Boston University College of Engineering
Department of Electrical & Computer Engineering

Annual Report
2007–2008

BOSTON
UNIVERSITY

Contents

BU Department of Electrical & Computer Engineering

Message From the Chair

David Castañón
Chair *ad interim*
2007–2008

Franco Cerrina
Department Chair

This past year represented a significant transition for the ECE department. Our former Chair, Professor Bahaa Saleh, stepped down after 13 years in the position, and has accepted a new position as Dean of the College of Optics and Photonics at the University of Central Florida, starting in January, 2009. I accepted the position as interim Chair, and led a national search for a new Department Chair, which concluded with the hiring of Professor Franco Cerrina in August 2008.

The Department maintained its growth in research, academic programs, and faculty under my tenure. On the academic side, we introduced new opportunities for our undergraduates in the College of Engineering, offering new minors in electrical engineering and in computer engineering. We were also able to grow our faculty in systems and networks with the addition of

As I begin my tenure as Chair of the Department of Electrical & Computer Engineering at Boston University, I feel it is necessary to acknowledge the work of my predecessors in the position. The Department is in excellent shape, with superb facilities, a dedicated staff, and an outstanding faculty. This would not have been possible without the efforts of Bahaa Saleh and David Castañón.

Since this is my first message as Chair, I want to take the opportunity to present some ideas about the future of the Department. In broad strokes, energy, health, and information are universally recognized as being central to our society's needs. The traditional areas of ECE—computers, systems, information sciences, and electrophysics—are fundamental components for fulfilling these needs. There is a bright future for the students that will choose to become involved in these areas.

But ECE can contribute even more by reaching out to establish new research and teaching links. Interdisciplinarity, in teaching as in research, is a necessity for a modern university. Compartmentalized structures cannot respond well to rapid changes, and thus it is important to broaden our activities beyond our core areas; collaborative efforts with other disciplines

Professor Christos Cassandras and Associate Professor Ioannis Paschalidis.

Our research portfolio grew in size and diversity in 2007–2008. In addition to the awards listed in this report, we also received two new research center awards that will start in the fall of 2008: The National Science Foundation Engineering Research Center on Smart Lighting (with RPI as lead institution) and the Department of Homeland Security Center of Excellence in Explosives Detection (with Northeastern University as lead institution). In addition, several of our faculty received prestigious awards, including Assistant Professor Hatice Altug, who was named Peter Paul Professor at Boston University.

The ECE department continues to receive external recognition among its peers. In the latest *U.S. News & World Report* annual ranking, the Department was ranked 44th among electrical engineering programs and 49th among computer engineering programs.

It was an honor to serve as Chair *ad interim* of the Department for the past year. I am excited to welcome Franco Cerrina as my replacement and colleague, and look forward to ECE's future under his stewardship.

David A. Castañón

changes, and thus it is important to broaden our activities beyond our core areas; collaborative efforts with other disciplines are a natural way of approaching these needs.

Growth can only be achieved by attracting talented new faculty, recruiting more students at both undergraduate and graduate levels, and developing a strong and diversified research portfolio. Research activity in ECE is strong, with good funding and outstanding publications from the research-active faculty. To continue its success, the Department must become even more research-oriented, increasing the extramural funding per faculty that is needed to support novel research and recruit top students. From a strong research base comes excellent teaching: education is our university's central mission, and we will foster that tradition of teaching excellence.

As you will read in this report, ECE is already part of several successful collaborative research efforts with other departments and universities. On the education side, the recent introduction of interdisciplinary "Divisions" in the College of Engineering increases the opportunities our students have to reach out beyond traditional departmental boundaries, broadening their formation.

I look at this time as an opportunity for renewal. We currently have several open faculty positions and have already started the search process to recruit promising new professors, even in these difficult economic times. Our Dean, Ken Lutchen, is strongly supportive of the Department's plan of growth, recognizing the central role that ECE must play in a growing College of Engineering. I am very optimistic about our future, and I look forward to working with the faculty, staff, and students to continue developing a vibrant department, where we can all enjoy a collegial and creative spirit.

Cerrina

Highlights

ECE Welcomes New Department Chair

After an extensive search, the Department of Electrical & Computer Engineering (ECE) is proud to welcome Professor Franco Cerrina as its new Department Chair, beginning August 2008.

Originally from Italy, Cerrina is an expert in optics, lithography and nanotechnology. He comes to ECE after 24 years at the University of Wisconsin-Madison, where he had a renowned career as a world-class researcher, educator, and innovator.

Cerrina's research has generated more than $45 million in grants, resulted in 16 patents, and has filled the pages of more than 250 reviewed publications. His research focus is on applying physics and engineering to manufacturing and biological problems, especially nanotechnology and biotechnology. His recent research involves semiconductor processing, particularly with nano-scale lithography, an approach he has applied to the fabrication of DNA microarray chips and the development of new techniques for synthesizing genetic material.

Cerrina holds a doctorate in solid-state physics from the University of Rome and is a fellow of the IEEE, the American Physical Society, and the Optical Society of America.

Faculty Awards and Honors

HATICE ALTUG received the BU Peter Paul Career Development Professorship. She also received a BU College of Engineering Dean's Catalyst Award for her proposal with Physics Professor Shyamsunder Erramilli to investigate a technique that uses photonic crystal nanostructures to detect proteins, even in very low concentrations.

IRVING BIGIO was named as an Honorary Guest Professor at the University College London, Department of Surgery.

CHRISTOS CASSANDRAS was elected Fellow of the International Federation of Automatic Control.

DAVID CASTAÑÓN was elected President of the IEEE Control Systems Society and was the General Chair of the 2007 IEEE Conference on Decision and Control. He also served on the 2007–2008 Air Force Scientific Advisory Board.

ROSCOE GILES was elected to the Board of Trustees of Associated Universities, Inc.

MARTIN HERBORDT was selected as a recipient of the IBM Faculty Award and was also named the General Chair of the IEEE 20th International Conference on Application-Specific Systems.

W. CLEM KARL was named as General Chair of the 2009 IEEE International Symposium on Biomedical Imaging.

RONALD KNEPPER was elevated to Life Fellow of the IEEE.

JANUSZ KONRAD was elevated to Fellow of the IEEE for contributions to motion estimation and stereoscopic imaging.

ROBERTO PAIELLA was elevated to Senior Member of the IEEE. He was also named the recipient of a BU Office of Technology Development Ignition Award, which is designed to bridge government funded research and commercial product development.

MICHAEL RUANE was named the College of Engineering's inaugural Faculty Director of Outreach.

BAHAA SALEH was selected as the recipient of the Optical Society of America's 2008 Distinguished Service Award.

JOSHUA SEMETER earned a *Laser Focus World* "Commendation for Excellence in Technical Communications" for his article "Segmented Tunable Filters Advance Multispectral Imaging."

SELIM ÜNLÜ was named by the BU College of Engineering as its Associate Dean for Research and Graduate Programs.

Undergraduate Program

This year the department changed the title of its Computer Systems Engineering degree program to Computer Engineering, adopting the now dominant term for such programs in the United States.

Another major accomplishment for this academic year was the creation of two new minors offered by the department. We now offer minors in both Electrical Engineering (EE) and Computer Engineering (CE) *(see page 21 for details)*.

Enrollment in the BS programs dropped slightly from last year, down approximately 7% from 244 students to 229 students in the EE and CE programs. We continue to enjoy a strong record of placement of our graduating seniors in both programs. The number of EE and CSE BS degrees awarded this year were 50 and 27, respectively *(see pages 16 and 17 for details)*.

Efforts to enhance the undergraduate laboratories are successfully ongoing, with new equipment, maintenance, and upgrades this year. In both classrooms and laboratories, emphasis is placed on design, laboratory practice, and applications. Successful ideas that were initiated in previous years, such as ECE Day and the ECE Teaching Excellence Award continued this year.

Undergraduate Student Awards

Students **EDY TAN**, **RUDIGER LIPPERT**, and **DANIEL COUGHLIN** were selected by Senior Project faculty as recipients of the 2008 P.T. Hsu Award for the best overall ECE senior design project.

Additionally, two other senior design teams were honored for their efforts on ECE Day with Best Presentation awards. These teams consisted of **MICHAEL CHEN**, **BILL NGUYEN**, **SAM TANG**, and **PATRICK YEN**; **WESLEY REITZFELD**, **SACHIT BAKSHI**, **OLEG SHATROVOY** and **ELAINE UY** *(see pages 22 and 23 for details)*..

Graduate Program

Four new PhD students were awarded Dean's Fellowships (DFs) and matriculated in Fall 2007. All four of these students will be continuing their degree programs and are making excellent progress. Twelve new graduate students matriculated with Graduate Teaching Fellowships (GTFs) in the same period; seven of these students were offered Research Assistantships (RAs) for the Fall 2008 semester. We also recruited three new Dean's Fellows and 15 new GTFs for the Fall 2008 semester.

The BU Photonics Center continued the Photonics Fellowship program funding photonics graduate students in the sciences and engineering. The program was conceived to engage greater interdisciplinary research and education in photonics via strong support of doctoral students. The awards are of two types: full-year Junior Assistantships and two-semester Senior Assistantships. ECE PhD students Ashwin Gopinath, Danilo D'Orsogna, F. Hakan Koklu, and Brian Hicks were recipients of the Senior Student Awards. The selection for these awards is merit based, and students were evaluated based on criteria that included academic record, scores on standardized tests, recommendation letters, publications, conference presentations, participation in the Photonics Center community, and recommendation of the graduate committee of the affiliated BU department. This cohort of students, including five others from ME, BME and Physics contribute to building an interdisciplinary photonics community.

Graduate Student Awards

ECE graduate students made an excellent showing in the 2008 Science and Engineering Day. The "President's Award," the highest award given at the event, was received by **I. EMRE OZKUMUR** for his poster entitled "High-Throughput, Label-Free and Dynamic Monitoring of Biomolecular Interactions" (Advisor: Prof. Selim Ünlü). Mr. Ozkumur was also the recipient of the "Electrical and Computer Engineering Award." **YIRONG PU** received the Founder's Award for her poster entitled "Back-End Algorithm of a Biomimetic Acoustic Localizing System" (Advisor: Allyn Hubbard). **AYCA YALCIN** received the "College of Engineering Dean's Award" for her poster entitled "Nanoscale Determination of Molecular Conformation on Layered Surfaces and Biological Applications" (Advisor: M. Selim Ünlü). The "Photonics Berman Future of Light Award" was given to **BRIAN HICKS** for his poster entitled "The MAIC: Bringing Darkness to Light" (Advisor: Supriya Chakrabarti).

The 4th IEEE International Conference on Distributed Computing in Sensor Systems named **GEORGE ATIA** as the recipient of its "Best Paper – Applications" honor for his submission entitled "An Information Theoretic Framework for Field Monitoring Using Autonomously Mobile Sensors."

CASSANDRA BROWNING received the "Clare Booth Luce Fellowship Award.

FAISAL SUDRADJAT received the 2007/2008 ECE Graduate Teaching Fellow of the Year Award.

Major Grants

New research funding this year totaled approximately $8.8M in awards for research, of which $6.2M 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, 25 were for new research projects, while 29 awards were for continuing projects *(see pages 36–42 for details)*.

This year, **HERBORDT MARTIN** received $309k in new funding for an HHS/NIH/NCRR award for FPGA-Based High Performance Computing and continued funding in the amount of $279k for the same award. **THEODORE MOUSTAKAS** received $294k in new funding from the National Science Foundation (NSF) for his project "Ultraviolet Electroabsorption Modulators Based on the Nitride Quantum Wells" and $125k in continued funding from NASA for developing a deep UV laser for identification of biological substances during exploration of Mars.

DAVID CASTAÑÓN and **CLEM KARL** received $250k in continued funding from the DOD/Air Force for a MURI award in conjunction with the Center for Information and Systems Engineering (CISE) through a subcontract with Ohio State University Research Foundation relative to fusion and sensor management for automatic target exploitation. **PRAKASH ISHWAR** received continued funding on an NSF Career award in the amount of $164k for Information-Scaling Laws, "Bit-Conservation" Principles, and Robust Coding Architectures in Sensor Networks in conjunction with CISE.

The NSF research center, Bernard M. Gordon Center for Subsurface Sensing and Imaging Systems (CenSSIS), a multi-university collaborative between Boston University, Northeastern University, Rensselaer Polytechnic Institute, and the University of Puerto Rico Mayagüez, continued its eighth year with Research Thrust 1 led by **BAHAA SALEH** and funded at $126k; Research Thrust 2 led by **DAVID CASTAÑÓN** and funded at $295k; and the education program led by **MICHAEL RUANE** and funded at $59k.

ALLYN HUBBARD continued his research regarding two Photonics Center projects that contributed funding for REDOWL in the amount of $521k and for Helmut in the amount of $117k. **LUCA DAL NEGRO** led another DOD/Army Photonics project regarding the Development of Efficient SERS Substrates via "Rationally" Designed Novel Nanofabrication Strategies in the Amount of $216k. Also **THEODORE MOUSTAKAS** and **SELIM ÜNLÜ** each led A DOD/Army Photonics project with respective award amounts of $300k and $244k.

Events

ECE Day 2008
Initiated in 1997, ECE Day is a forum for ECE seniors to present their capstone projects and graduate students to present their research posters. Held at the end of the Spring semester, ECE Day 2008 included 26 graduate research posters, 19 senior design presentations, and two senior thesis presentations attended by students, faculty, alumni, and industry representatives *(see page 22 for details)*.

MS Project Symposia
The MS Project Symposia are events that gives MS students who have participated in a faculty-advised Project Course an opportunity to present their completed work to their peers and the faculty. Symposia are held at the end of each semester. This year's events were August 10, 2007, December 13, 2007, and May 2, 2008.

Bernard M. Gordon CenSSIS NSF Site Visit
The Gordon-CenSSIS (Center for Subsurface Sensing and Imaging Systems) NSF Site Visit, held on April 16, 2008, brought together CenSSIS researchers and students from Boston University, Northeastern University, Rensselaer Polytechnic Institute, and University of Puerto Rico Mayaguez; NSF evaluators; and Gordon-CenSSIS industry and institutional collaborators. The Year Eight site visit included a student kick-off event at Jillians; faculty presentations on research and sustainability plans for Gordon-CenSSIS; a student-industry luncheon; a student poster session; student resume book, education, and diversity sessions; and a closed meeting with NSF evaluators for the student SWOT analysis. More than 125 people, including approximately 60 students, attended.

FUDCon Boston 2008: Fedora Users and Developers Conference
FUDCon is a conference/summit that focuses on the Fedora Project (a flavor of Linux), including infrastructure, development, community, marketing, and the state of the project.

The third day of FUDCon Boston 2008 was sponsored by ECE and held in the Photonics Center building on June 21, 2008. This day was organized as a BarCamp, which is an "unconference" where people interested in a wide range of issues come together to teach and learn. Rather than having scheduled speakers, sessions were pitched and voted upon by the 150 attendees the morning of the BarCamp. Elected sessions were put on a schedule and many small groups formed for intense group learning.

Faculty and Staff

Core Faculty
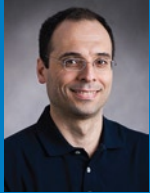
Murat Alanyali
Assistant Professor
Communication networks; performance analysis and optimization; stochastic systems

- » 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
- » 2008 Boston University Peter Paul Career Development Professorship
- » 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
- » 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; lattics 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 M.I.T., 1974-1976
- » Past Managing Editor, *International Journal of Computational Physics*

Maja Bystrom
Associate Professor
Source and channel coding; multi-media communications; image processing

- » PhD, Rensselaer Polytechnic Institute, 1997
- » 1999 NSF CAREER Award
- » 2005 ECE Award for Excellence in Teaching
- » 2001 Fulbright Award
- » Associate Editor, *Signal Processing Letters*

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
- » 2001 ECE Award for Excellence in Teaching

David Castañón
Professor & Chair ad interim
Stochastic control; estimation optimization; image understanding and parallel computation

- » PhD, Massachusetts Institute of Technology, 1976
- » Associate Director, CenSSIS; Co-Director, BU CISE
- » 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*
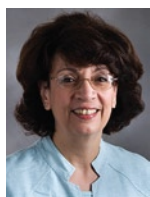
Luca Dal Negro
Assistant Professor
Optical amplification phenomena and laser physics; optical spectroscopy of semiconductor nanostructures; photonic crystals, anderson light localization and aperiodic dielectrics; nanophotonics and plasmonics

- » PhD, University of Trento, 2003
- » Dean's Catalyst Award, 2007

Azza Fahim

Assistant Professor
Electric machines; computations in electromagnetics

- » PhD, Cairo University, 1984

Roscoe 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

Martin Herbordt

Associate Professor
Computer architecture; electronic design automation; configurable computing; bioinformatics

- » PhD, University of Massachusetts, 1994
- » 2008 IBM Faculty Award
- » 1997 NSF CAREER Award

Mark Horenstein

Professor
Applied electromagnetics; electrostatics; microelectromechanical systems

- » PhD, Massachusetts Institute of Technology, 1978
- » Editor-in-Chief, *Journal of Electrostatics*

Allyn 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
Distributed and collaborative signal processing; multiterminal information theory; statistical modeling and inference; image and video coding and processing; multiresolution signal processing and optimization with applications to sensor networks; multimedia-over-wireless security

- » PhD, University of Illinois Urbana-Champaign, 2002
- » 2006 NSF CAREER Award
- » 2007 Dean's Catalyst Award

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, 1967
- » 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*

Janusz Konrad

Associate Professor
Multimedia communications; image and video processing; stereoscopic and 3-D imaging; digital signal processing

- » PhD, McGill University, 1989
- » Fellow, IEEE
- » 2001 IEEE Signal Processing Magazine Award
- » 2007 Dean's Catalyst Award
- » Associate Technical Editor, *IEEE Communications Magazine*; Past Associate Editor, *IEEE Signal Processing Letters*; Past Associate Editor, *IEEE Transactions on Image Processing*

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
Radio communications; experimental plasma physics; ionospheric plasma physics

- » PhD, University of California, San Diego, 1977
- » 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
- » 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
- » Fellow, 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
- » Special editor of the *Journal of Vacuum Science and Technology* and *Journal of Electronic Materials.*

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
- » Vice Chair, IEEE Laser and Electro-Optics Society (LEOS), New England Chapter
- » Senior Member, IEEE
- » 2008 BU Office of Technology Development Ignition Award

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

Tatyana Roziner
Associate Professor
Digital design; testing and diagnostics of computer hardware; fault-tolerant computing

- » PhD, Moscow Scientific Research Institute, 1975

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
- » 2004 ASEE New England Section Outstanding Teacher Award
- » 1999 ECE Award for Excellence in Teaching
- » 1991 College of Engineering Faculty Service Award

Bahaa E.A. Saleh
Professor & Chair
Quantum optics; nonlinear optics; image processing

- » PhD, Johns Hopkins University, 1971
- » Fellow, IEEE, Optical Society of America, John Simon Guggenheim Foundation
- » 2008 OSA Distinguished Service Award
- » 2006 Kuwait Prize
- » 2004 BACUS Award
- » 1999 OSA Beller Award
- » Deputy Director, Center for Subsurface Imaging and Imaging Systems (CenSSIS)
- » Past Editor-in-Chief, *Journal of the Optical Society of America: Optics, Image Science and Vision*

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
Assistant 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
- » 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

Masoud Sharif
Assistant Professor
Wireless multiuser networks, and communications and information theory

- » PhD, California Institute of Technology, 2005
- » 2006 Wilts Prize for the best PhD thesis in Electrical Engineering at Caltech
- » 2007 Dean's Catalyst Award

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 and sensor networks; QOS and traffic engineering; networks performance evaluation

- » PhD, Technion, Israel Institute of Technology, 1999
- » 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
- » 1997 IEEE Morris E. Leeds Award, 1992 Palacky University Memorial Gold Medal, 1969 IEEE Browder J. Thompson Memorial Prize
- » Editorial Advisor, Photonics and Physical Electronics, *Physics Today*

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

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
- » 1996 ONR Young Investigator 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 ARCNN Distinguished Lecturer
- » 2005-2007 IEEE/LEOS Distinguished Lecturer

Research Faculty

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

- » PhD, University of Arkansas, 1971
- » 1988 R&D Award
- » Co-Editor-in-Chief, *Particulate Science and Technology*

TOMMASO TOFFOLI
Research Associate Professor
Fundamental connections between physics and computation; fine-grained modeling of physics-like systems technology (cellular automata machines) and methodology (programmable matter); personal knowledge structuring

- » PhD, University of Michigan, 1977
- » Senior Member, IEEE
- » Member, Editorial Board Complex Systems; The Interjournal (on-line)

Affiliated Faculty

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

- » PhD, Harvard University, 1975
- » IEEE Fellow
- » Elected 40th President of IEEE
- » Distinguished Member, IEEE Control
- » Systems Society
- » Director, Boston University Center for
- » Control and Dynamics of Smart Structures

CHRISTOS CASSANDRAS
Professor, Manufacturing Engineering
Analysis and control of discrete event dynamic systems; stochastic control and optimization; dynamic control of computer and communication networks

- » PhD, Harvard University, 1982
- » IEEE Fellow, 1991 Lilly Fellow
- » Fellow of the International Federation of Automatic Control
- » IEEE Control Systems Society Board of Governors
- » Editor-in-Chief, *IEEE Transactions on Autonomic Control*

