numerical aperture increasing lens (NAIL) for the study of semiconductor devices and circuits and spectroscopy of quantum dots; micro resonant Raman and emission spectroscopy of individual carbon nanotubes; biosensors based on microring resonators; and development of new nanoscale microscopy techniques utilizing interference of excitation as well as emission from fluorescent molecules. In addition to microscopy, optical resonance is nearly ubiquitous in the research projects including development of resonant cavity enhanced photodetectors and imaging biosensors for DNA and protein arrays.

Research and development projects at QCM Laboratory concentrate on:
» Quantum optical device engineering using parametric amplification in specially designed periodically polled nonlinear structures, entanglement manipulation and processing on a chip, micro- and nano-photonics, and ultra-fast quantum optics
» High-performance single-photon detection and correlation measurement in a wide spectral range from ultraviolet to mid-infrared and terahertz
Research studies in the Quantum Photonics Laboratory (QPL) focus on photonic systems that rely on the quantum properties of light. Experiments are carried out on single-photon detection; the photon-counting statistics of various sources of light; and the response of the human visual system to small numbers of quanta incident at the retina. Investigations are conducted on multi-photon and entangled-photon absorption, photoemission, microscopy, and lithography; as well as on nonlinear optical processes such as parametric down-conversion and second-harmonic generation. Research is carried out on quantum-imaging paradigms such as quantum optical coherence tomography (QOCT); photon-counting optical coherence tomography (PCOCT); and digital quantum imaging based on entangled-photonic qubits in spatial-parity space.

Radio Communications and Plasma

Research studies in the Quantum Photonics Laboratory (QPL) focus on photonic systems that rely on the quantum properties of light. Experiments are carried out on single-photon detection; the photon-counting statistics of various sources of light; and the response of the human visual system to small numbers of quanta incident at the retina. Investigations are conducted on multi-photon and entangled-photon absorption, photoemission, microscopy, and lithography; as well as on nonlinear optical processes such as parametric down-conversion and second-harmonic generation. Research is carried out on quantum-imaging paradigms such as quantum optical coherence tomography (QOCT); photon-counting optical coherence tomography (PCOCT); and digital quantum imaging based on entangled-photonic qubits in spatial-parity space.

Sensor Networks

Sensor networks are formed by a typically large number of small battery-powered nodes that can sense their respective environments, process information, communicate (mostly wirelessly), and on occasion move in their physical environment. Sensor networks give rise to a rapidly expanding array of applications from building/industrial automation, environmental, agricultural, and wildlife monitoring, monitoring of critical infrastructure, and health monitoring. Research spans fundamental problems in the design, optimization, and control of these networks such as energy-aware routing, power management, multi-access control, and optimal coverage. Specific applications and protocols are also investigated including node localization, formation detection, and anomaly detection.

Testing, Reliable, and Secure Computing

Members of the Reliable Computing Laboratory conduct research on a broad variety of topics, including the design of computer chips; efficient hardware testing at the chip, board, and system levels; functional software testing; efficient signal processing algorithms; coding and decoding; fault-tolerant message routing for multiprocessor systems; and the design of reliable

Quantum Photonics

Teich

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Radio Communications and Plasma

Lee, Semeter, Knepper

Field experiments are conducted in this lab using ground-based facilities and spacecraft-borne instruments to investigate radio-wave propagation and interactions with ionospheric plasmas, with applications to establishing artificial radio communication paths. Laboratory experiments with a large, toroidal plasma device are also conducted to study the microwave interactions with magnetoplasmas, simulating and crosschecking the results obtained in the field experiments.

Semiconductor Photonics

Paiella

Semiconductor Photonics research is aimed at the development of novel optoelectronic devices based on artificially-structured material systems, whose properties can be tailored by design to meet specific applications in a way that is not afforded by simply using bulk materials. One important example is that of semiconductor quantum structures, in which nanoscale layers (or wires or dots) of different semiconductor materials are assembled to create an energy landscape in which electrons behave in a markedly quantum-mechanical fashion. By controlling the dimensions and geometry of these structures, one can tune their most basic electronic and optical properties to enable entirely new device concepts—an approach that has become known as bandgap engineering. Heterostructures involving materials with different optical properties (e.g. metals and dielectrics) can also be designed in a similar manner, and used to control the flow of light and its interaction with the underlying matter in novel and often useful ways.

