

**BOSTON
UNIVERSITY**

**Department of Electrical and
Computer Engineering
1998-99
Annual Report**

Fall 1999

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1. Highlights

This report provides a detailed description of the instructional and research activities of the faculty, staff, and students of the Department of Electrical and Computer Engineering (ECE) at Boston University during the 1998/99 academic year. The instructional activities reported are for the Fall 1998, Spring 1999, and Summer 1999 semesters. Publications and scholarly activities, as well as budget information, are reported for the 1999 fiscal year (July 1, 1998 to June 30, 1999). Key data for this year are also compared to previous years to show progress and identify areas of strength and weakness. Please refer to the Department's web site (<http://ece.bu.edu>) for more information on ECE's recent activities.

New Faculty

Dr. Neeraj Suri was appointed to the faculty last year at the Associate Professor rank. Dr. Suri was an Assistant Professor at the New Jersey Institute of Technology before coming to BU. His research focus includes reliable computing and distributed and networked systems (see sidebar).

The Department has continued its vigorous effort to recruit outstanding faculty in selected strategic areas. Two new faculty will join the Department in the Fall of 1999 at the rank of Professor – Dr. Theodore Morse, who held a faculty appointment at Brown University and is a world-renowned expert in fiber optics technology, and Dr. Ronald Knepper, who recently retired from IBM Microelectronics and is an expert in semiconductor technology.

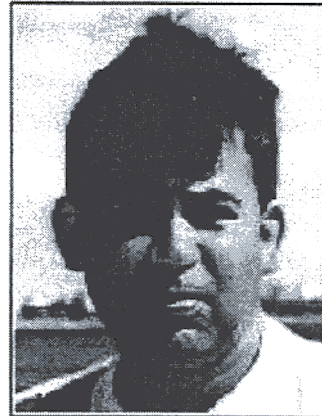
Undergraduate Program

Enrollment in the BS program increased by about 4% and has now reached 415. Enrollment in the Computer Systems Engineering (CSE) program now makes up roughly 64% of the total Undergraduate enrollment. Enrollment in the Electrical Engineering (EE) program has stabilized in the last three years after a period of decline in earlier years and is now increasing slightly.

Quality instruction continues to be of paramount importance to the ECE Department. The curriculum is continuously updated to meet the needs of tomorrow's engineers. Efforts to enhance the undergraduate laboratories are successfully ongoing, and new equipment has been added this year to update several laboratories. In both classrooms and laboratories, emphasis is placed on design, laboratory practice, and applications. Successful ideas

that were initiated in previous years, such as the Teaching Workshop, the ECE Conference Day, and the Teaching Excellence Award, continued this past year. A new Advising Day has been initiated. These programs are described further in sections 3 and 4.

This year, the Department has begun extensive discussions of the new ABET 2000 accreditation criterion and measures of its implementation. This effort has been led by the Undergraduate Committee. Among the ideas proposed for enhancement of our program are an expanded senior design project and a mechanism for the periodic monitoring, assessment, and modification of the core courses in electrical and computer systems engineering. These proposals were presented at a departmental faculty retreat in May. The faculty of the department were generally supportive of both aspects of the proposal.



Neeraj Suri received the Ph.D. in Computer Systems Engineering from the University of Massachusetts at Amherst in 1992. From 1991 to 1996, he was a member of the technical staff in the Dependable Systems Group at AlliedSignal Technology Center, and in 1996, he moved to the New Jersey Institute of Technology, where he was Assistant Professor in the Department of Computer and Information Science until 1998. In 1998, he was appointed Associate Professor in the ECE Department at Boston University. His research interests include theory and experimentation in distributed, dependable, and real-time systems; verification and validation; and algorithms and architectures for composite real-time and dependable services. Dr. Suri received an NSF CAREER grant in 1998. He is the guest editor of the IEEE Transactions on Parallel and Distributed Systems Special Issue on "Dependable Real-Time systems," published in June 1999.

Graduate Program

Enrollment in the MS programs increased by 19% this year (70 to 83). This is the second year of increase after a 6-year period of enrollment decline (1990-1996).

The number of Ph.D. students dropped slightly from 83 in 1997 to 80 in 1998. This number remains significantly greater than the number of doctoral students 5 years ago, which was near 50.

Recruitment of graduate students has been one of our key challenges. While 1998-1999 was not particularly successful, we had an excellent year for the incoming 1999-2000 graduate student class. (For details see Section 4).