SUPRIYA CHAKRABARTI
Professor, Astronomy
Space experimentation; ultraviolet spectroscopy

- » PhD, University of California, Berkeley, 1982
- » Director, Center for Space Physics

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

- » PhD, Queen's University, Canada, 1972
- » Fellow, IEEE, Biomedical Engineering Society, and American Institute of Medical and Biological Engineering

SOLOMON EISENBERG
Professor & Associate Dean for Undergraduate Programs
Electrically mediated phenomena in tissues and biopolymers

- » Sc.D., Massachusetts Institute of Technology, 1983
- » 1987 NSF Presidential Young Investigator
- » 1990 Metcalf Award for Excellence in Teaching

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

- » PhD, 1964 University of Missouri
- » Key member of the Apollo lunar exploration team
- » Member, U.S. National Academy of Engineering

THEODORE FRITZ
Professor, Astronomy
Space plasma and magnetospheric physics; magneto sphere-ionosphere coupling; substorms; charged particles and compositions; rocket and satellite experiments

- » PhD, University of Iowa, 1967

BENNETT GOLDBERG
Professor & Chair, 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

- » PhD, Brown University, 1987
- » Alfred P. Sloan Fellow
- » NSF Presidential Young Investigator

WILLIAM KLEIN
Professor, Physics
Kinetics of phase transitions, the physics of earthquakes and the study of damage in materials

- » PhD, Temple University

MICHAEL MENDILLO
Professor, Astronomy
Low-light level optical instrumentation; signal processing in space physics; planetary atmospheres; GPS satellite communications; space plasmas in the solar system
>> PhD, Boston University, 1971
>> Fellow, American Geophysical Union

ERIC SCHWARTZ
Professor, Cognitive & Neural Systems
Computational neural science; machine vision; neural anatomy; neural modeling
>> PhD, Columbia University, 1973

JEROME MERTZ
Associate Professor, Biomedical Engineering
Development and applications of novel optical microscopy techniques for biological imaging
>> PhD, Université Paris VI & University of California, 1991
>> 2002 Aimé-Cotton Prize, French Physical Society
>> 2001 Fabry-de-Gramont Prize, French Optical Society

WILLIAM SKOCPOL
Professor, Physics
Nanofabrication; device processing; transport experiments in materials
>> PhD, Harvard University, 1974

IOANNIS PASCHALIDIS
Associate Professor, Manufacturing Engineering
Design, performance analysis, and control of communication and sensor networks and manufacturing systems, supply chains, and distribution systems; computational biology; Queueing theory and stochastic systems
>> PhD, MIT, 1996
>> NSF CAREER Award, 2000

Emertius Faculty

JOHN BRACKETT
Professor Emeritus
Software engineering; software requirements definition; object-oriented testing; rapid prototyping of embedded systems
>> PhD, Purdue University, 1963

DAVID PERREAULT
Professor Emeritus
Nonlinear networks; computer-aided design; microprocessors; distributed digital networks
>> PhD, Purdue University, 1968

THOMAS KINCAID
Professor Emeritus
Signal and image processing; neurodynamics; non-destructive testing
>> PhD, Massachusetts Institute of Technology, 1965

RICHARD VIDALE
Professor Emeritus
Modeling and simulation, software engineering
>> PhD, University of Wisconsin-Madison, 1964

Adjunct Faculty

JOHN BRACKETT
EC518 (Spring 2008)
>> PhD, Purdue University, 1963

JOHN DAY
EC440 (Spring 2008)
>> MS, University of Illinois, 1976

VLADIMIR KLEPTSYN
EC578 (Fall 2007) & EC410 (Summer 2008)
>> PhD, Moscow Lomonosov's Institute of Fine Chemical Technology, 1983

BABAK KIA MONTAZAM
EC 464 (Spring 2008) & EC 757 (Summer 2008)
>> MS, Boston University, 1996

MEHMET MUSTAFA
EC 311 (Summer 2008)
>> PhD, Boston University, 2006

ALAN PISANO
SC463 (Fall 2007) & SC402 (Spring 2008)
>> PhD, Northeastern University, 1974

Staff

Administrative Staff

WAYNE RENNIE
Director

CARLY MARCHIONI
Assistant Director

JULIE GUTHRIE
Academic Programs Manager

KAREN GALVEZ
Senior Programs Coordinator

BECKY BELL
Assistant to the Chair

JAMES GOEBEL
Manager, Technology and Systems

ELBERT JORDAN
Financial Administrator

DAVID DELAKAS
Grants Administrator

GORDON RYAN
*Publications, New Media, and
Promotions Administrator*

Technical Staff

JIM BARDIN
Systems Analyst/Administrator I

DAN BERKOVITCH
Systems Analyst/Administrator I

ALEXEY NIKIFOROV
MBE Laboratory Manager

VLADIMIR KLEPSTYN
Electronic/Circuits Laboratory Manager

HOWARD COHEN
VNNS Laboratory Manager

New Administrative Staff

The ECE Department welcomed three new administrative staff members this year. Karen Galvez became the new Senior Programs Coordinator after serving the department for two years as a student employee. In addition to managing the front desk administration and student office assistants, Karen supports Julie Guthrie, ECE's new Academic Programs Manager, who joined the staff from BU's Metropolitan College. As Academic Programs Manager, Julie manages the administration of all ECE academic programs, including admissions, scheduling, and student affairs. The department also welcomed a new Assistant to the Chair, Rebecca Bell, who supports both the Department Chair and Director and manages faculty actions, departmental events, and other general administrative activities.

Research Staff

Name	Title	Advisor
Bergstein, David	Research Associate	Ünlü
Bertazzi, Francesco	Research Associate	Bellotti
Bhattacharyya, Anirban	Senior Research Associate	Moustakas
Bonato, Cristian	Research Assistant	Sergienko
Boriskina, Svetlana	Research Associate	Dal Negro
Boura, Jihad	Visiting Scholar	Hubbard
Chivas, Robert	Research Associate	Morse
De Vos, Katrien	Visiting Scholar	Ünlü
Dimakis, Emmanouil	Research Associate	Moustakas
Do, Synho	Visiting Scholar	Karl
Feng, Ning-Ning	Research Associate	Dal Negro
Furno, Enrico	Research Assistant	Bellotti
Jaspan, Martin	Senior Research Associate	Sergienko
Jodoin, Pierre-Marc	Research Associate	Saligrama
Laifenfeld, Moshe	Research Associate	Trachtenberg
Lopez, Carlos	Research Associate	Ünlü
Minaeva, Olga	Research Assistant	Sergienko
Moe, Craig	Research Associate	Moustakas
Mustafa, Mehmet	Visiting Scholar	Levitin
Nasr, Magued	Research Associate	Teich
Nikiforov, Alexey	Research Associate	Moustakas
Park, Jin	Senior Research Associate	Herbordt
Prezioso, Stefano	Visiting Scholar	Dal Negro
Redjdal, Makhlouf	Visiting Scholar	Semeter
Roberts, Carson	Visiting Scholar	Morse
Rykalova, Yelena	Visiting Scholar	Levitin
Shubochkin, Roman	Research Associate	Morse
Thomidis, Christos	Visiting Scholar	Moustakas
Wong, Wai-Yan	Research Assistant	Teich
Yanik, Ahmet Ali	Research Associate	Altug

Department Administration & Committees

DAVID CASTAÑÓN   Department Chair *ad interim*
JEFFREY CARRUTHERS   Associate Chair for Undergraduate Studies
THOMAS LITTLE   Associate Chair for Graduate Studies
WAYNE RENNIE   Department Director

Faculty committees direct the academic operations and planning for the ECE Department. The following is a list of each of our regularly convening committees, with a description of their functions and the names of the committee members (in *italics*).

The **Planning 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). *Castañón (Chair), Little (Assc. Chair, Grad), Carruthers (Assc. Chair, Undergrad), Herbordt (CSE), Karl (ISS), Sergienko (Electro-Phys.), Rennie (Director), Ünlü (ENG)*

The **Undergraduate Committee** is responsible for all aspects of the undergraduate programs, including program and curricular changes; new courses; evaluation of quality of instruction and student advising; and making 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), Bystrom, Guthrie, Ishwar, Ruane, Semeter, Swan, Taubin*

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), Oliver (Assc. Chair), Alanyali, Altug, Bellotti, Dal Negro, Guthrie, Konrad, Qin*

The **Search Committee** is responsible for the recruitment of new faculty. It coordinates the advertisements, visits and interviews of candidates, and makes recommendations to the faculty for appointment of new faculty. *Castañón (Chair), Herbordt, Hubbard, Ishwar, Karpovsky, Paiella, Rennie (ex-officio)*

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. *Castañón (Chair), Brower, Karl, Levitin, Moustakas, Nawab, Rennie (ex-officio), Teich*

The **Publicity, Special Events and Seminars Committee** makes strategic recommendations for the department's web site, brochures, reports, exhibits, and all media events aimed at promoting the Department and enhancing its visibility at the national and international level. It is also in charge of the ECE Colloquium, the Research Spotlight Seminar series, and other ad hoc seminars and research talks. *Ryan (Coordinator), Ishwar, Konrad, Kotiuga, Paiella, Qin, Rennie, Toffoli*

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. *Castañón (Chair), Horenstein, Hubbard, Knepper, Pisano, Rennie, Ruane, Skinner*

The **Information Technology Committee** is in charge of maintaining, upgrading, and improving the information technology infrastructure. *Bellotti (Chair), Giles, Goebel, Konrad, Hubbard, Rennie, Toffoli*

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. *Castañón (Chair), Bigio, Brower, Giles, Karpovsky, Nawab*

Undergraduate Program

The ECE Department continues to pride itself on developing a strong laboratory curriculum to accompany our classroom teaching for undergraduates. We continue to have excellent teaching labs with up-to-date equipment. Undergraduates are encouraged to become involved with research and development efforts in faculty labs through UROP (Undergraduate Research Opportunity Program), work study, or 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.

We continued improving our undergraduate programs this year. This process includes student surveys, student feedback forums, faculty review of courses and outcomes, and implementation of curriculum changes aimed at improving program outcomes.

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.

FALL 2007 ENROLLMENT			
	Electrical	Computer Systems	Total
Freshmen*	34	11	45
Sophomores*	30	19	49
Juniors	24	33	57
Seniors	50	28	78
Total	**138**	**91**	**229**

Note: ENG Students are not required to declare their major until their Junior year.

History of Undergraduate Degree Enrollment

CSE
EE
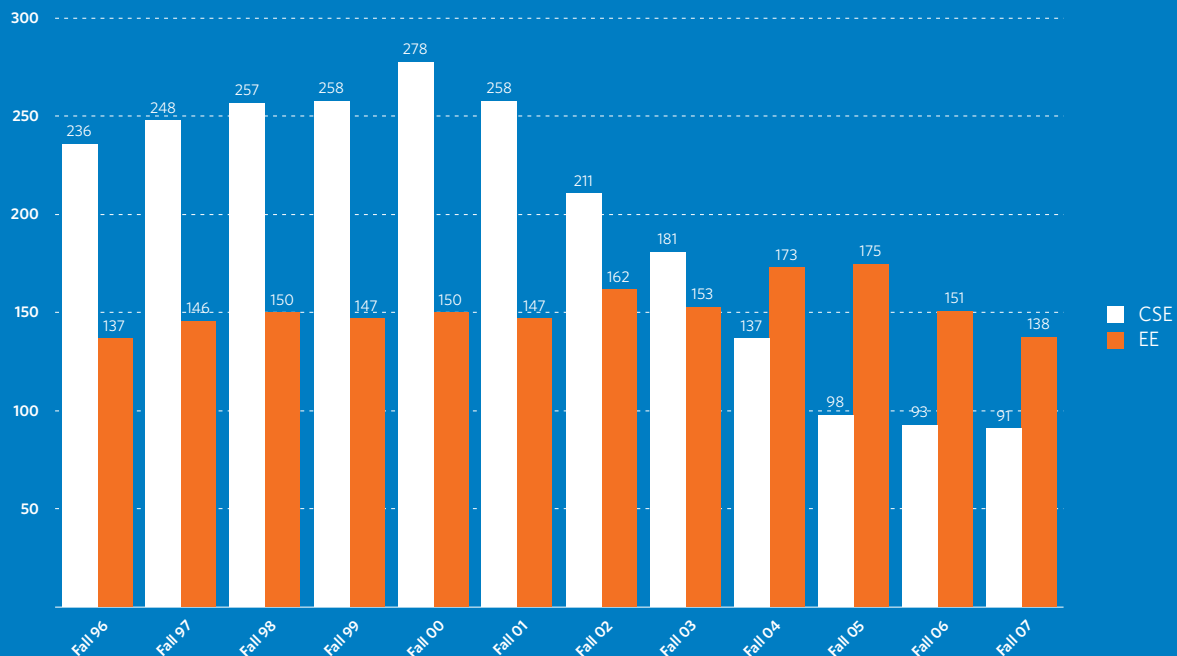
2008 ECE Award for Excellence in Teaching

Professor Min-Chang Lee (left) was the winner of the 2008 ECE Award for Excellence in Teaching. He received the award for his consistently excellent contributions to a wide range of core ECE courses, ranging from upper-division courses in electronics and electromagnetics to a freshman introduction to engineering module. Even in large courses, student reviews of Prof. Lee were positive, indicating a clear teaching style and a commitment to student learning.

The ECE Department instituted this award during the 1997-98 academic year to recognize innovation and excellence in teaching in the department. 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.

History of Undergraduate Degrees Awarded
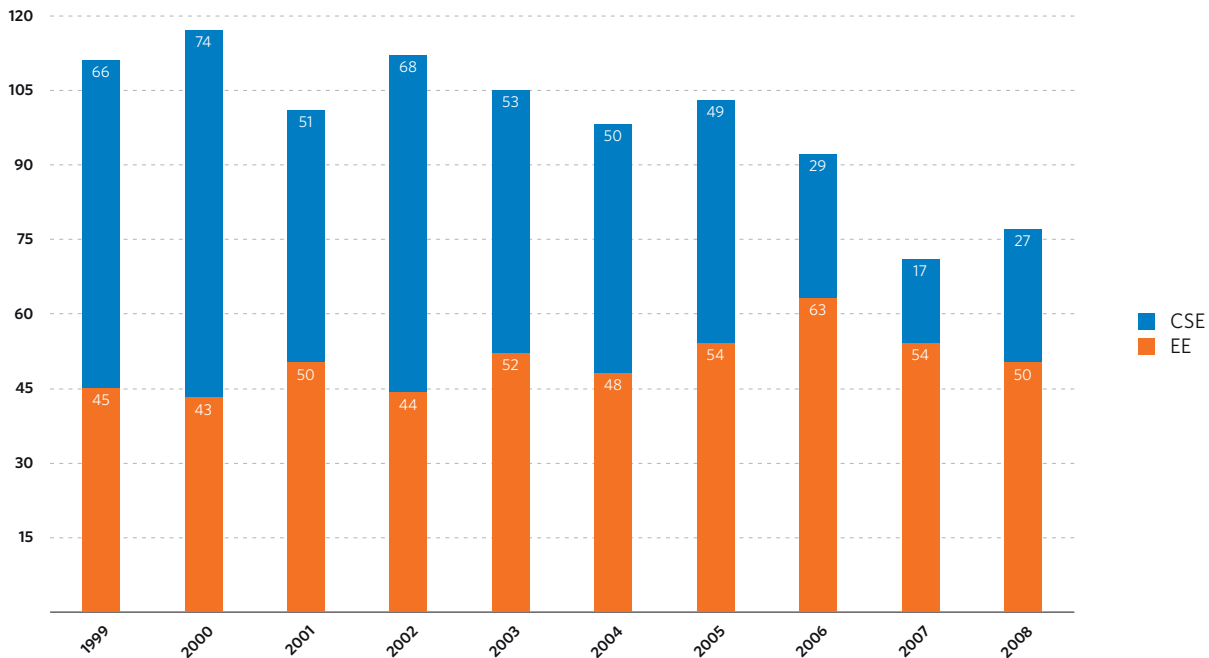
Undergraduate Courses

Course Number	Course Title	Fall '07	Spring '08	Summer '08
EK131	Intro to Engineering	Toffoli Ruane Levitin	Konrad Giles Swan Kotiuga	
EK307	Electric Circuit Theory	Horenstein	Semeter Paiella Oliver	Carruthers
EK317	Circuit Theory I	Carruthers		
EK318	Circuit Theory II		Carruthers	
EK501	Math Methods I	Kotiuga		
EC327	Intro to Software Engineering	Brower	Carruthers	
EC311	Intro to Logic Design	Qin	Karpovsky Ruane	Mustafa
EC312	Computer Organization	Taubin	Herbordt	
EC330	Applied Algorithms		Castañón	
EC381	Probability Theory in ECE	Teich	Paschalidis	
EC401	Signals and Systems	Karl	Bystrom	Carruthers
EC402	Control Systems		Pisano	
EC410	Intro to Electronics	Ünlü Lee Lee Knepper	Lee	Kleptsyn
EC412	Analog Electronics		Sergienko	
EC415	Communication Systems		Alanyali	
EC416	Intro to Digital Signal Processing	Bystrom	Nawab	
EC440	Intro to Operating Systems		Herbordt	
EC441	Intro to Computer Networks	Alanyali		
EC447	Software Design	Skinner		
EC450	Microprocessors	Giles	Giles	
EC455	Electromagnetic Systems I	Semeter	Lee	
EC456	Electromagnetic Systems II		Kotiuga	
EC463	Senior Design Project I	Ruane/Pisano		
EC464	Senior Design Project II		Ruane/Montazam	

Course Number	Course Title	Fall '07	Spring '08	Summer '08
EC471	Physics of Semiconductor Devices		Moustakas	
EC501	Dynamic Systems Theory	Dupont		
EC505	Stochastic Processes		Karl	
EC512	Enterprise Client-Server Software Systems Design		Skinner	
EC513	Computer Architecture	Herbordt		
EC514	Simulation	Vakili		
EC515	Digital Communication	Ishwar		
EC516	Digital Signal Processing	Nawab		
EC 517	Introduction to Information Theory		Ishwar	
EC518	Software Project Management		Brackett	
EC520	Image Processing and Communication	Konrad		
EC524	Optimization Theory and Methods	Paschalidis		
EC533	Intro to Discrete Mathematics	Levitin		
EC534	Discrete Stochatic Models		Levitin	
EC535	Intro to Embedded Systems		Qin	
EC541	Computer Communication Networks		Alanyali	
EC544	Networking the Physical World	Little		
EC551	Advanced Digital Design	Taubin		
EC560	Intro to Photonics	Altug	Altug	
EC561	Error-Control Codes	Karpovsky		
EC568	Optical Fiber Sensors	Morse		
EC570	Lasers		Teich	
EC571	VLSI Principles and Applications	Hubbard	Hubbard	
EC574	Physics of Semiconductor Materials	Bellotti		
EC575	Semiconductor Devices		Swan	
EC578	Fabrication Technology for Integrated Systems	Klepstyn		
EC579	Microelectronic Device Manufacturing		Cole	
EC580	Modern Active Circuit Design	Knepper		
EC582	RF/Analog IC Design Fundamentals		Knepper	
EC591	Special Topics in ECE Lab	Paiella Paiella		

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 (plant) with actuators and sensors. Various types of controllers (e.g. 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: Herbordt, Hubbard, Knepper, Taubin

The VLSI Instructional 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 additional, 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 also equipped with National Instruments data acquisition hardware. A variety of common electronic parts is available for sale at the equipment window. When not being used 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 EK131/132 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 Pentium 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 MSDNAA is available for all teams.

IEEE Student Branch

The ECE Department supports the Boston University student branch of the IEEE. This group held a number of successful events over the course of the year, ranging from lectures and panel presentations to social events for members to educational service activities. Highlights for 2007–2008 are detailed below.

Avid Tech Talk
In October, BU IEEE invited alum and current Avid employee George F. Matthews to talk about Unity ISIS's self-healing and distributed high-performance file system.

Microsoft Tech Talk
Also in October, Jim Miller, Senior Architect on Microsoft's CLR (Common Language Runtime) team, hosted a discussion entitled "Microsoft .NET: What Is It and What's Next?" Miller, regarded as one of the "fathers" of .NET, spoke about the implementation on some of the new technologies, the future direction of the CLR, and his current work on architectural changes to allow innovation in the core of the CLR and the managed Frameworks while preserving backward compatibility.

Meeting Pete Dempsey: Compiler of Dreams
In November, ECE alum Pete Dempsey from FastSearch spoke about the complexity of search in unstructured environments. Included was an overview of strategies to break down natural language search into sub-problems that are easier to handle algorithmically.

Soldering Tutorial & Competition
In February, the group sponsored a hands-on soldering tutorial (and competition) to teach students the essential tools and techniques for soldering bare wires, through-hole components, and surface mount devices.

Instructional Lab Expenditures	
	Approx. Cost
Microprocessor and Software Engineering Labs	$42,564.88
VLSI and Signals/Networks Lab	$62,280.45
Electronics Lab	$12,694.80
Senior Projects Lab	$41,080.59
Other	$22,517.91
Total	**$181,138.63**

Course and Program Development

This year, the Department proposed a change in the title of the Computer Systems Engineering degree program to Computer Engineering. In the years since the creation of this program, the degree title "Computer Engineering" has become the dominant and accepted term in the United States for similar programs. The new title, which was approved by the College and University, is used by 82% of ABET accredited programs (as of Oct 2007) and is thus better understood and accepted by the engineering community and society at large.