Using this general approach, researchers are investigating several device concepts to address a wide range of applications, literally spanning three orders of magnitude in optical wavelength. These include: light sources tunable by design over a broad portion of the mid- and far-infrared spectrum, including wavelengths currently not accessible with any other semiconductor technology; nonlinear all-optical switching devices for future ultrafast fiber-optic communications; high-efficiency surface-plasmon-enhanced visible LEDs for solid state lighting; and ultraviolet optical modulators based on the quantum confined Stark effect. Research in these areas involves both theoretical and experimental activities, including design and simulations (often based on the proverbial particle-in-a-box problem of quantum mechanics), device fabrication, and electrical and optical characterization.
computer networks. In addition, research is conducted on architectures based on asynchronous circuits for computer security and side-channel attacks resistance.

**Visual Information Processing**

**Konrad**

The VIP Laboratory provides computational and visualization infrastructure for research in the area of next-generation visual information processing. The topics of interest are: retrieval, analysis, compression, and transmission of visual information, whether in the form of still images, video sequences, or 3-D data. Three research thrusts are currently pursued. Videopsy (video autopsy) is concerned with the analysis of streaming video data from networked cameras. Some of its goals are: segmentation and tracking of moving objects, action recognition, detection of abnormal events, and condensation of video into short summaries. The second thrust is concerned with the analysis of biomedical imagery, such as that resulting from colonoscopy exams or image-guided catheter ablation of atrial fibrillation. Issues currently studied are: detection, classification, and visualization. The third thrust focuses on the analysis, compression and visualization of stereoscopic and multiscopeic (3-D) imagery. One application of this research is in the next-generation 3-D multimedia communications and entertainment, while another is in biomedical visualization. The VIP Laboratory is equipped with a network of state-of-the-art workstations to serve computational needs, while its visualization infrastructure includes 2-D and 3-D digital cameras and capture systems, as well as 3-D displays (shuttered and 9-view automultiscopic Synthagram).

**VLSI and Neural Networks Systems**

**Hubbard**

The VNNS group designs, builds, and tests innovative architectures that span a wide variety of VLSI applications in electrical, biomedical, and defense-related fields. Chips designed using digital and analog integrated circuit methodologies are built using CMOS technologies and tested in the lab. The group is equipped with a full suite of design tools and testing instrumentation for analog and digital systems. Applications include neural-net processing, single-chip large-molecule and DNA analyzers, and chips that emulate the functioning of the mammalian peripheral auditory system for the purpose of weapons classification and localization. Recent work has moved in the direction of algorithm development and FPGA implementations for event-based processing of signals from special-purpose hardware, the prototypes of which are originating in the VLSI lab. This hardware is now being advanced by a spun-out, local company started by former students, the second one of which the VNNS

**Wide Band Gap Semiconductors**

**Moustakas**

This laboratory investigates the growth, fabrication, and characterization of devices based on the family of III-Nitride semiconductors. The materials are grown by MBE, MOCVD, HVPE and Gas cluster Ion-beam deposition (GCIB). The current research focus is in the development of optical devices (blue, green, and UV-LEDs, UV-LDs, optical modulators, detectors), electronic devices (high power diodes, transistors, and thyristors) and electromechanical devices (SiC/III-Nitride MEMS sensors). Materials physics issues are also addressed and the group collaborates closely with Professor Enrico Bellotti in the area of theoretical modeling, Professor Karl Ludwig (Physics) in the area of materials structure, Professor Kevin Smith (Physics) in the area of electronic structure, and Professor Roberto Paiella in the area of devices based on intersubband transitions.
Affiliated Research Centers

Center for Computational Science
http://satchmo.bu.edu

The Boston University Center for Computational Science (CCS) was founded in 1990 to coordinate and promote computationally based research, to foster computational science education, and to provide for the expansion of computational resources and support.