In AY 1997-1998 we made a thorough review of the graduate curriculum and planned changes and additions to enhance our course offering. We have streamlined the scheduling of advanced courses and added a number of advanced (700-level) courses in Photonics.

The weekly or bi-weekly Graduate Student Seminar series continued, but was absorbed in the new course *Graduate Teaching Fellow Seminar*, SC850. The *ECE Colloquium* continued for a second year, and prominent speakers from both outside and inside the university gave presentations on current research topics (see list in Section 4).

Research

Research funding this year totaled approximately \$4.8M, a small drop from last year's \$4.9M. The average annual research funding in the last 5 years (1995-99) is \$4.4M, as compared to an average of \$2.3M in the 1990-94 period.

This year, the ECE faculty and graduate students published 93 archived journal articles, authored or edited 4 books, co-authored 13 book chapters, and made 168 conference contributions (papers, abstracts, and presentations). They also authored 10 patents or patent disclosures. These numbers do not include the work of affiliate faculty. The average number of papers published in reviewed journals this year is 2.9 per faculty member.

The first *Biennial Research Summary* was published this year. This is a collection of the abstracts of all research papers published in 1997-1999. A copy is available upon request.

Awards and Honors

The ECE faculty continue to be actively involved in national and international professional activities and to receive prestigious awards and recognitions.

Michael Ruane received the 1998/99 ECE Teaching Excellence Award.

Jeffery Carruthers received an NSF CAREER Award.

Alexander Sergienko received an NSF CAREER Award.

Neeraj Suri received an NSF CAREER Award. He was elected to serve on the editorial board of the *IEEE Transactions on Parallel and Distributed Systems* for a 4-year term in October.

Carol Espy-Wilson received a NIH Independent Scientist Award for "Studies of Speech Communication." This grant is intended to "foster the development of outstanding scientists and enable them to expand their potential to make significant contributions to their field of research." The grant, which was received last summer, is for 5 years at approximately \$67,000 per year.

Bahaa Saleh received the Optical Society of America 1998 Esther Hoffman Beller Award "for outstanding contributions to optical science and engineering education through innovative curricular development, imaginative teaching, textbook writing, editorial activities, and administrative leadership."

Fred Schubert was elected Fellow of the SPIE "for pioneering research in semiconductor doping and sustained contributions to the development of high-efficiency light-emitting diodes and lasers."

Dimiter Avresky was made a Senior Member of IEEE.

Roscoe Giles was featured in a front page article in an August edition of the *Sunday Boston Globe* about college programs that encourage women and minority students to enter fields in science and engineering, such as the NSF-funded PACI program.

Thomas Toffoli was cited in an article about reverse computing which appeared in the *New York Times "Science Times"* in June. It referred to work he did at MIT, prior to coming to BU, which was among the original work done in the development of this novel method of computing.

Tenure & Promotions

This year, four ECE faculty members were promoted by the University to Full Professor and one ECE faculty member was granted tenure. The new titles are effective September 1, 1999.



David A. Castañon received the Ph.D. in Applied Mathematics from M.I.T. in 1976. From 1976 to 1981, he was a research associate with the laboratory for Information and Decision Systems at M.I.T. From 1982 to 1990, he was senior research scientist at Alphatech, Inc. In 1990, Dr. Castañon joined the ECE Department at Boston University as Associate Professor. His research involves stochastic control, game theory, optimization, and parallel and distributed computing, with applications to detection, multitarget tracking and object recognition. He is a member of AMS, SIAM, IEEE, INFORMS, Tau Beta Pi and Phi Eta Sigma. He is a member of the Board of Governors of the IEEE Control System Society. He served as Associate Editor for the IEEE Transactions on Automatic Control (1984-1988), is an associate editor for Computational Optimization and Applications. He served as the Program Chair for the 1998 Conference on Decision and Control. This year he was promoted to Full Professor.



Roscoe C. Giles received the Ph.D. in Physics from Stanford University in 1975. From 1975 to 1976 he was post-doctoral fellow with the Stanford Linear Accelerator Center, and from 1976 to 1978 he was post-doctoral fellow with the Center for Theoretical Physics at M.I.T. From 1979 to 1985, he was Assistant Professor with the Department of Physics at M.I.T. and from 1985 to 1990 he held the position of Research Associate at the M.I.T. Center for Theoretical Physics. His research focuses on the applications of high performance and parallel computing to physics and materials problems. He leads Boston University's effort as a partner in the National Computational Science Alliance, which is one of the two NSF "Partnerships for Advanced Computational Infrastructure. Since 1992, Dr. Giles has been the Deputy Director of the Center for Computational Science at Boston University. He is a member of the American Physical Society, Sigma Xi, and Phi Beta Kappa. This year he was promoted to Full Professor.