Another major accomplishment for this academic year was the creation of two new minors offered by the department. We now offer a minor in Electrical Engineering and a minor in Computer Engineering. Currently, these minors are available to all students in the College of Engineering. The minors require the completion of 20 credits of ECE courses. EK307 Electric Circuit Theory is considered an ECE course for the minors. Students can apply up to eight credits of their minor program of study toward their major degree program requirements. Students choose the designation of the minor as Electrical or Computer, with the approval of the Department, based on their particular course selections.

Our course assessment and teaching evaluations continue to use a completely online mechanism, and the College of Engineering now uses this same system for all its courses. This provides for a faster response to the instructor, allowing the instructor to incorporate student feedback into future course offerings more quickly than was previously possible. In addition, it provides all students an opportunity to provide feedback to the instructor, rather than only those who are attending lecture on the day the evaluations were done in class.

The department has successfully migrated to courses numbered "EC" for Electrical and Computer instead of the old "SC" for "Systems and Computer." For the first time, our department name, degree programs, and course numbering are all aligned.

Student surveys were conducted to collect and analyze data on student perceptions of how well our programs are achieving their outcomes.

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 2, 2008, 19 teams and two BS Honors Thesis student presented their projects across two parallel sessions. Best presentation awards for each session were presented at a luncheon for faculty, customers, and seniors.

Notable Senior Design Projects

Go Game Recorder

Go, a two-player board game popular in East Asia, is notorious for being deceptively simple to learn and infuriatingly difficult to master. Because of the open nature of its rules of play and spaciousness of the board, games quickly become extremely complex and can last for hours, if not days. It has been calculated that the total number of possible game variations in Go far exceeds the number of atoms in our universe. Needless to say, traditional, manual recording of games for posterity and analysis is a daunting and tedious task.

Aiming to overcome the inefficiency of human-generated game records, ECE Senior Project team, "The Go-Getters" (Dan Coughlin, Rudiger Lippert, and Edy Tan), developed a system that automatically records games of Go. The Go Game Recorder works by utilizing a networked digital camera to periodically capture images of the board and a computer server to process the images and record the game in a standard file format. A unique Web interface enables end-users to easily access games and perform analysis over the Internet in real-time.

One of the chief engineering challenges the team's system addresses is environmental flexibility.

"The main difference between our project in relation to other Go recording systems is that our device can be placed at a wide range of distances and angles in relation to the board," said Tan. "This presented a challenge in terms of how to find the pieces in order to detect a move. This was further complicated by the necessity to create a system that was intelligent enough to differentiate between legitimate moves and, for example, a hand that is obscuring the camera's view of the board."

Ultimately, the variety of intricate challenges inherent to achieving their goal forced the team to develop a number of creative solutions.

"There were no obvious ways to overcome a lot of our obstacles," said Tan. "In order to succeed, we had to leverage the strengths of each team member and embrace unconventional ideas."
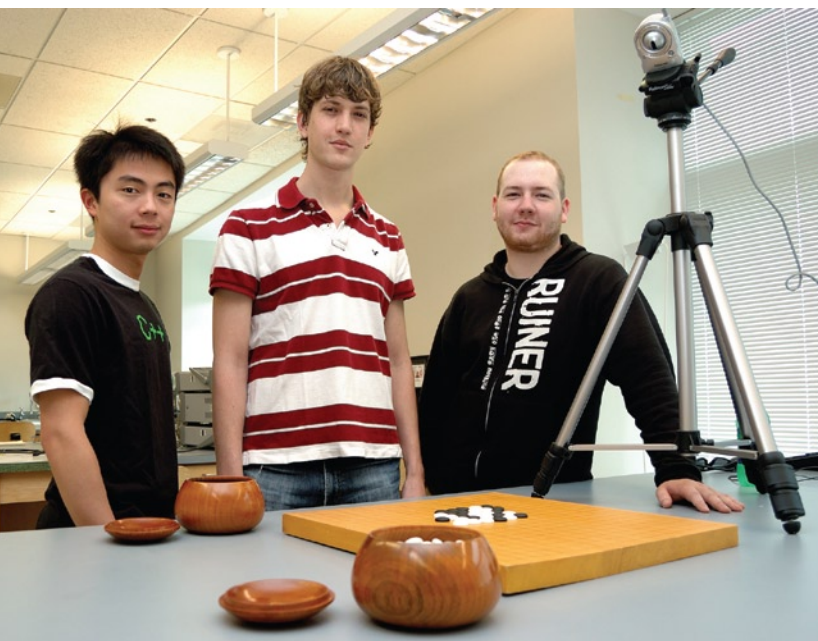
3D LED Cube Display

The 3D LED cube developed by ECE Senior Project team, "Hyperion 3D" (Sachit Bakshi, Wesley Reitzfeld, Oleg Shatrovoy, and Elaine Uy) is an exercise in precision and imaginative problem solving.

Using a grid of 512 white LEDs arranged in an 8x8x8 cube, the team created a visualization device that can display animated three-dimensional objects viewable from any angle. These true 3D images are transferred to the device via a standard USB cable from a PC running specialized software developed by the team.
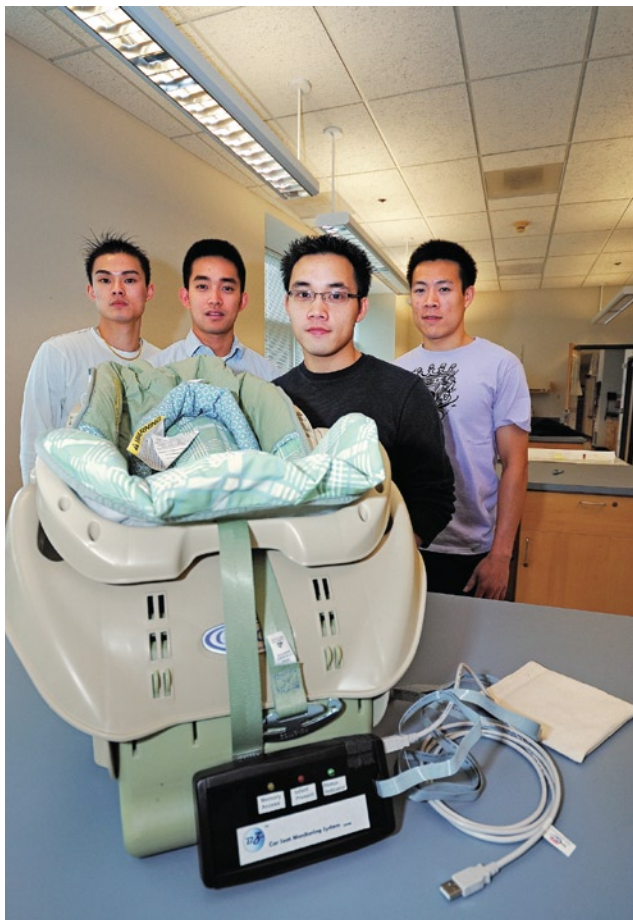
Despite being a relatively low-resolution monochrome display, the device can present remarkably sophisticated animations. Each LED is precisely calibrated to accurately display 16 degrees of user-specified brightness, allowing for varying degrees of contrast across the image. The device is also capable of updating objects at a rate of 30 frames-per-second, thus achieving perceivably smooth animation.

While ensuring unrestricted viewing angles and effectively utilizing the USB standard were speed bumps for the team, it was the manufacturing process that proved most difficult.

"None of us were familiar with the manufacturing process,"

said the team. "It took quite some time to discuss and plan each step of the design. In the end, we discovered that we were able to solve problems that we neither anticipated or thought we were capable of addressing."

Car Seat Black Box

Ask any new parent if you may hold their infant and you're likely to get the same advice—be gentle and support the head. There is a good reason for this; numerous studies (not to mention parental instincts) have shown that the skulls of newborns are fragile and remarkably susceptible to deformation. One previously unsuspected cause of head trauma currently being investigated by Children's Hospital Boston is the design of infant car seats.

To aide the hospital's research, ECE Senior Project team, "Baby Zetel" (Michael Chen, Bill Nguyen, Sam Tang, and Patrick Yen), was asked to develop a portable car seat monitoring system that records the duration of time a baby is in a car seat. The data obtained from this system will serve to help determine if there is a correlation between car seat positional problems and infant head abnormalities.

The system employs a portable PCB device mounted in a car seat, records the timing using a Freescale HCSO8 microcontroller, and stores the time to EEPROM. It is powered by two AA batteries (good for two months of recording) and senses the baby using an array of micro-switches. End-users are able to transfer data via USB to a PC, access it through a GUI, and save it in a .csv format that is compatible with Microsoft Excel.

"The great thing about our device is that it's an unobtrusive and automatic system and far more accurate than a stopwatch, pen and paper," said Yen. "I think the most valuable thing we learned was the importance of properly testing early and often. It really saved us a lot of time in the late stages of our project and ensured that our finished product was high quality and ready for implementation."

Graduate Program

Recruitment

Four new PhD students were awarded Dean's Fellowships (DFs) and matriculated in Fall 2007. All four of these students will be continuing their degree programs and are making excellent progress. Twelve new graduate students matriculated with Graduate Teaching Fellowships (GTFs) in the same period; seven of these students were offered Research Assistantships (RAs) for the Fall 2008 semester. We also recruited three new Dean's Fellows and 15 new GTFs for the Fall 2008 semester.

We received 650 applications for the Fall 2008 semester, down from 689 in Fall 2007, and up from 614 in Fall 2006. We offered admission to a total of 333 students; 282 of which were to the MS program (105 of these applied for the post-BS PhD program). Thirty-three students were offered admission as post-BS PhDs and 16 as post-MS PhDs. This is in comparison to Fall 2007, which had a total of 357 admits with 294 for the MS (124 of these applied for the post-BS PhD program), 40 for the post-BS PhD, and 23 for the post-MS PhD.

The numbers indicate a recruiting cycle comparable to prior years in terms of overall volume. However, for the Fall 2008 period we have secured a new class of funded PhD students by using fewer financial aid and admissions offers. This suggests the increased competitiveness of our offer package and the desirability of our program.

New Matriculants 2007–2008

		Male	Female	FT	PT	GTF	RA	Fellow	DF
MS	US	16	0	14	2	1	1	0	0
	Intl.	14	5	19	0	0	0	0	0
PHD	US	8	2	10	0	4	4	0	2
	Intl.	9	5	14	0	8	4	1	1
Total		**47**	**12**	**57**	**2**	**13**	**9**	**1**	**3**

Fall 2007 Mean GRE Scores

		Verbal	%	Quantitative	%	An. Writing	%
MS	US	473	51	766	86	4.03	35
	Intl.	594	79	755	83	4.61	55
PHD	US	488	56	782	89	3.88	32
	Intl.	552	68	768	86	5	76
Mean		**527**	**64**	**768**	**86**	**4**	**50**

Spring 2008 Mean GRE Scores

		Verbal	%	Quantitative	%	An. Writing	%
MS	US	---	---	---	---	---	---
	Intl.	473	52	770	86	3	16
PHD	US	570	77	750	80	5	70
	Intl.	---	---	---	---	---	---
Mean		**522**	**65**	**760**	**83**	**4**	**43**

History of MS Degree Enrollment

Chart: stacked bar chart showing MS Degree Enrollment, 1998–2007. Legend: Photonics, CSE, EE.

Year	EE	CSE	Photonics
1998	43	22	
1999	42	34	
2000	36	31	
2001	29	29	
2002	32	25	
2003	57	21	7
2004	62	34	9
2005	44	32	3
2006	43	34	5
2007	49	43	6
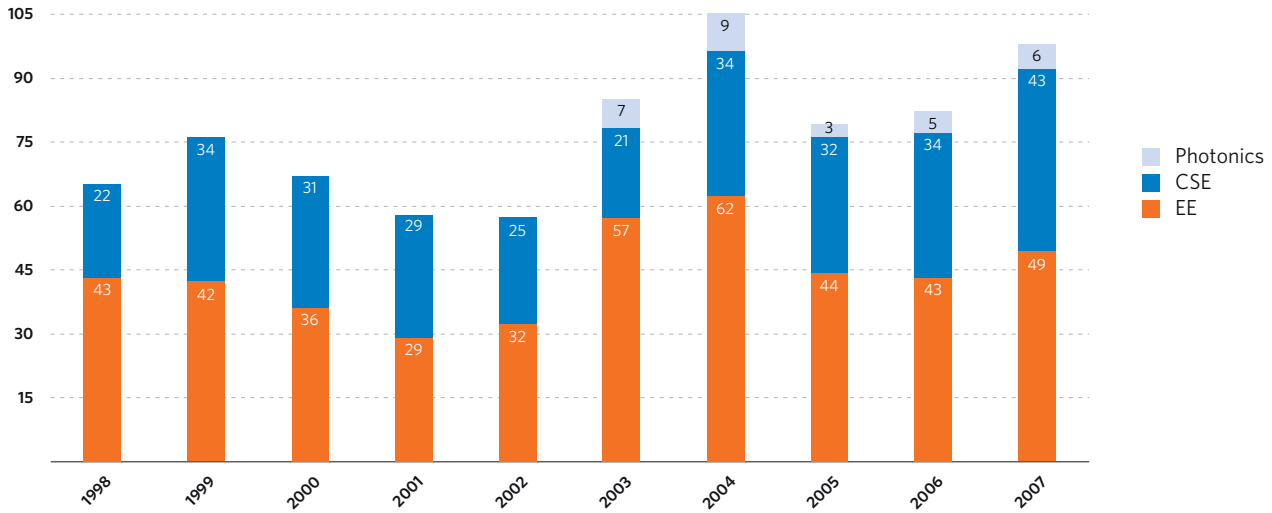
History of PhD Degree Enrollment

Chart: stacked bar chart showing PhD Degree Enrollment, 1998–2007. Legend: Systems, CE, EE.

Year	EE	CE	Systems
1998	47	21	3
1999	51	22	1
2000	63	18	2
2001	57	17	2
2002	66	22	
2003	70	26	1
2004	75	24	3
2005	83	19	4
2006	80	21	6
2007	79	18	6
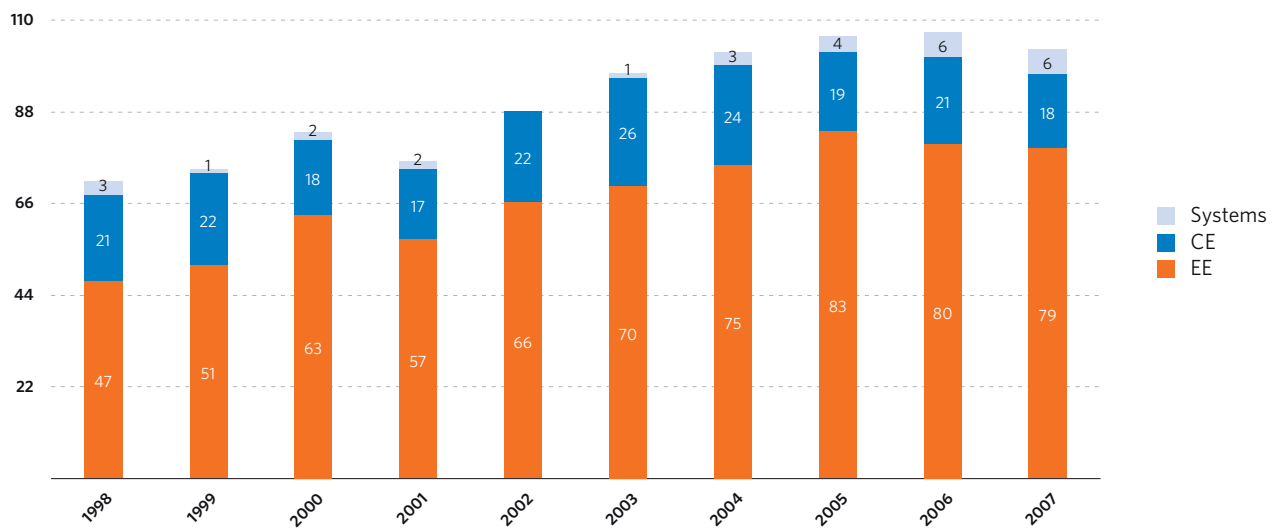
PhD Student Progress

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 candi-dacy 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 sho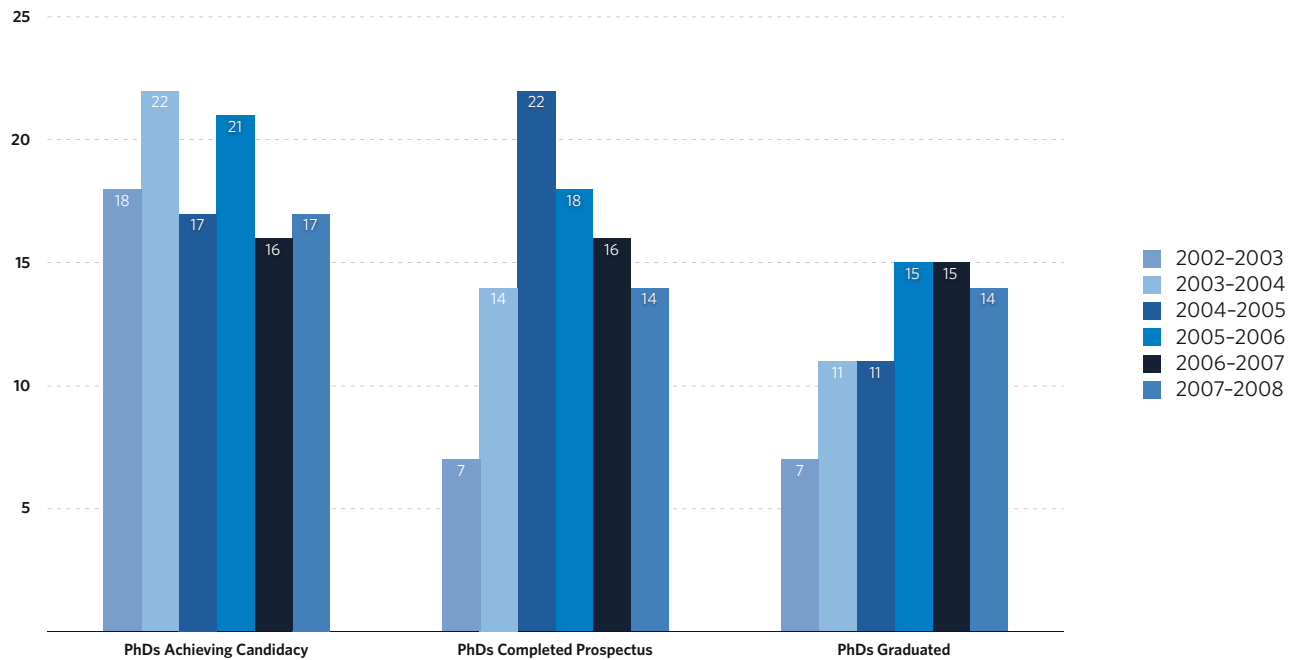ws the number of PhD students achieving candidacy, completing prospectus defense, and graduating over the last four academic years.