CCS provides a forum for the multidisciplinary exchange of ideas among researchers, educators, and students. Regularly scheduled seminars as well as workshops and symposia are offered to highlight advances in computational science. CCS has acted to develop and facilitate the formulation of projects in computationally based research and education, working with scientists from 20 different departments and centers.

CCS works in close collaboration with the Office of Information Technology, in particular with its Scientific Computing and Visualization Group (SCV) group, in the development of resources to support computational science. The high performance computing and visualization systems at Boston University currently include the IBM Blue Gene, IBM pSeries 690, an IBM pSeries 655, an Intel Pentium III Linux Cluster, our Deep Vision Display Wall, the Access Grid Conference Facility, the Laboratory for Virtual Environments, and the Computer Graphics Laboratory.

CCS offers a Certificate in Computational Science to graduate students in engineering and science pursuing a PhD through a multidisciplinary training program, ACES (Advanced Computation in Engineering and Science).

Center for Space Physics
http://www.bu.edu/csp

The Center for Space Physics provides a focus for research and graduate training in space physics. It is a multidisciplinary center within the Graduate School of Arts and Sciences that includes faculty from the College of Engineering and the College of Arts and Sciences. The Center carries out a wide variety of research in many fields of space physics including space plasma physics; magnetospheric physics; ionospheric physics; atmospheric physics; and planetary and cometary atmospheric studies.

The mission of the Center is to promote and foster space physics research and to provide a central base for that research and for the teaching of space physics, especially at the graduate level. The Center seeks to fulfill this mission by creating an intellectual atmosphere conducive to research and to the exchange and exploration of new ideas. The Center organizes a seminar series in space physics as well as internal research discussion groups, and often hosts visits of scholars from the United States and abroad. Although the Center itself offers no degree program, graduate education is a major component of Center activities. Graduate students from programs in Astronomy, Applied Physics, and Engineering conduct their thesis research at the Center. The Center provides a formal link between research groups in the Colleges of Engineering and Arts and Sciences, allowing them to co-locate research students and post-doctoral associates to allow greater interaction to everyone’s benefit. The Center also provides administrative support for research projects, particularly in the areas of grant management and proposal development.

Photonics Center
http://www.bu.edu/photonics

To help industry bridge the gap between basic research and practical application, Boston University launched the Photonics Center in 1994 with $29 million in seed funding from the federal government. The Center is now forging true business partnerships in which companies draw on the University’s exceptional expertise and resources in engineering, science, medicine, and management to build actual product prototypes and spawn a growing stream of new companies.

The Photonics Center at Boston University is a bold new model for university-industry collaboration. It has been established to work directly with investors and industrial partners to turn emerging concepts in photonics technology into commercial products. The Center is staffed and equipped to help industry partners reduce the technical and financial risk involved in developing new ideas, refining them in the laboratory, building working prototypes, and starting up companies. To date the Center has forged joint ventures with a dozen companies to develop new products in data storage, environmental monitoring, optoelectronics, and biotechnology.

In 1997, the University completed the nine-story, 235,000 square-foot Photonics Building to house this ambitious initiative. The $85 million facility includes a full complement of state-of-the-art laboratories as well as meeting rooms, lecture halls, and an entire floor devoted to incubator space for start-up companies that complements its existing incubator at 1106 Commonwealth Avenue. Faculty affiliated with the Center have in-depth expertise in all aspects of photonics technology, including the core areas of opto-electronics, photonic materials, data storage, imaging systems, medical applications, and sensors.
Resources available to industry partners, government officials, faculty, and students through the Photonics Center support development and testing of ideas and products. These resources include several research and development laboratories: Scanning Infrared Near-Field Microscopy Laboratory, Optoelectronic Device Characterization Laboratory, Femtosecond Laser Facility, Photochemical Processes Laboratory, Photonic Systems Engineering Laboratory, Liquid Crystal Display Laboratory, Quantum Imaging Laboratory, Precision Optics Laboratory, Optoelectronic Materials Laboratory, Precision Measurement Laboratory, Optoelectronic Processing Facility, Laser Measurement and Fiber Optic Sensors Laboratory, Magnetic and Optical Devices Laboratory, Near-Field Scanning Optical Microscopy Laboratory, Picosecond Spectroscopy Laboratory, and the Advanced Electronic Materials and Devices Processing Research Laboratory.

Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS)
http://www.censsis.neu.edu

The Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS) is a National Science Foundation (NSF) Engineering Research Center (ERC), one of an elite group of only nineteen ERCs in the nation. It seeks to revolutionize the ability to detect and image objects that lie underground or underwater, or are embedded within cells, inside the human body, or within man-made structures. CenSSIS is a collaborative effort of four academic institutions: Boston University, Northeastern University, Rensselaer Polytechnic Institute, and the University of Puerto Rico at Mayagüez; and four strategic affiliates: Massachusetts General Hospital, Memorial Sloan-Kettering Cancer Center, Lawrence Livermore National Laboratory, and the Woods Hole Oceanographic Institution. Together, the CenSSIS partnership works with industrial partners who provide their insight into research challenges.

The Center’s primary focus is on detecting, locating, and identifying objects obscured beneath a covering media, such as underground plumes, tumors under the skin or developmental defects in an embryo. Utilizing electromagnetic, photonic, or acoustic probes, CenSSIS will engage biomedical and environmental problems, developing techniques for sensing subsurface conditions. Projects integrate new methods of subsurface sensing and modeling, physics-based signal processing and image-understanding algorithms, and image and data information management methods. Research topics being addressed include: humanitarian de-mining, multilayer hyperspectral oceanography, 3-D subretinal visualization, nonlinear ultrasound medical imaging, subcellular biological imaging, electrical impedance tomography, acoustic diffraction tomography, and multi-sensor civil infrastructure assessment.

Overall, the CenSSIS program is a vehicle enabling substantial leverage of industrial investments because of the substantial level of funding available for basic research. In addition to research, the Center has established programs for education, industry collaboration, and technology transfer. An important outcome of this process is the education of students well-trained in these crucial fields for the future of public health and the preservation of the planet’s physical resources.

Center for Information and Systems Engineering (CISE)
http://www.bu.edu/systems

The Center for Information and Systems Engineering (CISE) provides an interdepartmental home for faculty and students interested in research in information and control systems theory and its relevance to various application domains encompassing the analysis, design, and management of complex systems that have come to prominence as a result of the information, communication, and computation revolution.

Information and systems engineering research at Boston University is strong and accomplished. Approved by the Trustees in 2002, with management support added in Fall 2002, CISE has raised the visibility of that strength and fostered greater interactions among researchers.

The Center fosters interdisciplinary collaboration and research in emerging applications and the use of methodologies such as optimization methods, information theory, control theory, applied probability and statistics, simulation, and modeling. Primary application interests are in the areas of automation, robotics, and control; communication, networking and information systems; production, service and supply chain systems; and signal processing and pattern recognition.

As of June 2009, CISE has grown from 13 to 29 affiliated faculty from the Departments of Mechanical Engineering, Biomedical Engineering, and Electrical & Computer Engineering in the College of Engineering; the Departments of Computer Science and Mathematics & Statistics in the College of Arts and Sciences; and the Department of Operations Management in the School of Management. There are approximately 60 graduate students affiliated through these faculty. CISE maintains a searchable data base of academic “systems” publications authored by the affiliated faculty and their students.