Carol Espy-Wilson received the Ph.D. in Electrical Engineering and Computer Science from M.I.T. in 1987. From 1988 to 1990 she was with the M.I.T. Speech Communication Group as a Research Scientist, and in 1990, she joined the ECE Department at Boston University. She held the title of Clare Booth Luce Professor in 1990 to 1995. Her research interests include speech communication, speech recognition, speech processing, acoustic phonetics, and digital signal processing. This year she received a NIH Independent Scientist Award for "Studies of Speech Communication." She is a member of the IEEE Signal Processing Society, Acoustical Society of America, and Sigma Xi. This year she was promoted to Associate Professor with tenure.



Allyn E. Hubbard received the Ph.D. in Electrical Engineering from the University of Wisconsin in 1977 and was a post-doctoral fellow at the Johns Hopkins University in 1979. He joined the ECE Department at Boston University in 1979 and was promoted to Associate Professor in 1984. He holds a joint appointment with the Department of Biomedical Engineering. His research interests include VLSI circuit design, neural information processing, neural network chips, sonar processing chips, and auditory models and experiments. He is a member of the Acoustical Society of America, IEEE, AAAS, ASEE, Massachusetts CAD Professor's Organization, and the Association for Research in Otolaryngology, Tau Beta Pi, and Phi Eta Sigma. He is the co-editor of *Peripheral Auditory Mechanisms*, Springer Verlag, 1986. This year he was promoted to Full Professor.



Mari Ostendorf received the Ph.D. in Electrical and Computer Engineering from Stanford University in 1981 and 1985, respectively. She worked at BBN Laboratories, Inc. in Cambridge, MA as a Scientist in 1985-1986. She has been a member of the ECE faculty since 1987. Her research includes statistical modeling for signal interpretation, acoustic and language modeling for spontaneous speech recognition, and computational modeling of prosody for speech synthesis. Dr. Ostendorf's Signal Processing and Interpretation Lab (SPILab) has a large research group of undergraduate, MS, and Ph.D. students. In 1998, she was chosen as the US editor for the *Computer, Speech and Language* journal. She is a member of ASA, SWE, Sigma Xi, and a senior member of IEEE. This year she was promoted to Full Professor.

Workshops, Conferences, and Special Meetings

ECE Day 1999

The tradition of a Project Conference Day for ECE Seniors, which was initiated in May 1997, continued this year. Held at the end of the Spring term, the Day included about 25 presentations on different projects conducted by groups of 2 to 4 students each. Graduate students also held a 90-minute poster session on their research projects. The conference was attended by departmental faculty and alumni. More information on ECE Day can be found in Section 3.

Teaching Workshop

The teaching workshops that were held during the previous two years were now offered formally as part of a new 2-credit course, SC850. This course is required for all ECE graduate students who are serving as teaching fellows for the first time. Besides being a valuable educational experience for these graduate students, this workshop also ensures that our undergraduates are served by better trained teaching fellows in their ECE courses. The workshop included panel and solo discussions, as well as play-acting scenarios on such topics as teaching methodology; presentation techniques; pedagogy; and an outline of teaching policies, procedures, and ethics. More details on this event are provided in Section 4.

ECE Advising Day

The ECE advising day is a major initiative launched this year to enhance the advising system for ECE undergraduates. Held in the fall and spring semesters on the Friday before telephone registration begins for the next term. The day included pre-registration advising throughout the day by faculty volunteers and a 90 minute "Advising Workshop" on topics such as Preparation for Careers in Electrical and Computer Engineering and How to Choose Your Technical Electives.

ECE Retreat

The ECE Department held its annual Faculty Retreat at BU's facility in Tyngsboro, MA, on May 20, 1999. This year, the discussions focused on the ABET Criterion 2000, its objectives, outcomes, and framework. A number of specific proposals were discussed including a new framework for the capstone project and a new grading system for core courses. Requirements for the EE/CSE double major degree and the combined BS/MS dual degree were debated. Marny Lawton, Director of the College Office of Distance Learning, presented plans initiating our new distance learning program.