Legend:
- 2002–2003
- 2003–2004
- 2004–2005
- 2005–2006
- 2006–2007
- 2007–2008

PhDs Achieving Candidacy: 18, 22, 17, 21, 16, 17
PhDs Completed Prospectus: 7, 14, 22, 18, 16, 14
PhDs Graduated: 7, 11, 11, 15, 15, 14

Graduate Teaching Fellows and Research Assistants

	SUMMER 2007	FALL 2007	SPRING 2008	TOTAL
Graduate Teaching Fellows	2	19	19	*40*
Research Assistants	97	89	82	*268*

Graduate Degrees

History of MS Degrees Awarded

Legend:
- Photonics
- CSE
- EE

Year	EE	CSE	Photonics
1999	23	18	
2000	29	26	
2001	27	18	
2002	25	16	
2003	16	18	
2004	28	23	1
2005	40	30	5
2006	35	23	6
2007	24	17	2
2008	28	30	2
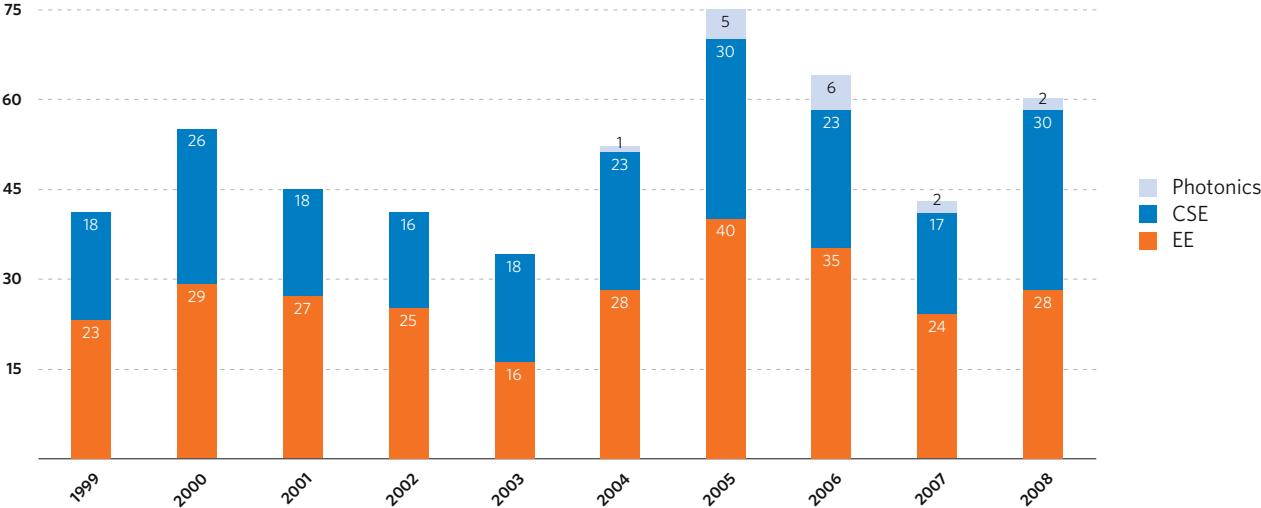
History of PhD Degrees Awarded

Legend:
- Systems
- CE
- EE

Year	EE	CE	Systems
1999	3	1	1
2000	6	4	
2001	5	2	
2002	7	1	1
2003	2	5	
2004	8	3	
2005	10	1	
2006	10	5	
2007	12	3	
2008	12	2	
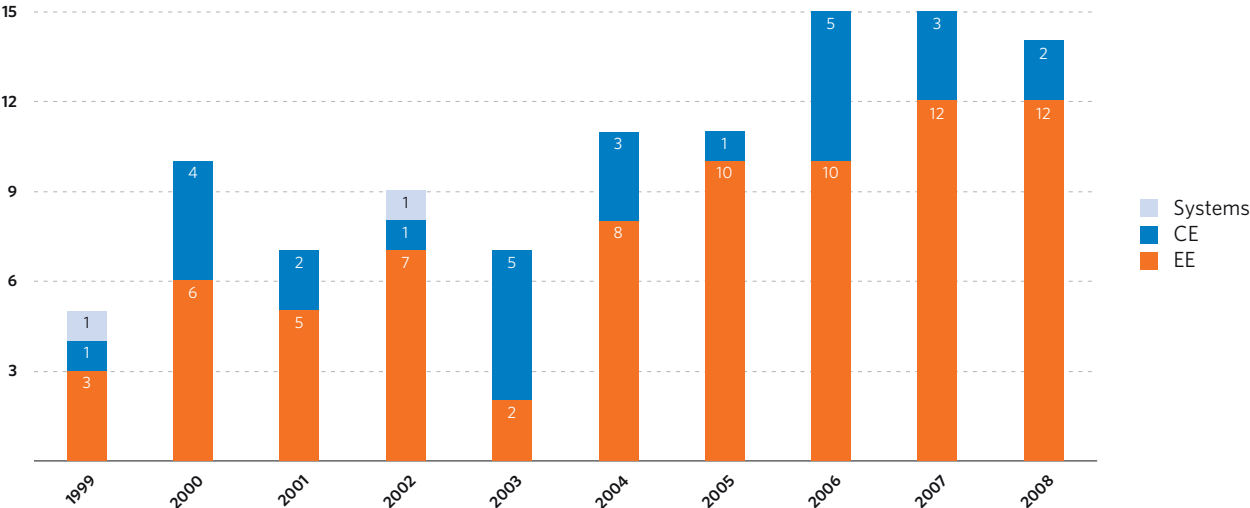
PhD Dissertations

Student Name	Dissertation Advisor	Dissertation Title
Abell, Joshua	Moustakas, Ted	Kinetics of Growth of InGaN Alloys by MBE and Development of Polar and Non-polar InGaN MQWs
Chandrasekaran, Ramya	Moustakas, Ted	Development of Ultra-violet light emitting diodes (UV-LEDs) along the polar [0001] and Non-polar [11-20] directions
Chen, Tai-Chou Papo	Moustakas, Ted	Development of III-Nitride Semiconductors by Molecular Beam Epitaxy and Cluster Beam Epitaxy and Fabrication of LEDs based on InGaN MQWs
Dai, Haitao	Knepper, Ronald	Substrate Noise Modeling and Supression in RF/Mixed Signal Integrated Circuit Technology
Dupuis, Julia	Ünlü, Selim	Hyperspectral Fourier Transform Spectrometer for White Light Reflection Spectroscopy and Spectral Self Interference Fluorescence Microscopy
Gu, Yongfeng	Herbordt, Martin	FPGA Acceleration of Molecular Dynamics Simulations
Ince, Serdar	Konrad, Janusz	Occlusion-Aware Intermediate View Reconstruction
Kim, Duk Joong	Hubbard, Allyn	Integrated CMOS Electronic Drivers for Large Scale Metal MEMS Mirror Array using Linearization Techniques
Laifenfeld, Moshe	Trachtenberg, Ari	Robust Identifying Codes and Rateless Codes in Sensor and Peer-to-Peer Networks
Li, Yan	Paiella, Roberto	Ultrafast All-Optical Switching Based on Intersubband Transitions in FaN/AIGaN Quantum Wells
Martin, Benjamin	Castañón, David	Incorporating Uncertainty and Motion in Intensity Modulated Radiation Therapy Treatment Planning
Mathur, Raman	O'Connor, Peter	A Cryogenic Low Noise Amplifier for Fourier Transform Mass
Rykalova, Yelena	Levitin, Lev	Queues, Latency and Critical Phenomena in Interconnection Networks
Vamivakas, Anthony	Swan, Anna	Optical Studies of Quantum Confined Nanostructures
Wei Lei	Moustakas, Ted	Materials and Device Studies for the Development of Gallium Nitride Heterojunction Bipolar Transistors by Molecular Beam Epitaxy
Yarnall, Timothy	Teich, Malvin	Experimental Investigations of Spatial-Parity Qubits

Graduate Courses

Course Number and Title		Fall '07	Spring '08	Summer '08
EC501	Dynamic Systems Theory	Dupont		
EC505	Stochastic Processes		Karl	
EC512	Enterprise Client-Software Systems Design		Skinner	
EC513	Computer Architecture	Herbordt		
EC514	Simulation	Vaikili		
EC515	Digital Communication	Ishwar		
EC516	Digital Signal Processing	Nawab		
EC517	Introduction to Information Theory		Ishwar	
EC518	Software Project Management		Brackett	
EC520	Image Processing and Communication	Konrad		
EC524	Optimization Theory and Methods	Paschalidis		
EC533	Intro to Discrete Mathematics	Levitin		
EC534	Discrete Stochatic Models		Levitin	
EC535	Intro to Embedded Systems		Qin	
EC541	Computer Communication Networks		Alanyali	
EC544	Networking the Physical World	Little		
EC551	Advanced Digital Design	Taubin		
EC560	Intro to Photonics	Altug	Altug	
EC561	Error-Control Codes	Karpovsky		
EC568	Optical Fiber Sensors	Morse		
EC570	Lasers		Teich	
EC571	VLSI Principles and Applications	Hubbard	Hubbard	
EC574	Physics of Semiconductor Materials	Bellotti		
EC575	Semiconductor Devices		Swan	
EC578	Fabrication Technology for Integrated Systems	Klepstyn		
EC579	Microelectronic Device Manufacturing		Cole	
EC580	Modern Active Circuit Design	Knepper		
EC582	RF/Analog IC Design Fundamentals		Knepper	
EC591	Special Topics in ECE Lab	Paiella Paiella		
EC700	Advanced Topics in Electrical and Computer Engineering	Knepper		
EC702	Recursive Estimation and Optimal Filtering	Castañón		
EC710	Dynamic Programming and Stochastic Control		Caramanis	
EC715	Wireless Communications		Bystrom	
EC717	Image Reconstruction and Restoration		Karl	
EC720	Digital Video Processing		Konrad	
EC724	Advanced Optimization Theory and Methods		Paschalidis	

Course Number and Title		Fall '07	Spring '08	Summer '08
EC725	Queueing Systems	Hu		
EC726	Personal Knowledge Engineering	Toffoli		
EC730	Information-Theoretical Design of Algorithms		Levitin	
EC733	Discrete Event and Hybrid Systems		Cassandras	
EC749	Interconnection Networks for Multicomputers	Karpovsky		
EC751	Design of Asynchronous Circuits and Systems		Taubin	
EC757	Advanced Microprocessor Design			Montazam
EC762	Quantum Optics	Sergienko		
EC763	Nonlinear and Ultrafast Optics	Teich		
EC765	Biomedical Optics and Biophotonics		Bigio	
EC770	Guided-Wave Optoelectronics	Dal Negro		
EC771	Physics of Compound Semiconductor Devices		Bellotti	
EC772	VLSI Graduate Design Project		Hubbard	
EC773	Advanced Optical Microscopy and Biological Imaging		Mertz	
EC777	Nano-Optics		Dal Negro	
EC892	Seminar: Electro-Physics	Moustakas Ünlü	Moustakas Ünlü	
EC915	Computer Systems Engineering Team Project		Little	
EK501	Math Methods	Kotiuga		

Course and Program Development

The ECE Department continues to refine the graduate curriculum, with one new course developed and four formally adopted with assigned course numbers following pilots as special topics. In Fall 2007, one new course was offered: EC 700 - RF/Analog IC Design - Advanced Applications by Prof. Ronald Knepper. Special topics courses (EC 500 and EC 700) that were assigned course numbers and entered into the course inventory are:

» EC 741 - Randomized Network Algorithms (Spring 2008)
» EC 782 - RF/Analog IC Design (Spring 2008)
» EC 773 - Advanced Optical Microscopy and Biological Imaging (Fall 2007)
» EC 777 - Nano-Optics (Fall 2007)

The course EC 700 - Requirements, Design, and Testing for Distributed Software-Intensive Systems was proposed by John Brackett and will be taught in Fall 2008.

The ECE Graduate Committee also recommended a revision of the MS Project Course guidelines and piloted these revisions in the Spring of 2007. These changes include the adoption of a reader of all MS projects, the use of a standard template for the final MS Project document, and encouragement for more rigorous assessment for grade assignment. The MS Projects were presented in a poster format in this first iteration.

In addition to adding courses to the curriculum, the course designations for all ECE courses were changed from SC to EC. This change was made to reflect the shift in the department's programs over the years from Systems and Computer Engineering to Electrical and Computer Engineering. The change was implemented in the Fall 2007 semester.

In response to demand by ECE students, a new Bioelectrical Concentration was added to the ECE MS Program. This change creates a course thread in ECE for students wishing to specialize in topics in Electrical Engineering at the interface with biological systems. Similarly, the LEAP program was enhanced to match this new ECE MS Bioelectrical Concentration.

Finally, under ECE initiative, the PhD Applied Mathematics Qualifying Exam was recommended to be eliminated. The College subsequently adopted individual math requirements for each department that effectively replace the exam.
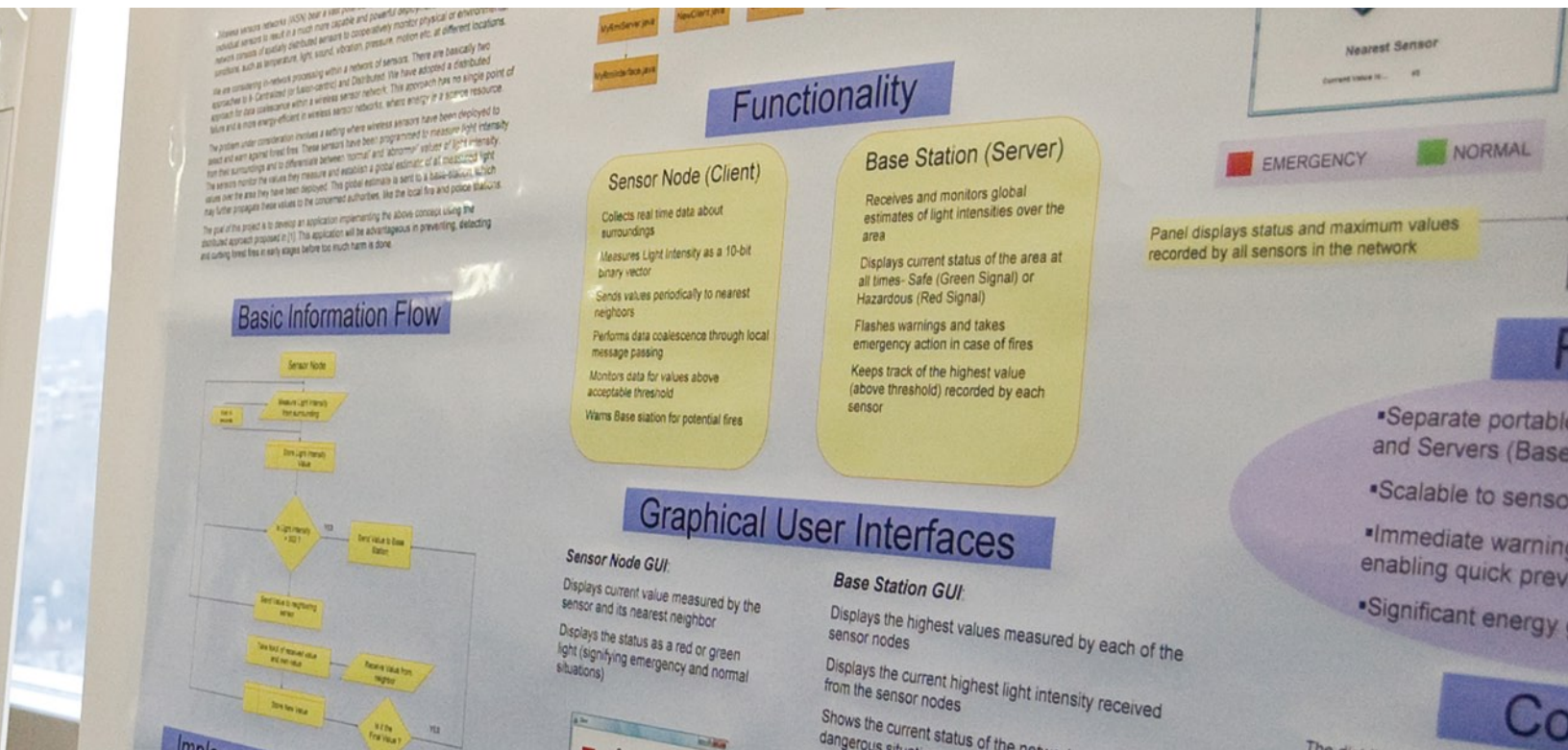
Instructional Laboratories

IMSIP Instructional Laboratory

Faculty: Karl, Konrad, Nawab, Oliver

This laboratory serves graduate instructional needs of the Department in the areas of multidimensional signal processing (including image and video processing), statistical signal processing, pattern recognition, as well as 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, Saleh, Teich, Ünlü

This lab supports introductory and intermediate level courses in the MS in Photonics program. Four stations have a 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.

Signals and Networks (SIGNET) Laboratory

Faculty: Bystrom, Carruthers, Konrad, Nawab

This laboratory provides instructional facilities for courses in the areas of signal processing and communication networks. This laboratory 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 Hyperception. The courses served by this laboratory include SC401 (Signals and Systems), SC415 (Communication Systems), SC416 (Intro to Digital Signal Processing), SC 512 (Digital Signal Processing), and some ECE modules in EK130 (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, Herbordt, 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 twenty-five 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.
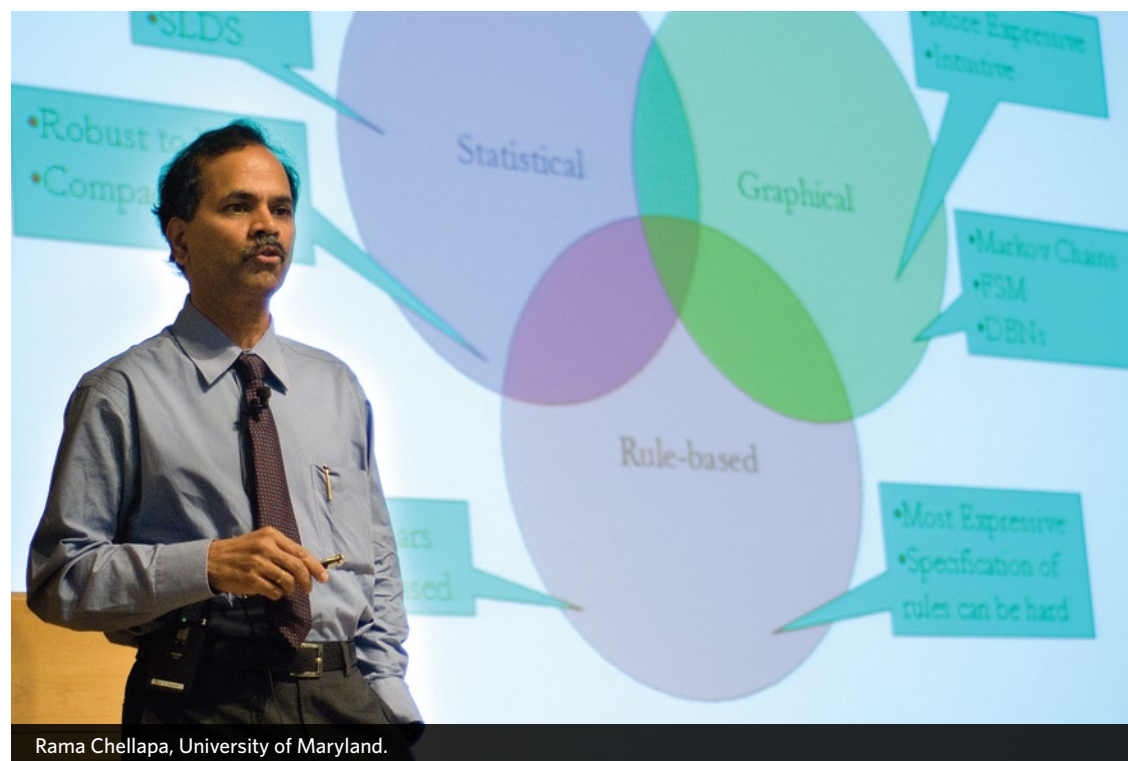
Colloquia & Seminars

The ECE Colloquium Series and Department Spotlight Seminar (DSS) series continued for another successful year. 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.

In addition to the Colloquium and DSS seminars, a number of additional talks by were given by visiting scholars on a variety of topics related to their current research.

| Date	Speaker	Title
7/10/2007	Janina Maultzsch Electrical Engineering Columbia University	Electron-Phonon Coupling in Metallic Carbon Nanotubes
9/19/2007	Franco Cerrina Electrical & Computer Engineering University of Wisconsin-Madison	Patterning at the Nanoscale: From Silicon to DNA[a]
9/21/2007	Alwyn Seeds Electronic & Electrical Engineering University College London	Photonic CW TeraHertz Sources
9/26/2007	Colin Sheppard Bioengineering National University of Singapore	Bioengineering and Bioimaging at National University of Singapore
10/23/2007	Barbara Simons Electronic Voting Expert	Computerized Voting Machines: Who is Counting your Vote?[a]
10/24/2007	Colin J. McKinstrie Bell Laboratories, Alcatel-Lucent	Parametric Processing of Optical Signals[a]
10/26/2007	Professor Martin Herbordt Electrical & Computer Engineering Boston University	Accelerating Discrete-Event Molecular Dynamics with an FPGA-Based Microarchitecture[b]
11/7/2007	Vivek Goyal Electrical Engineering & Computer Science Massachusetts Institute of Technology	Benefiting from Disorder: Source Coding for Unordered Data[a]
11/9/2007	Babak Kia Electrical & Computer Engineering Boston University	Lessons from the Land of Algorithm: Personal Reflections of Teaching in Iran[b]
11/15/2007	Robert Nowak Electrical & Computer Engineering University of Wisconsin-Madison	Network Inference from Co-Occurrences[a]
12/3/2007	Phillip Jones Computer Engineering Washington University	Adaptive Thermoregulation for Applications on Reconfigurable Devices
12/5/2007	Farouk El-Baz Center for Remote Sensing Boston University	Remote Sensing of Groundwater in Darfur[a]
12/7/2007	Steve Hranilovic Electrical & Computer Engineering McMaster University	Optical Wireless Communication Systems for Indoor and Long-Range Applications
1/30/2008	Lukas W. Snyman Electronic Engineering Tshwane University (South Africa)	Increased Emission Intensity of p+np Injection-Avalanche Si CMOS LED's (450nm-750nm) By Means of Depletion Layer Profiling and Reach-Through Techniques[a]

Date	Speaker	Title
2/1/2008	Wei Qin Electrical & Computer Engineering Boston University	Rendezvous Finite State Machine - A New Formalism for Hardware Modeling and Synthesis[b]
2/8/2008	Alan Pisano and Isabel Pisano Electrical & Computer Engineering Boston University	"Waging Peace" - Technical and Non-Technical Issues of Independent Film Making[b]
2/15/2008	David Schurig Electrical & Computer Engineering North Carolina State University	Transformation Design and Metamaterials: Tools for Conceiving and Realizing Invisibility Cloaks and Other Unique Devices
2/22/2008	Zygmunt J. Haas Electrical & Computer Engineering Cornell University	The Untold Story about the Romance between Mr. A.H Network and Mrs. S. Network and about their Son, Mr. D.-T Network[a]
2/27/2008	Anna N. Yaroslavsky Wellman Center for Photomedicine Massachusetts General Hospital	Optical Mapping of Skin Cancers
3/6/2008	Giovanni Ghione Electronic Engineering Politecnico di Torino	Physics-based noise simulation of semiconductor devices under large-signal operation
3/31/2008	Siddharth Ramachandran OFS Laboratories	Optical Fibers: Intelligent Structures that Manipulate Light
4/2/2008	Christos Flytzanis Laboratoire Pierre Aigrain Ecole Normale Superieure (France)	Photoinduced Magnetic Ordering and Spin Photogalvanic Effect In a Semimagnetic Semiconductor Quantum Microcavity

Rama Chellapa, University of Maryland.