As of November 2004, CISE launched the Sensor Network Consortium (SNC) to facilitate interactions among the academic community and industry participants who support the growth of the sensor network industry through focused research and de-
velopment activities. The SNC’s goals are to develop, test and accelerate adoption of sensor network related technologies in strategic applications areas; develop strategic partnerships to access federal and regional research funding; and educate graduate students and facilitate their involvement with industry. Industry participation includes a diverse group of companies, start-ups, system integrators and adopters of sensor network technology that currently includes Arch Rock Corporation, BP International, Ember Corporation, The Hartford, Honeywell, IBM, Millennial Net, Mitre Corporation, SAP, Siemens Building Technologies, Sun Microsystems, and Textron Systems.

Electrical & Computer Engineering Department faculty affiliated with CISE are Professors Alanyali, Baillieul, Carruthers, Cassandras, Castañón, Ishwar, Karl, Levitin, Little, Paschalidis, Saligrama, Starobinski, and Trachtenberg. The application interests of their CISE related research include Automation, Robotics and Control; Communications, Networking and Information Systems; Production and Service Systems and Supply Chain Management; and Signal Processing and Pattern Recognition. Professors David Castañón and Ioannis Paschalidis currently serve as Co-Directors of the Center. Several ECE faculty also serve on the CISE Management Committee.

Center for Remote Sensing
http://www.bu.edu/remotesensing

The Center was established in 1986 as a facility for scientific research in the fields of archaeology, geography, and geology. The Center uses satellite images and other data from airborne and ground sensors to study the Earth and its resources, particularly groundwater. This includes the monitoring of environmental changes due to both natural processes and human activities. In 1997, the Center was selected by NASA as a “Center of Excellence in Remote Sensing.”

Center for Nanoscience and Nanobiotechnology
http://nanoscience.bu.edu

Boston University formed the Center for Nanoscience and Nanobiotechnology (CNN) to advance academic and technological research and development by extending discoveries in nanoscale materials and platforms toward applications that examine and seek to understand and manipulate biological systems. The Center serves as a hub for nanoscience researchers from the Charles River and Medical Campuses and builds interdisciplinary research and training. The Center connects scientists and engineers from disparate disciplines with each other in seminars, meetings, joint visitors programs, interdisciplinary courses, industrial collaborations, and seeded projects.

CNN has three core functions: First, to develop interdisciplinary research and education in nanoscience and nanobiotechnology; second, to develop and run an industrial liaison program that partners researchers with external companies for mutual benefit; and third, to connect researchers to resources for technological commercialization. CNN and affiliated faculty are also involved in outreach activities, organizing hands-on activities, discussions, and panels on nanoscience for grade school students and local organizations and museums.

Smart Lighting Center
http://smartlighting.bu.edu

The Smart Lighting Center at Boston University (SLC/BU) is part of the National Science Foundation’s Smart Lighting Engineering Research Center (ERC) established in September 2008 by Rensselaer Polytechnic Institute, the University of New Mexico, and Boston University.

The Center focuses on the creation and application of a new generation of smart light sources whose properties are fully controllable and tunable in terms of their spectral composition, color temperature, polarization, and spatial and modulation properties. These solid state light sources, adaptable to myriad requirements and environments, will result in tremendous benefits to society and humankind, including:

» Reduced pollution and global warming through increased energy conservation
» Novel modes of communication, networking, and sensing for enhanced privacy, security, and pervasive connectivity
» Increased automobile safety. Localized directional communication provides active braking and collision avoidance
» Fundamental advances in biotechnology including the rapid highly specific identification of cells
» Displays with high efficiency and large color gamut enabled by polarized emitters
» Reduced dependency on sleep-inducing pharmaceuticals, reduced risk of cancer, and better support of the natural circadian rhythm, thereby enabling higher productivity and a better quality of life

These benefits are enabled through the systematic exploration and development of smart-lighting principles in three vertically integrated research thrusts: (i) novel materials, (ii) device technology, and (iii) system applications and impacts.

In addition to these research thrusts, other key components of the Center include an Industrial Advisory Board, to drive industry requirements and technology commercialization; and a network of educational outreach partners, to foster the development of a new, globally competitive science and technology workforce.
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