2. Faculty and Staff

2.1 Faculty

Dimitter Avresky, Associate Professor

- Ph.D., Moscow Institute of Engineering, 1971
- Fault tolerance in parallel and distributed systems; network computing; performance analysis of networks, routing verification, testing, and validation of software and protocols

John Brackett, Professor (retired 8/31/98)

- Ph.D., Purdue University, 1963
- Software engineering; software requirements definition; object-oriented testing; rapid prototyping of embedded systems

Richard Brower, Professor

- Ph.D., University of California-Berkeley, 1969
- Lattice gauge theory; molecular dynamics simulations

Jeffrey Carruthers, Assistant Professor

- Ph.D., University of California, Berkeley, 1997
- Wireless infrared communications; broadband communications; mobile and wireless networks
- NSF CAREER Award

Christos Cassandras, Professor (primary appointment with the Department of Manufacturing Engineering)

- Ph.D., Harvard University, 1982
- Analysis and control of discrete event dynamic systems; stochastic control and optimization; dynamic control of computer and communication networks
- Editor-in-Chief, *IEEE Transactions on Automatic Control*; Member, IEEE Control Systems Society Board of Governors
- Fellow, IEEE; 1991 Lilly Fellow

David Castañon, Associate Professor

- Ph.D., Massachusetts Institute of Technology, 1976
- Stochastic control; game theory; estimation optimization; parallel and distributed computation
- Member, IEEE Control Systems Society Board of Governors

Scott Dunham, Associate Professor

- Ph.D., Stanford University, 1985
- Modeling and simulation of semiconductor fabrication processes and device operation; point-defect interaction in semiconductors; kinetics of extended defect evolution; atomic scale materials simulation
- Associate Editor, *Journal of Electronic Materials*

Charles Eddy, Assistant Professor

- Ph.D., Johns Hopkins University, 1998
- Semiconductor device processing and process characterization; electronic and optoelectronic device fabrication and characterization; novel III-V, especially III-V nitride, devices
- Naval Research Laboratory Alan Berman Research Publication Award, 1994

Solomon Eisenberg, Associate Professor, Associate Dean for Undergraduate Programs (primary appointment with the Department of Biomedical Engineering)

- Sc.D., Massachusetts Institute of Technology, 1983
- Electrically mediated phenomena in tissues and biopolymers

Carol Espy-Wilson, Assistant Professor

- Ph.D., Massachusetts Institute of Technology, 1987
- Speech processing, speech variability, acoustic and articulatory modeling and lexical access.
- Clare Boothe Luce Professor (1990-1995)
- NIH Independent Scientist Award

Azza Fahim, Research Assistant Professor

- Ph.D., Cairo University, 1984
- Electric machines; computations in electromagnetics

Leopold Felsen, Professor (primary appointment with the Department of Aerospace and Mechanical Engineering)

- D.E.E., Polytechnic Institute of Brooklyn, 1952

Wave propagation and diffraction in various disciplines; high-frequency and time domain asymptotics; wave-oriented data-processing and imaging

Member, National Academy of Engineering;
Fellow – IEEE, Optical Society of America, and Acoustical Society of America
IEEE Heinrich Hertz Gold Medal for 1991
URSI Balthasar Van der Pol Gold Medal for 1975

Theodore Fritz, Professor (*primary appointment with the Department of Astronomy and the Center for Space Physics*)

- Ph.D., University of Iowa, 1967
- Space plasma and magnetospheric physics; magnetosphere-ionosphere coupling; substorms; charged particles and compositions; rocket and satellite experiments

Roscoe Giles, Associate Professor

- Ph.D., Stanford University, 1975
- Advanced computer architectures; distributed and parallel computing; computational science
- NSF Partnerships for Advanced Computational Infrastructure (PACI): Co-Chair, National Educational Outreach and Training Coordinating Committee; Co-Chair, Alliance Collaborative and Data Storage Team
- 1996 College of Engineering Award for Excellence in Teaching

Bennett Goldberg, Associate Professor (*primary appointment with the Department of Physics*)

- Ph.D., Brown University, 1987
- Room- and low-temperature, near-field microscopy of semiconductors and biological systems; magneto-optics and magneto-transport of two- and one-dimensional electron fields
- Alfred P. Sloan Fellow, NSF Presidential Young Investigator

Mark Horenstein, Associate Professor

Ph.D., Massachusetts Institute of Technology, 1978

- Applied electromagnetics; electrostatics, micro-electromechanical systems (MEMS)
- Member, Executive Council, Electrostatics Society of America
- Registered Professional Engineer