Date	Speaker	Title
4/2/2008	Pavan Nuggehalli Vanu, Inc.	QoS with Selfish Nodes in Wireless Networks
4/4/2008b	Yelena Rykalova Electrical & Computer Engineering Boston University	How computer interconnection networks work and when they stop working (queues, latency, and saturation)[b]
4/9/2008	Rama Chellappa Electrical & Computer Engineering University of Maryland	Looking for Patterns in Video[a]
4/14/2008	Eugene N. Parker Enrico Fermi Institute University of Chicago	Hydrodynamics, Magnetohydrodynamics, and Astrophysical Plasmas & Fields
4/23/2008	Karl Ni University of California at San Diego	Statistical Learning Methods for Image Processing
4/25/2008	Andreas F. Molisch Mitsubishi Electric Research Labs and Lund University	Cross-Layer Optimization of Wireless Collaborative Ad-hoc Networks[a]
5/16/2008	John Day Electrical & Computer Engineering Boston University	What Went Wrong?: How the Internet Stagnated[b]
5/19/2008	Juan Hernández-Cordero Materials Research Institute Universidad Nacional Autónoma de México	Highly Nonlinear Fibers In All-Optical Modulators

a ECE Colloquium Series
b Research Spotlight Seminar
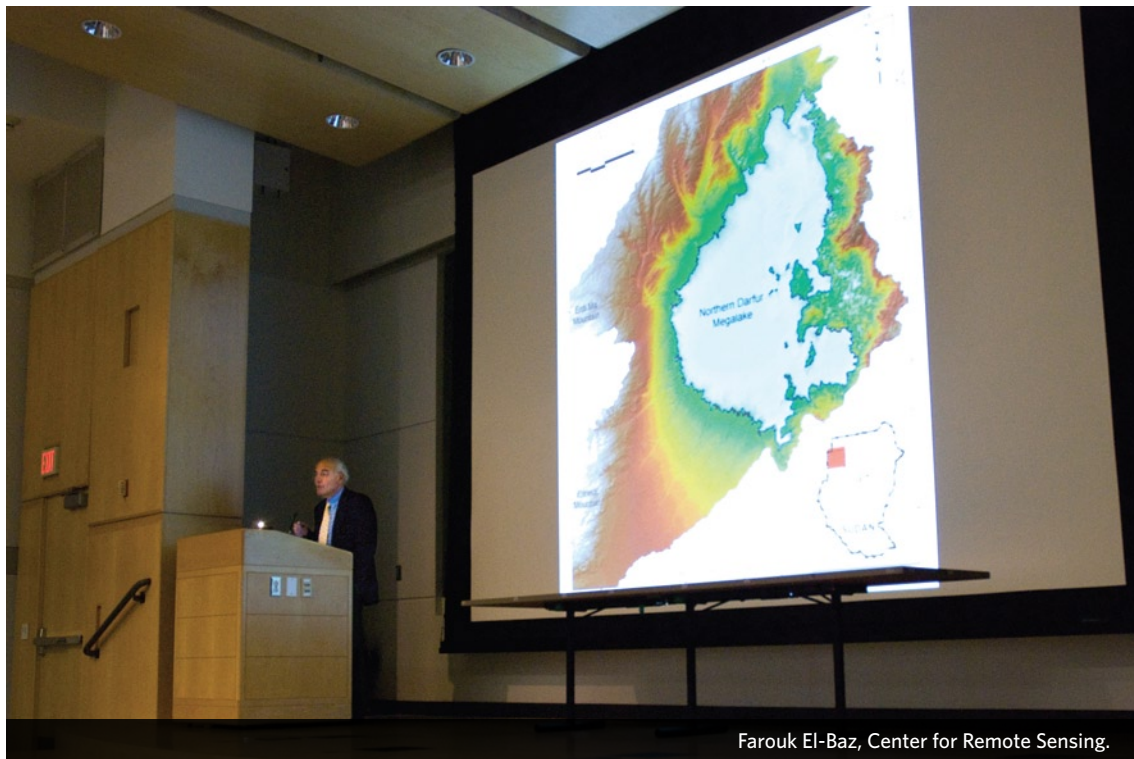
Farouk El-Baz, Center for Remote Sensing.

Research

ECE is a multidisciplinary department, with a strong systems perspective. There are three overlapping areas of research and instruction: Electrophysics, 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. The faculty has collegial ties to a number of important BU research centers, which are detailed in this section. ECE also has strong links with several other departments at the university. Many faculty members pursue collaborative cross-disciplinary research with faculty in other BU departments and have strong extramural ties in larger centers, multi-university initiatives, and industry collaboratives.

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 $7.8M, compared to $6.4M in the 1999-2003 period, and $4.1M in 1994-98.

The following tables delineate the new and continuing grants awarded over the 2008 fiscal year. The funding level for new grants, where an ECE faculty member is the Principal Investigator (PI) is approximately $6.2M. 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 $8.8M.

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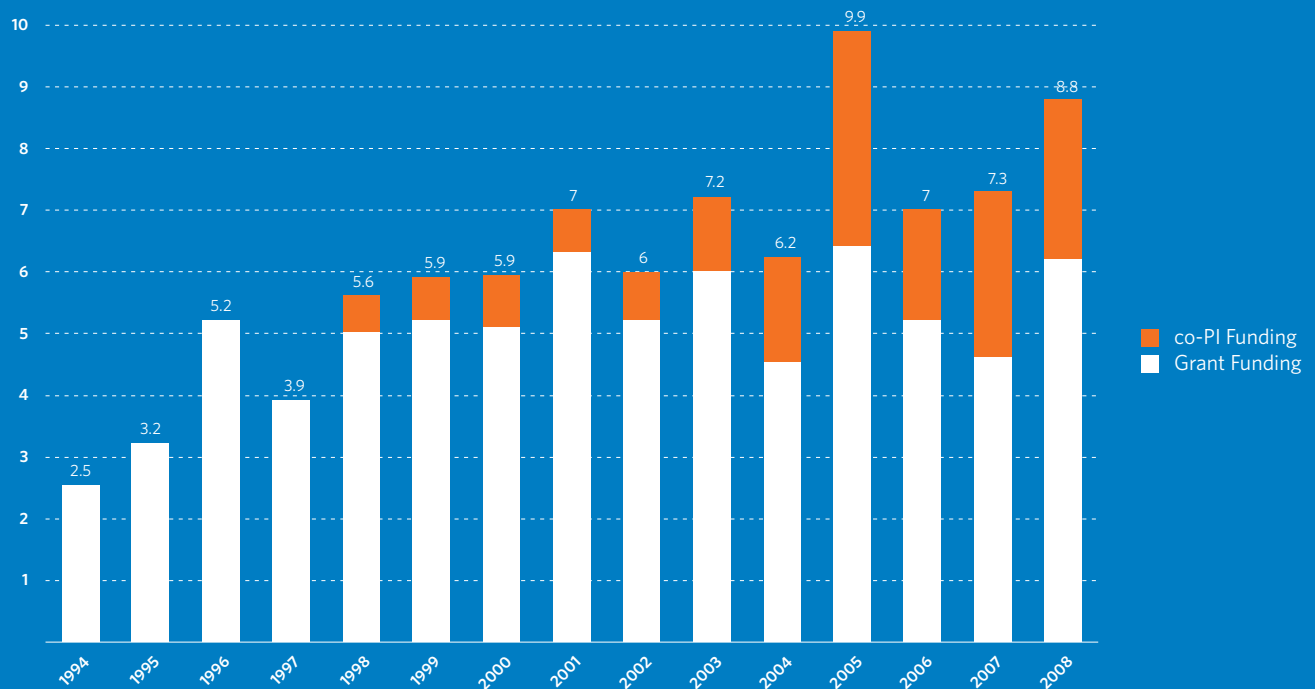
New Grants with ECE Principal Investigators

Recipient	Title of Award	Source	Begin	End	Amount
Bellotti, Enrico	New Sensing Capabilities for Situational Awareness (SBIR Phase II) (Subcontract via Photronix, Inc.)	DOD/Air Force	03/20/07	03/20/09	$25,000
Bellotti, Enrico	New Sensing Capabilities for Situational Awareness (SBIR Phase II) (Subcontract via Photronix, Inc.)	DOD/Air Force	03/20/07	03/20/09	$25,000
Bellotti, Enrico	Simulation Models for IR FPAs	CSC, US/BAE Systems	09/01/07	08/31/09	$46,000
Bellotti, Enrico	Simulation Models for IR FPAs	CSC, US/BAE Systems	09/01/07	08/31/09	$48,000
Castañón, David Karl, W. Clement	MURI: Fusion and Sensor Management for Automatic Target Exploitation (in conjunction with Center for Information and Systems Engineering) (Subcontract via Ohio State University Research Foundation)	DOD/Air Force	10/01/07	09/30/08	$250,004
Castañón, David Cassandras, Christos	Distributed Mission Control for Unmanned Air Vehicles in Stochastic Environments (in conjunction with Center for Information and Systems Engineering)	DOD/Air Force	07/01/07	11/30/08	$173,938
Castañón, David Saleh, Bahaa	Center for Subsurface Sensing and Imaging Systems (CenSSIS) -- Research Thrust 2 - Core MVT(Subcontract via Northeastern Univ.)	NSF	09/01/07	08/31/08	$294,717
Castañón, David	Graduate Student Support (R. Williams)	MIT/Lincoln Labs	09/01/07	12/31/07	$15,299
Castañón, David	Student Support for 2007 Conference on Decision and Control Held in New Orleans, LA	NSF	01/01/08	12/31/08	$10,000
Dal Negro, Luca	Biodegradable Communications System (Subcontract via Tufts University)	Tufts University/ DOD/Army	01/01/08	09/26/08	$136,625
Dal Negro, Luca	MURI: Electrically-Pumped, Silicon-Based Lasers for Chip-Scale Nanophotonic Systems (Subcontract via MIT)	DOD/Air Force	07/01/06	11/30/08	$100,000
Herbordt, Martin	FPGA-Based High Performance Computing	HHS/NIH/NCRR	07/01/07	04/30/08	$309,375
Herbordt, Martin	FPGA-Based High Performance Computing	HHS/NIH/NCRR	05/01/08	04/30/09	$278,688
Horenstein, Mark	STTR Phase II: Low Power MEMS Retroreflectors for Optical Communication (Subcontract via Boston Micromachines Corp.)	DOD/Army	11/01/07	10/31/09	$100,850
Ishwar, Prakash	CAREER: Information-Scaling Laws, "Bit-Conservation" Principles, and Robust Coding Architectures in Sensor Networks (in conjunction with Center for Information and Systems Engineering)	NSF	12/15/07	11/30/09	$164,470
Karl, W. Clement	Cardiac MDCT Artifact Reduction (Subcontract via MGH/CIMIT)	DOD/Army	01/01/07	08/31/08	$57,298
Karl, W. Clement	Foundation for Automatic Target Recognition (in conjunction with Center for Information and Systems Engineering)	DOD/Air Force	12/01/07	11/30/08	$84,914

Recipient	Title of Award	Source	Begin	End	Amount
Kotiuga, P. Robert	A Celebration of Raoul Bott's Legacy in Mathematics (in conjunction with Center for Computational Science)	NSF	06/01/08	05/31/09	$25,000
Lee, Min-Chang	Controlled Studies of Whistler Wave Interactions with Energetic Particles in Radiation Belts	DOD/Air Force	12/01/07	11/30/08	$110,000
Lee, Min-Chang	Controlled Studies of Whistler Wave Interactions and Energetic Particles in Radiation Belts	DOD/Air Force	12/01/07	11/30/08	$100,000
Little, Thomas Konrad, Janusz Ishwar, Prakash	NeTS-NOSS: Localized Computation and Network Path Formation to Enable Pervasive Video Sensing (in conjunction with Center for Information and Systems Engineering)	NSF	09/01/07	08/31/08	$150,000
Little, Thomas Konrad, Janusz Ishwar, Prakash	NeTS-NOSS: Localized Computation and Network Path Formation to Enable Pervasive Video Sensing (in conjunction with Center for Information and Systems Engineering)	NSF	09/01/08	08/31/09	$150,000
Morse, Theodore	Miniature Laser Therapy Endoscope (Subcontract via Massachusetts General Hospital)	HHS/NIH/NIBIB	08/01/07	07/31/08	$48,750
Morse, Theodore	Doped Silica Preforms and Tubes: OVD Process	OFS Laboratories	03/20/07	05/20/08	$60,000
Morse, Theodore	A New Approach to High-Power, Eye-Safe, Laser Technology Applications (in conjunction with Center for Nanoscience and Nano-biotechnology)	DOD/Navy	06/01/07	08/31/10	$250,000
Morse, Theodore	A New Approach to High-Power, Eye-Safe, Laser Technology Applications (in conjunction with Center for Nanoscience and Nano-biotechnology)	DOD/Navy	06/01/07	08/31/10	$250,000
Morse, Theodore	Ultra-High Definition (1 um) Digital X-Ray Imaging	MTTC	05/01/08	04/30/09	$40,000
Moustakas, Theodore	Deep UV Semiconductor Laser for in situ Organic and Biological Exploration (see source #9207-5) (Subcontract via Photon Systems, Inc.)	NASA	01/01/06	12/31/08	$125,000
Moustakas, Theodore Paiella, Roberto	Ultraviolet Electroabsorption Modulators Based on III-nitride Quantum Wells	NSF	09/01/07	08/31/10	$294,337
Moustakas, Theodore	Photonics Research and Development (Subcontract via University of Las Vegas Research Foundation)	DOE	02/01/08	07/31/08	$50,000
Paiella, Roberto	Plasmonic Band-Structure Engineering for Light-Emission Efficiency Enhancement	DOE	08/15/07	08/14/08	$99,771

Recipient	Title of Award	Source	Begin	End	Amount
Paiella, Roberto Moustakas, Theodore	Intersubband All-Optical Switching and Optically-Pumped Light Emission with III-Nitride Quantum Wells	NSF	09/01/08	08/31/09	$83,925
Qin, Wei	Rendezvous Finite State Machine: Where TLM Meets RTL	SRC	08/01/07	07/31/08	$60,000
Ruane, Michael Swan, Anna	REU Site: Research Experience for Under-graduate Students in Photonics	NSF	05/01/08	04/30/09	$2,704
Ruane, Michael Swan, Anna	REU Site: Research Experience for Under-graduates in Photonics	NSF	05/01/08	04/30/09	$111,751
Ruane, Michael Swan, Anna	REU Site: Research Experience for Under-graduates in Photonics	NSF	05/01/08	04/30/09	$4,000
Ruane, Michael Swan, Anna	Center for Subsurface Sensing and Imaging Systems (CenSSIS) -- Education Program (Subcontract via Northeastern Univ.)	NSF	09/01/07	08/31/08	$59,537
Saleh, Bahaa Teich, Malvin Sergienko, Alexander	Quantum Imaging: New Methods and Appli-cations (MURI) (Subcontract via University of Rochester)	DOD/Army	05/01/05	04/30/08	$89,711
Saleh, Bahaa	Center for Subsurface Sensing and Imag-ing Systems (CenSSIS) -- Research Thrust 1-Photonics (Subcontract via Northeastern Univ.)	NSF	09/01/07	08/31/08	$126,128
Saleh, Bahaa Nawab, S. Hamid	Learning an Integrated View of Engineering (LIVE)	NSF	01/15/08	12/31/09	$150,000
Saleh, Bahaa Teich, Malvin	Quantum Optical Coherence Tomography (CenSSIS Supplement) (Northeastern Uni-versity)	NSF	02/01/03	08/31/08	$35,000
Saligrama, Venkatesh	Automatic Dispersion Extraction from Acoustic Array Data	Schlumberger-Doll Research	01/01/07	12/31/07	$43,000
Saligrama, Venkatesh	Automatic Dispersion Extraction from Acoustic Array Data	Schlumberger-Doll Research	01/01/08	12/31/08	$43,000
Semeter, Joshua	Ground-Based Investigation of Upflowing Ions in the Discrete Aurora (in conjunction with Center for Space Physics)	NSF	01/01/08	12/31/08	$80,071
Semeter, Joshua	AMISR Graduate Studies: Development of Multi-Sensor Analysis Techniques and a Syn-ergistic Educational Program (in conjunction with Center for Space Physics)	NSF	01/01/08	12/31/08	$76,310
Semeter, Joshua	CAREER: Magnetosphere-Ionosphere Cou-pling Through Multi-Sensor Data Fusion	NSF	05/01/08	04/30/09	$80,081
Sergienko, Alexander Saleh, Bahaa Teich, Malvin Jaeger, Gregg	Phase-Sensitive Quantum-Optical Sensor (in conjunction with Photonics Center)	DOD/Army	08/01/07	09/10/08	$139,900

Recipient	Title of Award	Source	Begin	End	Amount
Sharif, Masoud	Collaborative Research: Low Peak to Average Power Multi-Carrier Signals via Coding: Fundamental Limits and Algorithms	NSF	09/01/07	08/31/09	$73,742
Starobinski, David Trachtenberg, Ari	WN: Management of Secondary Markets in Deregulated Wireless Networks (Collaborative Research) (in conjunction with Center for Information and Systems Engineering)	NSF	09/01/07	08/31/09	$200,000
Starobinski, David Alanyali, Murat	Secure and Efficient Data Distribution on Varying Topology Networks (in conjunction with Center for Information and Systems Engineering)	Deutsche Telekom	07/01/07	08/31/08	$50,118
Swan, Anna	Vibrational and Electronic Aspects of Carbon Nanotubes and Their Interactions (in conjunction with Photonics Center and Center for Nanoscience and Nanobiotechnology)	NSF	09/01/07	08/31/10	$300,000
Teich, Malvin Saleh, Bahaa Sergienko, Alexander	Quantum Imaging: New Methods and Applications (MURI) (Subcontract via University of Rochester)	DOD/Army	05/01/05	09/30/08	$128,803
Trachtenberg, Ari Starobinski, David	A Theory of Monitoring Based on Identifying Codes and Their Variants	NSF	10/01/07	09/30/10	$280,000
Ünlü, M. Selim Goldberg, Bennett	New Instrumentation for Nanoscale Subsurface Spectroscopy and Tomography (in conjunction with Center for Nanoscience and Nanobiotechnology) (Subcontract via University of Rochester) (see source #8281-5)	DOD/Air Force	06/15/03	09/30/08	$38,763
Subtotal	**Grants With ECE PIs**				**$6,129,580**

New Grants with ECE co-PIs

Recipient	Title of Award	Source	Begin	End	Amount
Brower, Richard Rebbi, Claudio	Collaborative Research: Multigrid QCD at the Petascale ($743,095)	NSF	12/01/07	11/30/11	$371,548
Brower, Richard Lane, Kenneth Cohen, Andrew Rebbi, Claudio Glashow, Sheldom	Research in Particle Physics, Task E: Theoretical Particle Physics ($100,000)	DOE	02/01/07	01/31/08	$20,000
Castañón, David Baillieul, John	Behavioral Dynamics in the Cooperative Control of Mixed Human/Robotic Teams (MURI-07) (in conjunction with the Center for Information and Systems Engineering) ($1,285,246)	DOD/Air Force	12/01/07	11/30/08	$642,623
Dal Negro, Luca Reinhard, Bjorn M. Ziegler, Lawrence	Development of Efficient SERS Substrates via "Rationally" Designed Novel Nonofabrication Strategies ($216,366)	DOD/Army	06/06/07	06/30/08	$72,122
Giles, Roscoe Holmes, Raquell	BPC-A-Empowering Leadership: Computing Scholars of Tomorrow (Subcontract via Rice University) ($42,499)	NSF	03/01/07	02/28/09	$21,250
Hubbard, Allyn E.	Soldier Wearable ADF ($520,934)	DOD/Army	06/06/07	06/30/08	$520,934
Hubbard, Allyn E.	Continued Miniaturization of ADF ($116,761)	DOD/Army	06/06/07	06/30/08	$116,761
Little, Thomas Wagenaar, Robert	Body-Area Instrumentation (LIFT Monitor) for Avoidance of Workplace Injury (in conjunction with the Center for Information and Systems Engineering) ($125,016)	The Hartford	01/01/08	08/31/08	$62,508
Moustakas, Theodore **Paiella, Roberto** **Bellotti, Enrico**	Development of III-Nitrides Based on Opto-electronics from the UV to the THz Biochemical Threat Detection ($299,904)	DOD/Army	06/06/07	06/30/08	$99,968 $99,968 $99,968
Nawab, S. Hamid De Luca, Carlo Roy, Serge Jabre, Joe	Wearable Sensor System for Monitoring Motor Function ($617,760)	HHS/NIH/NIBIB	09/01/07	08/31/08	$154,440
Nawab, S. Hamid De Luca, Carlo	Harnessing Motoneuron Activity: From Lab to Clinic ($619,987)	HHS/NIH/NICHD	06/01/08	05/31/09	$150,000
Ünlü M. Selim **Sharif, Masoud** Irani, Rostem	Compact Label-Free Multiplexed Immunosensor ($243,701)	DOD/Army	06/06/07	06/30/08	$81,234 $81,234
Ünlü, M. Selim Goldberg, Bennett	Nanoscale Measurements of Field Localization in Deterministic Aperiodic Arrays (Subcontract via University of Rochester) ($36,237)	DOD/Air Force	06/15/03	09/30/08	$18,119
Ünlü, M. Selim Goldberg, Bennett	Nanoscale Measurements of Field Localization in Deterministic Aperiodic Arrays (Subcontract via University of Rochester) ($48,622)	DOD/Air Force	06/15/06	01/14/08	$24,311
Subtotal	**Grants With ECE co-PIs**				**$2,636,988**
Grand Total					**$8,766,568**