Allyn Hubbard, Associate Professor

- Ph.D., University of Wisconsin-Madison, 1977
- VLSI circuit design; digital, analog, subthresh-

old analog, biCMOS, CMOS; information processing in neurons, neural net chips, synthetic aperture radar (SAR) processing chips, sonar processing chips; auditory models and experiments

Floyd Humphrey, Research Professor

- Ph.D., California Institute of Technology, 1956
- Materials; magnetic digital storage; magnetic sensors; magnetic flux reversal
- Life Fellow, IEEE
- IEEE 100th Anniversary Gold Medal for Service
- IEEE Magnetics Society 1988 Achievement Award

W. Clem Karl, Assistant Professor

- Ph.D., Massachusetts Institute of Technology, 1991
- Multidimensional and multiscale signal and image processing and estimation, particularly applied to geometrically and medically oriented problems
- Associate Editor, *IEEE Transactions on Image Processing*

Mark Karpovsky, Professor

- Ph.D., Leningrad Electrotechnical Institute, 1967
- Testing and diagnosis of computer hardware; fault-tolerant computing; error correcting codes
- Fellow, IEEE

Thomas Kincaid, Professor

- Ph.D., Massachusetts Institute of Technology, 1965
- Signal and image processing; neurodynamics; non-destructive testing

Robert Kotinga, Associate Professor

- Ph.D., McGill University, 1985
- Electromagnetics; numerical methods for three-dimensional vector field problems; Whitney forms and the Finite Element Method
- Member, Electromagnetics Academy

Lev Levitin, Distinguished Professor

- Ph.D., USSR Academy of Sciences, Gorky University, 1969
- Information theory; physics of communication and computing; quantum theory of measurements; complex and organized systems; reliable computing
- Fellow, IEEE; Member, New York Academy of Sciences

Thomas Little, Associate Professor

- Ph.D., Syracuse University, 1991
- Multimedia computing, computer networking, software engineering
- Editorial Board Member, *IEEE Multimedia, Multimedia Systems*
- Member, Executive Committee for the IEEE Computer Society Technical Committee on Multimedia Computing

Michael Mendillo, Professor (primary appointment with the Department of Astronomy and the Center for Space Physics)

- Ph.D., Boston University, 1971
- Low-light-level CCD instrumentation; atmospheric emission tomography; GPS satellite communications; space plasmas in the solar system

Theodore Moustakas, Professor

- Ph.D., Columbia University, 1974
- III-V nitrides, semiconductor properties and devices (blue-UV lasers, light-emitting diodes, detectors and transistors for high temperature and power applications)
- Fellow, American Physical Society; Fellow, Electrochemical Society; Member-at-large, governing body of Dielectric Division of the Electrochemical Society; Member, Electronic Materials Committee
- 1997/98 ECE Faculty Award for Excellence in Teaching

S. Hamid Nawab, Associate Professor, Associate Chairman for Undergraduate Studies

- Ph.D., Massachusetts Institute of Technology, 1982
- Digital signal processing; real-time, low-power, and distributed signal processing; image processing; communication and biomedical applications.
- 1988 Best Paper Award, *IEEE Signal Processing Society*
- 1993 Metcalf Award for Excellence in Teaching
- 1998 College of Engineering Award for Excellence in Teaching

Truong Nguyen, Associate Professor

- Ph.D., California Institute of Technology, 1989
- Digital image processing; wavelets; filter banks and applications; image and video compression
- Associate Editor, *IEEE Transactions on Signal Processing*; Associate Editor, *IEEE Transactions on Circuits and Systems II*

1992 Best Paper Award, *IEEE Signal Processing Society*

1999 Boston University Technology Award

William Oliver, Associate Professor, Associate Chairman for Graduate Studies

- Ph.D., University of Illinois, 1973
- Radar studies of the upper atmosphere and ionosphere; geophysical modeling and simulation; global change in the upper atmosphere

Mari Ostendorf, Associate Professor

- Ph.D., Stanford University, 1985
- Statistical modeling for signal interpretation; continuous speech recognition; computational modeling of prosody for speech synthesis
- Editorial board, *Computer, Speech and Language*
- ATR ITL paper award

David Perreault, Professor

- Ph.D., Purdue University, 1968
- Nonlinear networks; computer-aided design; microprocessors; distributed digital networks

Tatyana Roziner, Associate Professor

- Ph.D., Moscow Scientific Research Institute, 1975
- Digital design; testing and diagnostics of computer hardware; fault-tolerant computing