Continuing Grants

Recipient	Title of Award	Source	Begin	End
Alanyali, M.	CAREER: Scalable Architectures for Self-Managed Networks	NSF	07/01/03	07/31/08
Alanyali, M. Saligrama, V.	Distributed Methods for Statistical Decision Making in Net-worked Environments REU Supplement	NSF	08/01/04	07/31/08
Alanyali, M. Saligrama, V.	Distributed Methods for Statistical Decision Making in Net-worked Environments	NSF	08/01/04	07/31/08
Bellotti, E.	CAREER: Theoretical Investigation of Single Photon Detection for Quantum Technology: A Nano-Structure Devices Approach	NSF	05/01/05	04/30/10
Bellotti, E.	Development of Low-Stress Ohmic Contacts for HGCDTE	DODDS	09/22/06	12/14/08
Morse, T.	Specialty Fibers for Clinical Applications	DOD/Air Force	12/01/04	07/31/08
Morse, T.	Aerosol/Combustion Synthesis of Unaglommerated Yttria Nano-particles	DOD/Air Force	04/30/07	07/31/08
Moustakas, T.	Photonics Research and Development	DOE	08/01/05	07/31/08
Oliver, W.	Incoherent Scatter Radar Studies of Hot Oxygen	NSF	11/15/03	10/31/09
Oliver, W.	REU Supplement: Incoherent Scatter Radar Studies of Hot Oxygen	NSF	11/15/03	10/31/09
Roy, R.	Quantitative Ultrasound Imaging and Coral Imaging	MBS/NEU	01/01/03	06/30/08
Roy, R.	The Utilization of the Analogic Ultrasound Imaging Engine in API and MedBED	NSF	05/01/03	08/31/08
Saleh, B. Roy, R. Cleveland, R.	CenSSIS Research Thrust 1: Acoustics	NSF	07/01/00	08/31/08
Saligrama, V.	CAREER: A Systems Approach to Networked Decision Making in Uncertain Environments	NSF	06/01/05	05/31/08
Saligrama, V.	Networked Sensing Systems for Urban Target Recognition	ONR/ERA	12/31/05	12/30/08
Semeter, J.	AMISR Graduate Studies: Development of Multi-Sensor Analysis Techniques and a Synergistic Educational Program	NSF	01/01/06	12/31/08
Starobinski, D.	CAREER: Quality of Service Engineering with Multiple Time-Scale Traffic (REU)	NSF	05/01/03	07/31/09
Starobinski, D.	REU Supplement: NeTS-NOSS: SensorNet Architecture for Indoor Location Detection: From Resolution to Robustness	NSF	09/01/04	08/31/08
Starobinski, D.	CAREER: Quality of Service Engineering with Multiple Time-Scale Traffic	NSF	08/01/02	09/30/08
Starobinski, D. Trachtenberg, A.	REU Supplement: NeTS-NOSS: SensorNet Architecture for Indoor Location Detection: From Resolution to Robustness	NSF	09/01/04	08/31/08
Trachtenberg, A.	CAREER: Practical Data Synchronization: Minimizing Communication	NSF	02/01/02	08/31/08
Ünlü, M.S.	High-Throughput, Label-Free Promoter Sequence Discovery	PHS/NIH/NIGMS	07/01/06	06/30/09
Ünlü, M.S. Swan, A. Goldberg, B. DeLisi, C.	IRES: US-Turkey-Switzerland Collaboration on Resonant Struc-tures for Biosensing and Imaging (In conjunction with the Center for Nanoscience and Nanotechnology)	NSF	05/01/06	04/30/09
Ünlü, M.S. Swan, A. Goldberg, B. DeLisi, C.	IRES: US-Turkey-Switzerland Collaboration on Resonant Struc-tures for Biosensing and Imaging: Participant Support (In con-junction with the Center for Nanoscience and Nanotechnology)	NSF	05/01/06	04/30/09

Faculty Publications

Books
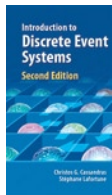
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Z. Liang, S. Do, **W.C. KARL**, T. Brady, and H. Pien, "Analysis and Mitigation of Calcium Artifacts in Multidetector CT," *Proceedings of 2008 IEEE Intl. Symposium on Biomedical Imaging*, Paris, FR, May, 2008.

M.J. King, B. Black, B. Harris, M. Hynes, R. Lanza, **W.C. KARL**, and **D. CASTAÑÓN**, "Cooperative Semi-Autonomous Mobile Networked Sensors for Enhanced Location of Radiological Threats", 9th International Conference on Applications of Nuclear Techniques, 2008.

K. Kulikowski, Z. Wang, and **M.G. KARPOVSKY**, "Comparative Analysis of Fault Attack Resistant Architectures for Private and Public Key Cryptosystems," *International Workshop on Fault-tolerant Cryptographic Devices,* 2008.

K. Kulikowski, V. Venkataraman, Z. Wang, **A. TAUBIN**, and **M.G. KARPOVSKY,** "Asynchronous Balanced Gates Tolerant to Interconnect Variability," *Proceedings of ISCAS,* May 2008.

M.G. KARPOVSKY, K. Kulikowski, and Z. Wang, "Robust Error Detection in Communication and Computation Channels," *International Workshop on Spectral Techniques,* 2007.

K. Kulikowski, **M.G. KARPOVSKY**, A. Taubin, and Z. Wang, "System-Level Concurrent Fault Detection for Secure QDI Asynchronous Circuits," *Workshop on Dependable and Secure Nanocomputing,* DSN-08.

R.S. Stankovic, J. Astola, and **M.G. KARPOVSKY**, "Some Historical Remarks on Switching Theory," *International Workshop on Spectral Techniques,* 2007.

R. Mathur, C. Lin, K. Aizikov, **R.W. KNEPPER**, and P.B. O'Connor, "A Novel, High Sensitivity Cryogenic Fourier Transform Ion Cyclotron Mass Spectrometer," *56th ASMS Conference on Mass Spectrometry,* Denver, CO, June 2-6, 2008.

P-M. Jodoin, **V. SALIGRAMA**, and **J. KONRAD**, "Behavior Subtraction," *SPIE Visual Communications and Image Process*, vol. 6822, pp. 10.1-10.12, January 2008.

P.R. KOTIUGA, "Knotted Linear Force-Free Magnetic Fields: Topological Aspects," *6th International Conference on Industrial and*

Applied Mathematics (ICIAM 07), Zurich, Switzerland, 16-20 July 2007.

L. LEVITIN and **T. TOFFOLI**, "Orthogonalization Time Revisited," *The 9th Conference on Quantum Structures, QS2008*, Sopot, Poland, July 2008.

L. LEVITIN and **T. TOFFOLI**, "A Generalized Bound On The Rate Of Quantum Dynamics," *The 9th International Conference on Quantum Communication, Measurement and Computing, QCMC 2008*, Calgary, Canada, August 2008.

S. Agarwal, **D. STAROBINSKI**, and **T.D.C. LITTLE**, "Analytical Model for Message Propagation in Vehicular Ad Hoc Networks," *IEEE Vehicular Technology Conference 2008, Singapore, May 2008.*

J.P. Tower and **T.D.C. LITTLE**, "A Proposed Scheme for Epidemic Routing With Active Curing for Opportunistic Networks," Okinawa, Japan, March 2008.

S. Guo, C. Fan, and **T.D.C. LITTLE**, "Supporting Concurrent Task Deployment in Wireless Sensor Networks," *International Symposium on Network Computing and Applications (NCA2008),* Cambridge, MA, June 2008.

W. Ke and **T.D.C. LITTLE**, "Dynamic Routing for Wireless Sensor Networks," *International Symposium on Network Computing and Applications (NCA2008),* Cambridge, MA, June 2008.

T.D.C. LITTLE and A. Agarwal, "Connecting Vehicles to 'The Grid'," *NITRD National Workshop on High-Confidence Automotive Cyber-Physical Systems,* Troy, MI, 3-4 April, 2008.

A. Rosales-Garcia, **T. F. MORSE**, and J. Hernandez-Cordero, "Polarization Mode Beating Intracavity Technique for Fiber Laser Sensing," *19th International Conference on Optical Fibre Senors*, SPIE, vol. 7004, pp. 70045U-70045-5, June 2008.

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R. PAIELLA, "Plasmonic Dispersion Engineering for Light-Emission Efficiency Enhancement," *Fundamental Synthesis Research Challenges for the 21st Century Materials: Mechanism and Methods*, DOE Office of Basic Energy Sciences, Baltimore, MD, July 2007.

I. PASCHALIDIS, W. Lai and X. Song, "A Decomposition Method for Transmission Scheduling in Multi-Channel Wireless Sensor Networks," *IEEE INFOCOM Conference*, Phoenix, AZ, April 2008.

I. PASCHALIDIS and D. Guo, "Robust and Distributed Localization in Sensor Networks," *46th IEEE Conference on Decision and Control*, pp. 933-938, New Orleans, LA, December 2007.

Y. Shen, P. Vakili, S. Vajda and **I. PASCHALIDIS**, "Optimizing Noisy Funnel-like Functions on the Euclidean Group with Applications to Protein Docking," *46th IEEE Conference on Decision and Control*, pp. 4545-4550, New Orleans, Louisiana, December 2007.

P. Pennesi and **I. PASCHALIDIS**, "Solving Sensor Network Coverage Problems by Distributed Asynchronous Actor-Critic Methods," *46th IEEE Conference on Decision and Control*, pp. 5300-5305, New Orleans, LA, December 2007.

I. PASCHALIDIS, W. Lai and X. Song, "Optimal Transmission Scheduling Policies for Wireless Sensor Networks with Frequen-cy Diversity," *46th IEEE Conference on Decision and Control*, pp. 512-517, New Orleans, LA, December 2007.

K. Li, S.-C. Kang, and **I. PASCHALIDIS**, "Some Results on the Analysis of Stochastic Processes with Uncertain Transition Probabilities and Robust Optimal Control," *45th Annual Allerton Conference on Communication, Control, and Computing*, Monticello, IL, September, 2007.

W. Lai and **I. PASCHALIDIS**, "Sensor Network Minimal Energy Routing with Latency Guarantees," *ACM MobiHoc 2007 Conference*, pp. 199-208, Montreal, Canada, September, 2007.

E. Ozkumur, J. Needham, D.A. Bergstein, A.C. Wu, **M.F. RUANE**, **B.B. GOLDBERG**, and **M.S. ÜNLÜ**, "Label-free Microarray Imaging Using Spectral Reflectance Information," *2007 BMES Annual Fall Meeting*, September 2007.

E. Ozkumur, J. Needham, D.A. Bergstein, **M.F. RUANE**, **B.B. GOLDBERG**, and **M.S. ÜNLÜ**, "Label-free and High-Throughput Screening of Biomolecular Interactions," *Proceedings of CLEO/QELS 2008*, 2008.

T. Yarnall, A. F. Abouraddy, **B.E.A. SALEH**, and **M.C. TEICH**, "Entangled Qubits in Photonic Spatial-Parity Space Entangled Qubits in Photonic Spatial-Parity Space," *Royal Society Conference on Photons, Atoms, and Qubits (PAQ07)*, London, UK, September 2007.

S. Capozzi, **J. SEMETER**, and J. P. Thayer, "Probing the Auroral Acceleration Region through ISR Inversion," *AGU*, San Francisco, 2007.

M. Zettergren and **J. SEMETER**, "Optical Estimation of the Ionospheric State," *AGU*, San Francisco, 2007.

O. Minaeva, N. Mohan, M. Jaspan, **A. SERGIENKO**, **M.C. TEICH**, **B.E.A. SALEH**, and G. N. Goltsman, "Superconducting Single Photon Detectors for Biophotonics Applications," *SPIE Optics East*, Boston, MA, September 2007.

O. Minaeva, N. Mohan, M. Jaspan, **A. SERGIENKO**, **M.C. TEICH**, **B.E.A. SALEH**, and G. N. Goltsman, "Biophotonics Applications of Superconduting Single-Photon Detectors," *Single-Photon Workshop*, Istituto Nazionale di Recerca Metrologica, Turino, Italy, September 2007.

A. SERGIENKO, M. Jaspan, **B.E.A. SALEH**, and **M.C. TEICH,** "New Sources of Optical Entanglement for Quantum Cryptography

At 1.5 Microns," *SPIE Optics East 2007*, Boston, MA, September 2007.

N. Mohan, O. Minaeva, M. Nasr, **B.E.A. SALEH**, **A. SERGIENKO**, and **M.C. TEICH**, "Optical Coherence Domain Imaging Using Super-Conducting Single-Photon Detectors," *SPIE Photonics West*, San Jose, CA, January 2008.

A. SERGIENKO, C. Bonato, **B.E.A. SALEH**, S. Bonora, and P. Villoresi, "Aberration Cancellation in Quantum Interferometry," *3rd International conference of Quantum Information, ICQI 2008*, Boston, MA, July 2008.

C. Bonato, **A. SERGIENKO**, **B.E.A. SALEH**, S. Bonora, and P. Villoresi, "Even-order Aberration Cancellation in Quantum Interferometry," *4th International Workshop "Advances in foundations of Quantum Mechanics and Quantum Information with Atoms and Photons,"* Turing, Italy, May 2008.

J. SEMETER, "Radar and Optical Observations of Plasma Instabilities Related to Auroral Phenomena," *International Union of Geodesy and Geophysics (IUGG) General Assembly*, Perugia, Italy, July 2007.

S. Capozzi, **J. SEMETER**, and J.P. Thayer, "Probing the Auroral Acceleration Region through ISR Inversion," *AGU Fall Meeting*, San Francisco, 2007.

M. Zettergren and **J. SEMETER**, "Optical Estimation of the Ionospheric State," *AGU Fall Meeting*, San Francisco, 2007.

A. SERGIENKO, "Precise Optical Measurement in the Infrared with Superconducting Single-Photon Detectors (SSPD)," *SPW 2007, Single-Photon Workshop*, INRIM Istituto Nazionale di Recerca Metrologica, Turin, Italy, September 2007.

O. Minaeva, **A. SERGIENKO**, and G. Goltsman, "High-Speed Infrared Photon Counting with Superconducting Single-Photon Detectors (SSPD) for Quantum Communication", *SPIE Symposium on Defense & Security*, Orlando, FL, March 2008.

A. SERGIENKO, C. Bonato, S. Bonora, and P. Villoresi, "Engineering Multiparameter Entangled States With Adaptive Optics," *4th International Workshop "Advances in foundations of Quantum Mechanics and Quantum Information with Atoms and Photons,"* Turing, Italy, May 2008.

H. Entekhabi and **M. SHARIF**, "On the Peak to Average Power Re-

duction of OFDM Signals Using Reserved Subcarriers," *IEEE International Symposium on Personal, Indoor and Mobile Radio Communications PIMRC*, March 2008.

M. Vu, N. Devroye, **M. SHARIF**, and V. Tarokh, "Scaling laws of cognitive networks," *International Conference on Cognitive Radio Oriented Wireless Networks and Communications*, August 2007.

R. Cohen, N. Fazlollahi, and **D. STAROBINSKI**, "Competitive Advance Reservation with Bounded Path Dispersion," *IEEE HSN 2008*, Phoenix AZ, April 2008.

A. Hagedorn, **D. STAROBINSKI**, and **A. TRACHTENBERG**, "Rateless Deluge: Over-the-Air Programming of Wireless Sensor Networks using Random Linear Codes," *ACM/IEEE IPSN 2008*, Saint Louis, MO, April 2008.

M. Laifenfeld, **A. TRACHTENBERG**, R. Cohen, and **D. STAROBINSKI**, "Joint Monitoring and Routing in Wireless Sensor Networks using Robust Identifying Codes," *IEEE Broadnets 2007*, Raleigh, NC, September 2007.

A.N. Vamivakas, M. Atatüre, J. Dreiser, S. T. Yilmaz, A. Badolato, **A.K. SWAN**, **B.B. GOLDBERG**, A. Imamoglu, and **M.S. ÜNLÜ**, "Solid Immersion Lens Assisted Resonant Light Scattering from a Single Quantum Dot," *Laser and Electronics Optical Society*, Lake Buena Vista, FL, 2007.

M. Dogan, **A.K. SWAN**, **M.S. ÜNLÜ**, and **B.B. GOLDBERG**, "Nanometer Scale Axial Localization of Fluorescent Emitters for Cellular Imaging," *Laser and Electronics Optical Society*, Lake Buena Vista, FL, 2007.

K. Kulikowski, V. Venkataraman, Z. Wang, and **A. TAUBIN**, "Power Balanced Gates Insensitive to Routing Capacitance Mismatch," *The 11th Design, Automation and Test in Europe (DATE)*, March 2008.

T. TOFFOLI, "Renaissance Man: CVI BONO? Charting a Path from Hands-on Learning to Literate Design," *Creating the New Humanist in University Undergraduate Education*, Boston University, April 2008.

T. TOFFOLI, "Lattice Gases vs Cellular Automata: The Whole Story at Last," *Automata 2008*, Bristol, June 2008.

E. Ozkumur, J. Needham, D. A. Bergstein, **B.B. GOLDBERG**, and **M.S. ÜNLÜ**, "Label-free Real-time Microarray Imaging Using

Spectral Reflectivity Information," *Photonics West 2008 - BIOS*, January 2008.

F.H. Koklu, A.N. Vamivakas, J.I. Quesnel, S.B. Ippolito, **B.B. GOLD-BERG**, and **M.S. ÜNLÜ**, "Subsurface Imaging of Integrated Circuits with Widefield and Confocal Microscopy Using Numerical Aperture Increasing Lens," *Proceedings of IEEE Lasers and Electro-Optics Society 2007 Annual Meeting*, October 2007.

A. Yalcin, F. Damin, E. Ozkumur, G. di Carlo, **B.B. GOLDBERG**, M. Chiari, and **M.S. ÜNLÜ**, "Characterization of Swelling of A Polymeric Coating for DNA Microarray Applications Using Spectral Self- Interference Fluorescence Microscopy," *Proceedings of IEEE Lasers and Electro-Optics Society 2007 Annual Meeting*, October 2007.

M. Ghioni, G. Armellini, P. Maccagnani, I. Rech, M. K. Emsley, and **M.S. ÜNLÜ**, "Resonant-Cavity- Enhanced Single Photon Avalanche Diodes," *Single-Photon Workshop 2007*, September 2007.

A. Abdo, M. Sahin, P. S. Spuhler, A. C. Wu, V. Jayasinha, and **M.S. ÜNLÜ**, "Floating Light Activated Micro-Electrical Stimulators," *Neural Interfaces Conference*, Cleveland, OH, June 2008.

M.S. ÜNLÜ, "Optik Girisim Goruntuleme - Molekuler konformasyon ve protein dizin olcumlerine uygulamalar [Applications of Optical Resonance to Biological Imaging and Label-free Protein Microarrays] ," *Biyomut 08, 13th Biyomedikal Muhendisligi Ulusal Toplantisi*, ODTU, Ankara, May 2008.

A. Yalcin, F. Damin, I. E. Ozkumur, G. di Carlo, **B.B. GOLDBERG**, **M.S. ÜNLÜ**, and M. Chiari, "Characterization of A Polymeric Coating for Microarray Applications using Spectral Self-Interference luorescence Microscopy," *Photonics West 2008 - BIOS*, 2008.

Invited Lectures

M. ALANYALI and M. Dashouk, "On Power-of-Choice in Downlink Transmission Scheduling," 3rd Information Theory and Applications Workshop, UCSD, January 2008.

M. ALANYALI, A. Al Daoud, and **D. STAROBINSKI**, "Pricing Spectrum Access in Cellular CDMA Networks with Heterogeneous Demand," IEEE Broadnets 2007, Raleigh, September 2007.

M. ALANYALI, "Dynamics of Reinforcement Learning with Applications in Data Networks," McGill University, March 2007.

H. ALTUG, "Plasmonic and Photonic Crystal Based Sensors for Bio-detection," Boston University, Future of Light Symposium, Boston, MA, June 16, 2008.

H. ALTUG, "Nanophotonic Devices for Communication and Sensing," OSA New England Chapter, Waltham, MA, February 21, 2008.

E. BELLOTTI, "Trends for Photonics Research in the USA—Implications for Systems in Developing Countries," TUT-University and University of Pretoria, South Africa, August 7, 2007.

I.J. BIGIO, "Light Scattering Spectroscopy for the Detection of Early Cancer and Pre-cancer," OSA Ukraine Chapter, Kharkov, Ukraine, May 2008.

I.J. BIGIO, "Overview of Diagnostic Optical Spectroscopy," Society for Applied Spectroscopy, New England Chapter, January 2008.

I.J. BIGIO, "Optical Spectroscopy in Clinical Cancer Diagnosis," College of Engineering, University of Connecticut, December 2007.

I.J. BIGIO, "Elastic Light Scattering Spectroscopy for the Detection of Early Cancer and Pre-cancer," Jordanian International Biomedical Engineering Conference, Amman, Jordan, November 2007.

I.J. BIGIO, "Optical Spectroscopy for Noninvasive Detection of Early Cancer," INAOE Puebla, Mexico, October 2007.

R.C. BROWER, The XXV International Symposium on Lattice Field Theory, University of Regenburg, July 20, 2007.

C.G. CASSANDRAS, "Scalable Optimization of Systems with Real-Time Constraints," BBN Technologies, Cambridge, MA, October 2007.

C.G. CASSANDRAS, "Event-Driven Sensing for Enterprise Reconfigurability and Optimization," NSF EFRI Program meeting, Arlington, VA, December 2007.

C.G. CASSANDRAS, "Joys and perils of Automation," NSF Worshop on Systems and Control for High School Students, New Orleans, LA, December 2007.

C.G. CASSANDRAS, "Cooperative Control and Optimization of Sensor Networks in Uncertain Environments," University of Cyprus, Nicosia, Cyprus, October 2007.

C.G. CASSANDRAS, "Asynchronous Distributed Optimization: Achieving Cooperation with Minimal Communication," AFOSR Program meeting, Arlington, VA, April 2008.

C.G. CASSANDRAS, "Cooperation with Minimal Communication: Asynchronous Distributed Optimization and Applications to Wireless Sensor Networks," Workshop on New Directions in Systems and Control, Beijing, China, June 2008.

C.G. CASSANDRAS, "A New "Best Rank" Approach for Solving a Class of Stochastic Optimization Problems in Real Time," Tsinghua University, Beijing, China, June 2008.

C.G. CASSANDRAS, "How Much Communication to Achieve Optimal Cooperation ?," Chinese Academy of Sciences, Beijing, China, June 2008.

L. DAL NEGRO, "Nanoplasmonics: Science and Technology of Metal Nanostructures," Boston University, Boston, MA, June 16, 2008.

L. DAL NEGRO, "Silicon-based Light Emitting Nanomaterials and Plasmonic Structures," California Institute of Technology, Pasadena, CA, April 1, 2008.

L. DAL NEGRO, "Light Scattering, SERS Sensing and Structural Colour in Deterministic Aperiodic Structures," University of Trento, Trento, March 7, 2008.

L. DAL NEGRO, "Surface Enhanced Raman Scattering and Structural Colour in Deterministic Aperiodic Structures," University of Verona, Verona, Italy, March 5, 2008.

L. DAL NEGRO, "Light Scattering, SERS Sensing and Structural Colour in Deterministic Aperiodic Structures," European Laboratory for Nonlinear Spectroscopy (LENS), Florence, Italy, March 3, 2008.

L. DAL NEGRO, "Giant Field Enhancement and Localization in Aperiodic Plasmonic Structures," IEEE-LEOS Plasmonics Workshop, MIT Lincoln Laboratory, November 7, 2007.

A. Gopinath, N.-N. Feng, and L. DAL NEGRO, "Deterministic Aperiodic Plasmonic Structures," LEOS 07, Buena Vista, FL, October 24, 2007.

L. DAL NEGRO, "Silicon Photonics and Plasmonic Structures," European Optical Society Meeting, Capri, Italy, September 30-October 3, 2007.

L. DAL NEGRO, "Silicon-based Plasmonic Structures," OSA-Optical Micro-Systems, Capri, Italy, September 30 ñ October 3, 2007.

L. DAL NEGRO, "Energy Transfer and Light Emission from Erbium-doped Silicon Nanostructures," CNEC-LEOS, MIT Lincoln Library, September 13, 2007.

R. GILES, "Jobs in Computing," SC2007 Conference, November 2007.

R. GILES, "Universities and Diversity," Tapia Celebration of Diversity, October 15, 2007.

M.C. HERBORDT, "High Performance Computing Using FPGAs," Altera Corp, Santa Cruz, CA, April 16, 2008.

M.C. HERBORDT, "High Performance Reconfigurable Computing: Case Study in Discrete Event Simulation," Massachusetts Institute of Technology, Cambridge, MA, April 4, 2008.

M.C. HERBORDT, "High Performance Computing Using FPGAs: Case Studies in Bioinformatics and Compuational Biology," Division of Engineering, Brown University, Providence, RI, April 3, 2008.

M.C. HERBORDT, "Does High Performance Computing Using FPGAs Work?," IBM T.J. Watson Research Center, Yorktown Heights, NY, February 1, 2008.

M.C. HERBORDT, "High Performance Reconfigurable Computing:

Case Study in Discrete Event Simulation," Washington University, St. Louis, MO, November 2, 2007.

M.C. HERBORDT, "Discrete Event Simulation of Molecular Dynamics using Configurable Logic," Imperial College, London, United Kingdom, August 31, 2007.

A. HUBBARD, D. Anderson, S. Chiu, D. Freedman, T. Gore, **W.C. KARL**, D. Mountain, M. Nourzad, Y. Pu, A. Zosuls, and S. Deligeorges, "Biomimetic Acoustic Direction Finding System," 19th International Congress on Acoustics, Madrid, Spain, September 2007.

P. ISHWAR, "A Relay-assisted Distributed Source Coding Problem," 3rd International Workshop on Information Theory and its Applications (ITA '08), San Diego, CA, January 2008.

P. ISHWAR, "Distributed Field Reconstruction in Sensor Networks," Center for Advanced Network Sciences (ANS) inaugural invited summer lecture series, California Institute of Telecommunications and Information Technologies, University of California, San Diego, CA, August 1-10, 2007.

M.G. KARPOVSKY, Moscow State University, Russia, 2007.

M.G. KARPOVSKY, Tel-Aviv University, Israel, 2007.

J. KONRAD, "Videopsy: Enabling Technology for Camera Webs," Worcester Polytechnic Institute, Worcester, MA, March 13, 2008.

J. KONRAD, "3-D Displays and Signal Processing: An Answer to 3-D Ills?," XV-th European Signal Processing Conference, EU-SIPCO-2007, Poznan, Poland, September 7, 2007.

P.R. KOTIUGA, "A Rationale for Pursuing EIT and MREIT in 3-D based on Weyl Asymptotics and Problem Conditioning," EIT 2008 Conference, Dartmouth College, Hannover, NH, June 16-18, 2008.

P.R. KOTIUGA, "Cochains, Combinatorial TXFTs, Networks, Bott and History," A Celebration of Raoul Bott's Mathematical Legacy, CRM, Montreal, Canada, June 9-13, 2008.

P.R. KOTIUGA, "Algebraic Number Fields, Primes, and Photonic Devices," 1036th Meeting of the AMS, Courant Institute, New York University, New York, NY, March 15-16, 2008.

M.C. LEE, "Ionospheric Plasma Turbulence Triggered over Puerto Rico via Rayleigh-Taylor Instability by Tsunami-launched Acoustic Gravity waves on December 26, 2004," Turbulent Mixng and Beyond Workshop, International Center for Theoretical Physics, Trieste, Italy, 18-26 August, 2007.

M.C. LEE, R. Pradipta, A. Labno, L.M. Burton, J.A. Cohen, W.J. Burke, M.P. Sulzer, and S.P. Kuo, "Generation of Multi-scale Ionospheric Plasma Turbulence by Injected High-Power Radio Waves at Arecibo, Puerto Rico," Turbulent Mixing and Beyond Workshop, International Center for Theoretical Physics, Trieste, Italy, 18-26 August, 2007.

A. Labno, R. Pradipta, **M.C. LEE**, M.P. Sulzer, L.M. Burton, J.A. Cohen, S.P. Kou, and D.L. Rokusek, "Lower Hybrid Wave Turbulence and Meter-scale Plasma Density Irregularities Produced by Whistler Wave Interactions and Ionospheric Plasmas," Turbulent Mixing and Beyond Workshop, International Center for Theoretical Physics, Trieste, Italy, 18-26 August, 2007.

J. A. Cohen, L.M. Burton, R. Pradipta, A. Labno, **M.C. LEE**, and S.P. Kou, "Diagnoses of Large Plasma Sheets Excited by HF Heater via Thermal Filamentation Instability at Gakona, Alaska," Turbulent Mixing and Beyond Workshop, International Center for Theoretical Physics, Trieste, Italy, 18-26 August, 2007.

L.M. Burton, D.L. Rokusek, J.A. Cohen, R. Pradipta, A. Labno, **M.C. LEE**, S.P. Kou, and D.L. Rokusek, "Excitation and Diagnosis of Langmuir Wave Turbulence in Ionospheric Plasmas at Gakona, Alaska," Turbulent Mixing and Beyond Workshop, International Center for Theoretical Physics, Trieste, Italy, 18-26 August, 2007.

M.C. LEE, R. Pradipta, W.J. Burke, A. Labno, L.M. Burton, J.A. Cohen, S.E. Dorfman, A.J. Coster, M.P. Sulzer, and S.P. Kuo, "Did Tsunami-launched Gravity Waves Trigger Ionospheric Turbulence over Arecibo?," US-Canada International Union of Radio Science Meeting, Ottowa, Canada, 21-26 July, 2007.

R. Pradipta, A. Labno, **M.C. LEE**, W.J. Burke, M.P. Sulzer, J.A. Cohen, L.M. Burton, S.P. Kuo, and D.L. Rokusek, "Electron Precipitation from the Inner Radiation Belt above Arecibo," US-Canada International Union of Radio Science Meeting, Ottowa, Canada, 21-26 July, 2007.

A. Labno, R. Pradipta, **M.C. LEE**, M.P. Sulzer, L.M. Burton, J.A. Cohen, S.P. Kuo, and D.L. Rokusek, "Whistler-mode Wave Interactions with Ionospheric Plasmas over Arecibo," US-Canada

International Union of Radio Science Meeting, Ottowa, Canada, 21-26 July, 2007.

J.A. Cohen, L.M. Burton, R. Pradipta, A. Labno, **M.C. LEE**, and S.P. Kuo, "Generation of Large Plasma Irregularity Sheets by HAARP Heater via Thermal Filamentation Instability," US-Canada International Union of Radio Science Meeting, Ottowa, Canada, 21-26 July, 2007.

L.M. Burton, D.L. Rokusek, J.A. Cohen, R. Pradipta, A. Labno, **M.C. LEE**, and S.P. Kuo, "Excitation and Diagnosis of Langmuir Wave Turbulence by HAARP Heater and MUIR at Gakona, Alaska," US-Canada International Union of Radio Science Meeting, Ottowa, Canada, 21-26 July, 2007.

T.D.C. LITTLE, "Using Sensor Network Technology for Mitigating Lifting Injuries in the Workplace," Boston University CISE Sensor Network Consortium Meeting, Boston, MA, November 20, 2007.

T.D.C. LITTLE, "Research in Free-Space Optical Networking at Boston University," Smart Lighting ERC Industry Day, RPI, Troy, NY, November 6, 2007.

M. MENDILLO, "The International Mercury Watch: Overview for 2008," International Mercury Watch Workshop, Paris, France, May 2008.

M. MENDILLO, H. Rishbeth, R. Roble, J. Wroten, and B. Foster, "Approach to the Study Of Non-Electrodynamical Sources of Ionospheric Variability at Equatorial and Low Latitudes," International Symposium on Equatorial Aeronomy, Crete, Greece, May 2008.

M. MENDILLO, J. Niehof, K. Garcia, C. Prested, S. McGregor, N. Viall, L. Moore, P. Withers, C. Martinis, and A. Stephan, "Can Equatorial Spread-F Occur on Other Planets?" International Symposium on Equatorial Aeronomy, Crete, Greece, May 2008.

M. Patzold, S. Tellman, P. Hausler, D. Hinson, L. Tyler, **M. MENDILLO**, and P. Withers, "The Structure of the Ionosphere of Mars," American Geophys. Union Meeting, San Francisco, December 2007.

M. MENDILLO and J. Wilson, "Comparative Ionospheres: Common Processes With Uncommon Results at Earth, Mars and Saturn," Research Institue for a Sustainable Humanosphere (RISH), Kyoto University, Kyoto, Japan, November 19, 2007.

M. MENDILLO, "Comparative Exospheres: The Escaping Atmospheres of Comets, Moons and Planets," Department of Geophysics and Planetary Science, Tohoku University, Sendai, Japan, November 2007.

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I. PASCHALIDIS, "Localization of Hazardous Sources in Sensor Fields," DOE Review meeting, Boston, MA, June 2008.

I. PASCHALIDIS, "Next Generation Localization in Wireless Sensor Networks," The Sensor Network Consortium, Boston, MA, May 2008.

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A. SERGIENKO, "Quantum Cryptography and Secure Comminication," Special Seminar, GE Global Research Center, Albany, NY, January 2008.

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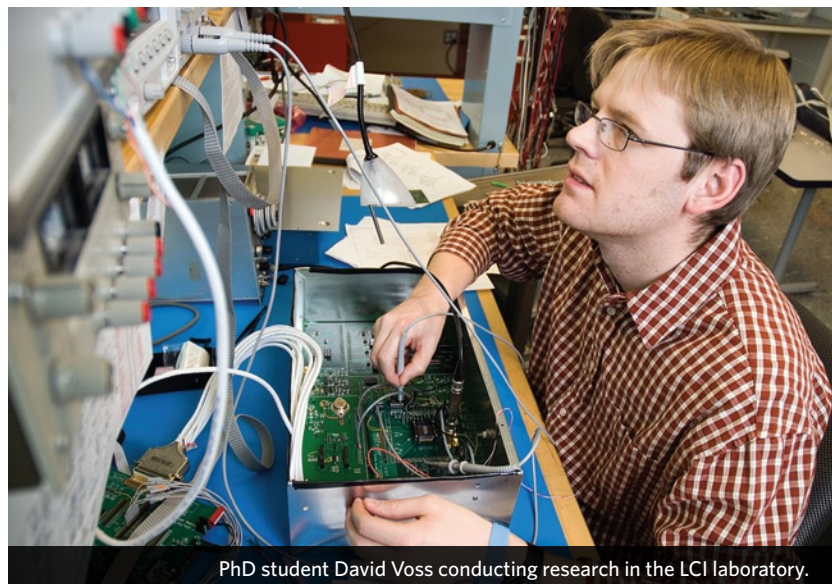
PhD student David Voss conducting research in the LCI laboratory.

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D. STAROBINSKI, "On the Global Effects of Local Transmission Strategies in Wi-Fi Mesh Networks", EPFL (Swiss Institute of Technology), Department Colloquium, Lausanne, Switzerland, January 2008.

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A.K. SWAN, "Perspectives on Nanoscience," University Of Chalmers, Sweden, February 2008.

A.K. SWAN, "Balancing Work and Life in a Career in Science," Women in Science Symposium, University of Tennessee, October 2007.

M.C. TEICH, "Heart Rate Variability," VCU/NHLBI Workshop on Computational Modeling and Simulation of Cardiovascular and Cardiopulmonary Dynamics, Virginia Commonwealth University, Richmond, VA, February 2008.

M.C. TEICH, "Fractal-Based Point Processes," Seminar, Department of Electrical & Computer Engineering, University of Rhode Island, Kingston, RI, April 2008.

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T. TOFFOLI, "A Knowledge Home: A Culture for Extending Literacy by the Computer," Informatics Seminar, University of Reykjavik, 16 June 2008.

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Areas of Research

The ECE Department has three overlapping areas of research:

» **Electrophysics**, which includes photonics, solid state materials and devices, and electromagnetics and space physics;

» **Information Systems & Sciences**, which includes signal and image processing, and control and communication systems;

» **Computer Systems Engineering**, which includes hardware, software applications, and computer and communication networks.

The following sections detail the various research projects being conducted in each of these areas.

Electrophysics

Electrophysics encompasses several strong and emerging areas of electrical engineering, including photonics, solid-state materials and devices, electromagnetics, and space physics. The electrophysics faculty have strong campus collaborations with the Photonics Center, the Center for Nanoscience and Nanobiotechnology (CNN) and the Center for Space Physics, and play key roles in the NSF Engineering Research Center (ERC) for Subsurface Sensing and Imaging Systems (CenSSIS).

Photonics

Research in photonics includes photonic materials, devices, and nanostructures; fiber-optics; optical imaging and microscopy; biophotonics and medical optics; and quantum optics.

Photonic Materials and Devices and Nanophotonics. TED MOUSTAKAS is pursuing ground-breaking research in photonic devices based on wide band-gap semiconductors, including blue, green, and UV-LEDs, UV-LDs, optical modulators, and detectors. He and **ROBERTO PAIELLA** are developing devices based on intersubband transitions such as quantum-cascade lasers.

LUCA DAL NEGRO's research is focused on steady-state optical spectroscopy, ultrafast emission spectroscopy, optical gain relaxation dynamics, and nonlinear optical characterization of semiconductor nanostructures and photonic and plasmonic nano-devices. He implements optical techniques including photoluminescence, picosecond fluorescence lifetime spectroscopy, time-resolved variable stripe length and pump-probe gain techniques, emission quantum efficiency and photon statistics, Z-scan nonlinear characterization, and second harmonic generation (SHG).

HATICE ALTUG is designing, fabricating, and experimentally characterizing nano-photonic structures and nanoparticles that can control the light-matter interaction. She is also developing state-of-the-art nano-photonics devices such as ultrafast lasers, efficient light emitting diodes and slow light structures that are important for the realization of a high bandwidth, high speed, low power, and compact all-optical circuits.

ANNA SWAN uses both elastic and inelastic light scattering to probe the properties of nanoparticles, with the largest research effort focused on individual carbon nanotubes. Her lab's optical techniques include resonant Rayleigh scattering, interference techniques, resonant Raman scattering, and photo luminescence.

BENNETT GOLDBERG and **SELIM ÜNLÜ** 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.

Optical Fiber Technology. The Lightwave Technology Laboratory led by **TED MORSE** is one of the few university laboratories capable of designing, fabricating, and characterizing silica optical fibers. The research activities of this laboratory focus on new processing techniques for optical fibers, high power optical fiber lasers, and a variety of optical fiber sensors. A new technique is being developed for combining multimode pump radiation into double clad fibers. The laboratory has a fabrication laboratory with three glass lathes including a new state-of-the-art Nextrom MCVD system and an 8m optical fiber draw tower, newly outfitted with Nextrom widing and control equipment.

Biomedical Optics and Biophotonics. **IRVING BIGIO**'s biomedical optics research concentrates on minimally-invasive optical diagnostics and therapeutics. His lab is developing a variety of optics-based technologies for clinical applications and biomedical research. Current projects include advanced spectroscopic technologies for tissue diagnosis, non-invasive measurement of drug concentrations in tissue, interstitial laser thermotherapy and photodynamic therapy, optical sensing of in-

ternal cellular processes, optical methods for imaging of nerve activation, and analytical and computational methods for modeling photon transport in tissue.

Other research projects in this area includes resonant cavity enhanced photodetectors and imaging biosensors for DNA and protein arrays developed by **BENNETT GOLDBERG** and **SELIM ÜNLÜ**; photonic nanostructures used by **HATICE ALTUG** to develop ultra sensitive and compact sensors integrated on chip with microfluidic channels for proteomics and genomics applications; novel bio-compatible materials based on nanostructures research conducted by **LUCA DAL NEGRO**; and the development of both a device for tag-free bio-sensing and IR imaging and a mask-free optical synthesizer for bio-arrays by **MIKE RUANE**.

Quantum Information. Research in the Quantum Imaging Laboratory, directed by **BAHAA SALEH**, **ALEXANDER SERGIENKO**, and **MALVIN TEICH**, focuses on the enhancement of optical information processing by use of the unique properties of non-classical light, particularly light in an entangled state. Non-linear optical techniques, including parametric downconversion, are used to generate such light. Fundamental aspects of spatial, temporal, and polarization entanglement; coherence; and interferometry are addressed. Applications include microscopy, optical coherence tomography, metrology, as well as secure communication and networking via quantum key distribution.
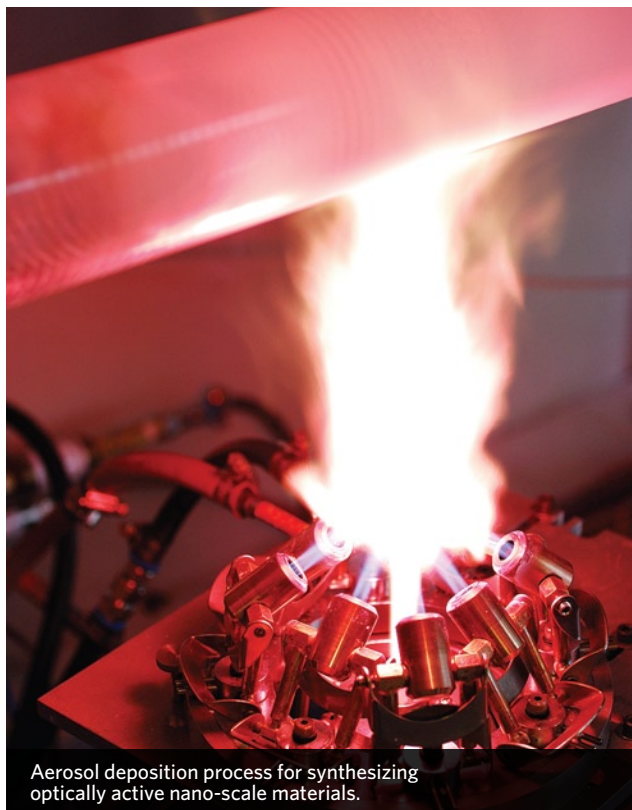
Aerosol deposition process for synthesizing optically active nano-scale materials.

LEV LEVITIN and **TOM TOFFOLI** are investigating ultimate physical limits on the operation time of quantum gates, measures of conditional entropy and mutual information between quantum systems, paradoxes of quantum communication theory, and issues of energy dissipation in reversible computing.

Solid-State Materials & Devices

This area overlaps naturally with photonics. The most senior faculty member in this area, **TED MOUSTAKAS**, leads a large research program in the more advanced family of nitride semiconductors, an area for which the group is recognized as one of the leading organizations in the world. The research is a combination of theoretical/modeling work in parallel with experimental studies of these advanced materials and corresponding devices. Intellectual property derived from this work has been licensed by BU to major U.S. and Japanese companies producing blue LEDs and blue lasers. Junior faculty member **ROBERTO PAIELLA** is involved in applications of the nitrides to long-wavelength devices, including quantum cascade lasers, and **ENRICO BELLOTTI** pursues world class, and well funded, research in numerical modeling of semiconductor materials and devices. The group is funded by the DOE (for applications in solid state lighting), DARPA and NASA (for the development of UV lasers and LEDs for identification of biological and chemical agents), the Air Force (development of transistors for high power and high frequency applications), and ARL (development of quantum cascade lasers). Fundamental work is supported by NSF, ONR and AFOSR-MURI. The group collaborates closely with members of the Physics Department. The most recent addition to this group is **LUCA DAL NEGRO**, who is developing a laboratory in silicon light sources.

Wide Band Gap Semiconductors. In the Wide Band Gap Semiconductors Laboratory, **TED MOUSTAKAS** 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 focus is in the development of optical devices, 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 **ENRICO BELLOTTI** in the area of theoretical modeling, Karl Ludwig (Physics) in materials structure, Kevin Smith (Physics) in electronic structure, and **ROBERTO PAIELLA** in devices based on intersubband transitions.

Computational Electronics. Led by **ENRICO 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 technologically mature

semiconductor devices. The group's 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 a variety of high performance PCs and printers.

Electromagnetics & Space Physics

Electromagnetics. ECE faculty pursue research in a variety of theoretical and applied aspects of electromagnetics. **MARK HORENSTEIN**'s research is devoted to problems in experimental electromagnetics with a primary focus on industrial electrostatics, sensors, and micro-electromechanical systems (MEMS). Current projects include transdermal delivery of drug-laden nanoparticles via electrostatic pulse, driver circuitry for MEMS retro-mirror communication systems, and a variable stiffness, smart-joint endoscope for orthoscopic surgery.

ROBERT KOTIUGA examines 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.

MIN-CHANG LEE is conducting field experiments 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.

Space Physics. Several ECE faculty have maintained collaborations with the Boston University Center for Space Physics (CSP). **BILL OLIVER** and **JOSH SEMETER** are directly involved in atmospheric and remote sensing studies, and others are involved in signal processing applications (**DAVID CASTAÑÓN**, **CLEM KARL**, and **JANUSZ KONRAD**) and instrumentation (**ALLYN HUBBARD** and **MIKE RUANE**). **MIKE RUANE** and **JOSH SEMETER** are investigating miniature magnetometers based on Giant Magneto Impedance, and developing the motor controls for the Loss Cone Imager, which will fly on the USAF DSX satellite in 2009. ECE affiliate appointments for CSP/AST **TED FRITZ**, **MICHAEL MENDILLO**, and **SUPRIYA CHAKRABARTI** have strengthened the collaboration and facilitated the involvement of ECE students in CSP projects in areas such as atmospheric studies using radio wave technology, remote sensing, and astronomical imaging. Affiliated with CSP, the Imaging Science Laboratory, led by **MICHAEL MENDILLO** and **JOSH SEMETER**, 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 observation sites world-wide, and digital signal processing.

Information Systems and Sciences

Research in ISS deals with the extraction, interpretation, visualization, processing, and communication of information. An important focus of this group involves the extraction of uncertain/incomplete information in physical as well as engineered systems. Applications include biomedical signal and image processing, remote sensing for atmospheric science, buried land mine detection, coding for communication systems, multimedia communication, distributed and mobile information processing, sensor networks, and advanced visual communication and entertainment. The group has an ongoing collaboration with the Biomedical Engineering (BME) department and the Bio-Informatics program at BU. It has established strong collaborative efforts with Massachusetts General Hospital, and plays an important role in the Center for Subsurface Sensing and Imaging Systems. Research is supported by NSF, NIH, ONR, AFOSR, DARPA, as well as industry. There are four primary research areas: Signal and Image Processing, Multimedia Processing, Information and Decision Systems, and Communications and Networks.

Signal and Image Processing

Signal and image processing encompasses the development and implementation of algorithms and means to analyze and extract information from signals obtained from observing a phenomenon. The original signals can be a variety of types arising in a multitude of applications, including speech, audio, still images, video, and remote sensing and telemetry data. Possible processing goals for such signals include transmission, display, storage, interpretation, classification, segmentation, or diagnosis.

Image Processing. Research in imaging processing is led by a number of faculty including **MAJA BYSTROM**, **DAVID CASTAÑÓN**, **PRAKASH ISHWAR**, **CLEM KARL** and **JANUSZ KONRAD**. Research thrusts include feature-enhanced imaging, geometric-based estimation, wavelet-based overcomplete representations,

inverse problems under dynamic conditions, problems related to visual perception, sampling and quantization of visual data, image restoration and enhancement, image segmentation, image recognition, and image transmission and storage (compression, watermarking, authentication, etc.).

Statistical Signal Processing. This area focuses on the efficient and robust extraction of information from diverse sources in the face of uncertain data and models using a statistical approach. Research of several ECE faculty, including **DAVID CASTAÑÓN**, **CLEM KARL**, **VENKATESH SALIGRAMA**, and **PRAKASH ISHWAR**, is based on the development of statistical models for both observations and prior knowledge, and the subsequent use of these models for optimal or near-optimal processing. Fundamental issues such as understanding the structure of very high dimensional and multiresolution data through information-theoretic methods are pursued. Some unifying principles tying the set-theoretic and maximum-entropy approaches to modeling and estimation have been uncovered. Applications that motivate this research include 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).

Biological and Medical Signal Processing. The creation of new ways to probe biological media is providing researchers with unprecedented data concerning a range of biological phenomenon, ranging from the molecular to the clinical. The objective of research in this area conducted by **CLEM KARL** in collaboration with Massachusetts General Hospital (MGH) is to develop new methods of signal and image processing to robustly separate signal from noise. Probing modalities include

Prof.'s Carruthers, Little, and Altug conduct LED smart lighting research.

optical and fluorescence microscopy, computed tomography, ultrasound, MRI, dynamic PET & SPECT. Applications include molecular, brain, dynamic, and interventional imaging.

Research conducted in the area of Cognition and Brain Signal Processing by **HAMID NAWAB**'s laboratory involves signal processing for cognition signals from physical stimuli of human perception and for brain signals from electrical transmissions of neural activity. Over the years, this laboratory has been a major innovator in computational signal processing, short-time and short-space signal processing, artificial intelligence for signal processing, auditory signal processing, and decomposition of electromyographic signals.

Multimedia Processing

Research in multimedia processing concentrates on issues related to the modeling of multimedia signals (e.g., image sequences, video, music, speech, and their combinations). Current research activity centers primarily on visual information and multimedia transmission. A wide range of interesting topics are investigated, with the main focus on multidimensional signal modeling, motion modeling, estimation and segmentation, video compression and transmission, watermarking and authentication, and 3-D multimedia systems design. Applications that motivate this research are primarily encountered in video surveillance, video compression for various new services (Internet, cellular and wireless), new human-computer interfaces (3-D), next-generation multimedia services, etc.

Visual Information Processing. Research in this area, led by **JANUSZ KONRAD**, includes manipulation, compression, transmission and retrieval of visual information, whether in the form of still images, video sequences, or multimedia data. In addition to standard monoscopic (2-D) images, stereoscopic and multiscopic (3-D) images are studied. In this thrust, advanced solutions are sought to such challenges as enhancement, segmentation (moving object extraction) and compression of image sequences. One particular video characteristic that is exploited is the temporal coherence of visual data along motion trajectories; various video processing and compression methods are being developed by jointly processing the visual data in spatial (horizontal and vertical) and temporal coordinates. The primary application of this research is in next-generation multimedia communications: life-like (3-D), efficient (low bit rate), reliable (error-resilient), and flexible (object-based). Facilities for visualization infrastructure include 2-D and 3-D digital cameras and capture systems, as well as 3-D displays (shuttered and 9-view automultiscopic "Synthagram").

Multimedia Transmission. Multimedia transmission is a new and rapidly growing field concerned with all aspects of

processing and manipulating multimedia data for transmission and storage. Fundamental issues in this area, pursued by **MAJA BYSTROM**, **PRAKASH ISHWAR**, and **JANUSZ KONRAD**, include data compression, preprocessing, interaction with physical transmission storage elements, and post-processing such as voice or video restoration. Bystrom's work is focused on joint source channel coding/decoding of images and video and on resource allocation in multimedia systems. Applications range from video-on-demand consumer services to ad hoc network design to medical data storage, transmission, and access. Ishwar has been focusing on distributed signal processing and multiuser information theory motivated by new challenging problems and emerging applications in sensor networks, multimedia-over-wireless, and information security. This includes ongoing work on distributed sampling, resource-constrained distributed inference in unreliable sensor networks, and distributed video coding where his efforts are contributing to uncover fundamental performance limits and guide the development of new coding architectures and constructive algorithms.

Information and Decision Systems

Research in information and decision systems spans a variety of topics, including robust signal processing that deals with developing statistical modeling and processing techniques for limited informational contexts, distributed and networked signal processing to deal with noisy distributed information from multiple sources that must be fused under communication constraints, and control and decision theory.

Research in these areas straddles a wide variety of applications ranging from mobile communications, echo-cancellation, sensor networks, sensor array processing, and image processing. The goal of the research is twofold: 1) understand fundamental limits to achievable quality of information; and 2) develop general as well as application specific algorithms. Faculty involved in this area include **DAVID CASTAÑÓN**, **VENKATESH SALIGRAMA**, and **PRAKASH ISHWAR**.

Communications and Networks

This area deals with digital communications theory and applications, wireless infrared and broadband communications, scalability, heterogeneity, and performance of networks.

Broadband Wireless Communications. **JEFFREY CARRUTHERS** leads 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-datarate indoor wireless local-area networks. His laboratory includes facilities for the fabrication and testing of experimental prototypes as well as computing resources for system design and analysis.

Networking and Information Systems. **DAVID STAROBINSKI** and **ARI TRACHTENBERG** are involved in providing novel perspectives on modern networking issues, including scalability, heterogeneity, and performance. Their laboratory of Networking and Information Systems is equipped with sophisticated hardware and software and promotes research into the fields of network synchronization, mobile computing, Internet traffic engineering, distributed Web caching, and coding theoretic approaches to real-time information reconciliation.

Networked/Distributed Signal Processing. **VENKATESH SALIGRAMA** is developing tools for a fundamental system-level framework for networked decision making in uncertain environments. While significant effort over the last decade in sensor development, physical layer transmission and networking has laid the initial groundwork for practical deployment, the full potential for networked sensing systems can only be realized through a fundamental understanding of decision-making in networked and uncertain environments. He is modeling communications and networking constraints at a systems level and developing distributed methods for group of decision agents to reliably detect, localize, and track relevant dynamic and uncertain events. Additionally, he aims at understanding fundamental limitations of large-scale wireless networks in terms of throughput, delay and stability.

Computer Systems Engineering

Research in computer systems engineering is pursued in areas including gate, chip, and circuit-level systems, embedded systems, computer architecture and automated design, fault-tolerant and reliable computing, distributed and network computing, multimedia applications, and high-performance computing.

VLSI

The VLSI group led by **ALLYN HUBBARD** designs, builds, and tests chips in innovative architectures that span a wide variety of VLSI applications. Chips designed using digital, analog, and subthreshold methodologies are realized using CMOS, BiCMOS, and Bipolar technologies. Applications include neural-net image processing, integrated photonic devices and parallel photonic testing, automatic partial-valued dynamic logic synthesis, single-chip large-molecule and DNA analyzers, and neural tissue interface chips. The group is equipped with a full suite of design tools and testing instrumentation for analog and digital systems.
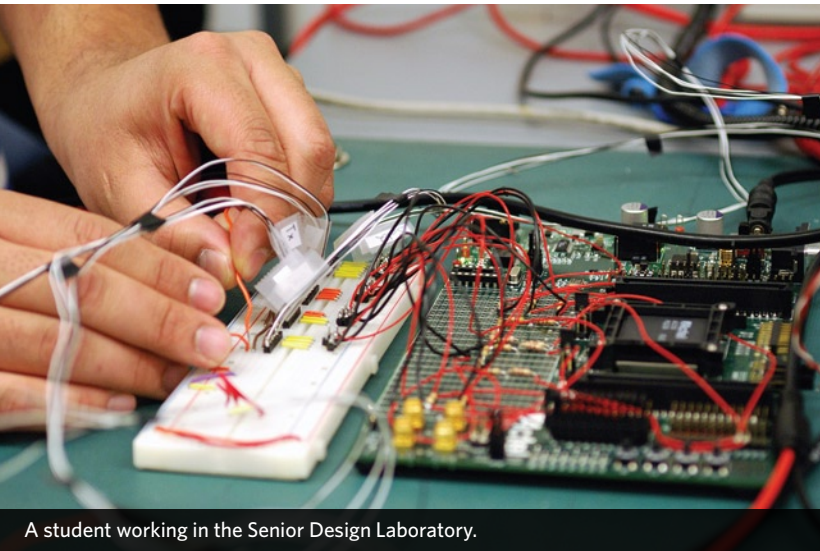
A student working in the Senior Design Laboratory.

Embedded Systems

Research in embedded systems led by **WEI QIN** covers design methods and performance evaluation tools. This includes system level design of embedded multiprocessor systems, fast system simulation techniques using multi-processing, high-level modeling of digital systems, and functional test generation of microprocessors.

Asynchronous Circuits

Research activities in the design of asynchronous systems pursued by **ALEXANDER TAUBIN** include analysis, synthesis, testing, formal verification, and architectural design.

Computer Architecture and Automated Design

Research in this area led by **MARTIN HERBORDT** focuses on experimental computer architecture, particularly on the application of emerging technology to computationally intensive application. Projects include developing design tools for application specific coprocessors, designing MPP router switches, vision computers, and the application of configurable computing to bioinformatics.

Testing, Reliable, and Secure Computing

MARK KARPOVSKY and **LEV LEVITIN** conduct research on efficient hardware testing at the chip, board, and system levels, functional software testing, fault-tolerant message routing for multiprocessor systems, and the design of reliable computer networks. **ALEXANDER TAUBIN** is also active in research in architectures based on asynchronous circuits for computer security and side-channel attacks resistance.

Distributed and Multimedia Applications

Research in this area led by **TOM LITTLE** includes investigation of distributed modes interaction among wireless computers; aggregation and clustering techniques for scaling large-scale Mobile Ad Hoc Networks (MANETs) and sensor networks; communication systems for continuous media; and conceptual and physical database organizations. His laboratory is equipped with a high-performance simulation environment and a wireless testbed for proof-of-concept prototype development.

Network Computing

Research in network computing led by **MARK KARPOVSKY** focuses on interconnection network topologies; routing, network flow control, and deadlocks in multicomputer networks; multicast and broadcast, fault-tolerance in interconnection networks; modules for realization (nodes and routers); performance metrics and scalability; message passing interference, protocols and programming, scalable coherent interface (SCI), and distributed shared memory; network of workstations (NOW), case studies of high performance scalable networks, and cluster computing.

High-Performance Computing

The use of high-performance parallel computers to solve problems in physics, materials science, and engineering systems is pursued by a number of ECE faculty using the resources of the BU Center for Computational Science. **RICHARD BROWER** works on molecular dynamics simulation for biomolecules, lattice methods for statistical mechanics and quantum field theory of strings and particles. **ROSCOE GILES'** research developed algorithms for large-scale micromagnetic modeling and molecular dynamic simulation.

Knowledge Engineering

TOM TOFFOLI is pioneering research in Knowledge Engineering on a personal scale. He addresses issues such as concepts and tools individuals need in order to acquire, structure, and activate knowledge for their own sake—not just as operators of their employer's information-processing machinery—in research, business, personal life, authoring, presence on the Internet, etc.

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 Common-

wealth 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, 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, but it is spread across departments, colleges, and schools within the University. 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 for Information and Systems Engineering 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 2008, CISE has grown from 13 to 28 affiliated faculty from the Departments of Manufacturing Engineering, Aerospace & Mechanical Engineering, and Electrical & Computer Engineering in the College of Engineering; the Department 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 development 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, Little, Pashilidis, Saligrama, Sharif, 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. Professor David Castañón is currently serving as Co-Director along with Professor Yannis Paschalidis of the Department of Manufacturing Engineering. 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
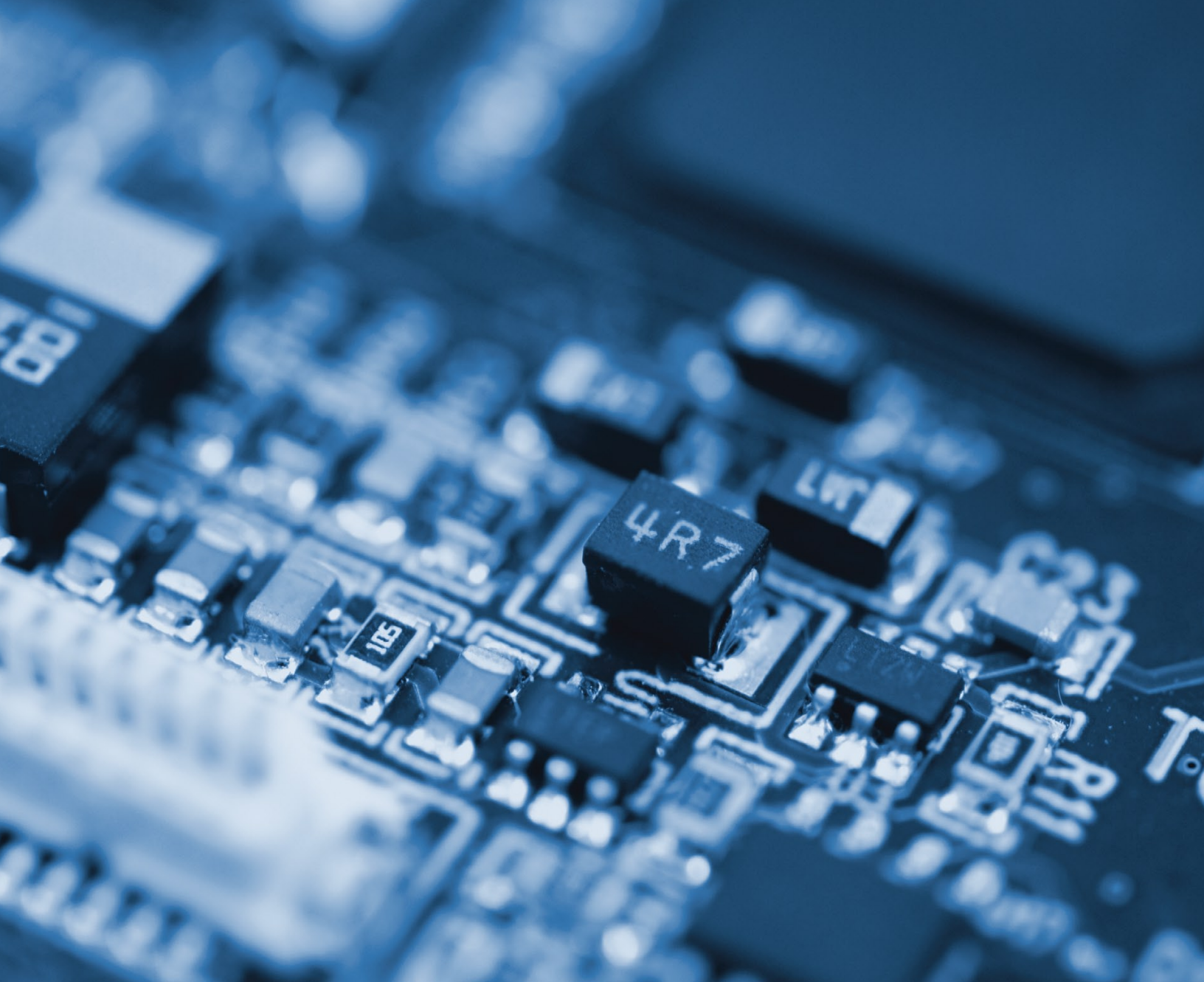
http://nanoscience.bu.edu/
Boston University formed the Center for Nanoscience and Nanobiotechnology (CNN) to advance academic and technological research and development by extending discoveries in nanoscale materials and platforms toward applications that examine and seek to understand and manipulate 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.