Michael Ruane, Associate Professor

- Ph.D., Massachusetts Institute of Technology, 1980
- Magneto-optical materials; optical data storage; optical systems; communications

Bahaa E.A. Saleh, Professor and Chairman

- Ph.D., Johns Hopkins University, 1971
- Quantum optics; statistical optics; optical processing; image processing; Liquid Crystal Displays
- Fellow – IEEE, Optical Society of America, and John Simon Guggenheim Foundation
- Editor in Chief, *Journal of the Optical Society of America A* (1991-1997); Chairman, Board of Editors, *Optical Society of America* (1998)
- Optical Society of America Beller Award

E. Fred Schubert, Professor

- Ph.D., University of Stuttgart, 1986
- Technology and physics of lasers and light-emitting diodes; semiconductor devices research

Fellow, SPIE
Literature Prize of the German Engineering Society, 1993

Eric Schwartz, Professor (primary appointment with Department of Cognitive and Neural Systems)

- Ph.D., Columbia University, 1973
- Computational neural science; machine vision, neuroanatomy; neural modeling

Alexander Sergienko, Assistant Professor

- Ph.D., Moscow State University, 1987
- Quantum optics, including quantum radiometry and metrology; laser physics; nonlinear optics; quantum communications; remote laser sensing; correlation spectroscopy
- NSF CAREER Award

Thomas Skinner, Associate Professor

- Ph.D., Boston University, 1982
- Microprocessors; computer networks; operating systems; distributed systems
- 1997 College of Engineering Award for Excellence in Teaching

William Skocpol, Professor (primary appointment with Department of Physics)

- Ph.D., Harvard University, 1974
- Nanofabrication; device processing; transport experiments in materials
- Fellow, American Physical Society

Johannes Smits, Associate Professor

- Ph.D., Twente University of Technology, the Netherlands, 1978
- Integrated sensors and actuators; piezo electric thin films; silicon bulk machining; MEMS devices; optical scanners; micropumps; DNA sequencing tools
- Fellow, IEEE; Elected Member, ADCOM, IEEE Ultrasonics, Ferroelectrics and Frequency Control Society
- Chair, IEEE Standards Committee on Actuators and Transducers
- Associate Editor, *IEEE Transactions Ultrasonics, Ferroelectrics and Frequency*

Neeraj Suri, Associate Professor

- Ph.D., University of Massachusetts at Amherst, 1992
- NSF CAREER Award
- Distributed, dependable, real-time systems; distributed algorithms and architectures

Malvin C. Teich, Professor

- Ph.D., Cornell University, 1966
- Quantum optics and imaging; photonics; fractal stochastic processes; information transmission in biological sensory systems
- Fellow – IEEE, Optical Society of America, American Physical Society, Acoustical Society of America, American Association for the Advancement of Science, and John Simon Guggenheim Foundation
- IEEE Browder J. Thompson Memorial Prize; IEEE Morris E. Leeds Award

Tommaso Toffoli, Research Associate Professor

- Ph.D., University of Michigan, 1977
- Fundamental connections between physics and computation; fine-grained modeling of physics-like systems technology (cellular automata machines) and methodology (programmable matter); personal knowledge structuring
- Editorial Board Member, *Complex Systems; The Interjournal*

Selim Ünlü, Associate Professor

- Ph.D., University of Illinois, Urbana-Champaign, 1992
- Design, processing, characterization and simulation of semiconductor optoelectronic devices; near-field optical microscopy and spectroscopy of semiconductor materials and devices
- NSF CAREER Award, Lightwave Technology Program
- ONR Young Investigator Award

Richard Vidale, Professor

- Ph.D., University of Wisconsin-Madison, 1964
- Modeling and simulation, software engineering

Moe Wasserman, Professor Emeritus

- Ph.D., University of Michigan, 1955
- Semiconductor processing, electronic circuits

2.2 Adjunct Faculty

The ECE Department looks outside the University for individuals to teach a few specific courses, as the need arises. These individuals bring a vast amount of engineering expertise, in both academic and industrial capacities, to the classroom. Below is a list of people who have helped the Department meet its teaching needs over the past year.

Ernesto Guerrieri, *SC504 Advanced Data Structures (Spring 1999)*

- Director of Technology at Inso Corporation, Electronic Publishing Solutions Division
- Teaching courses on as needed basis in ECE Department since 1990.

Yefim Levin, *SC453 Electromagnetics I (Summer 1999)*

- Manager of Microprocessor Laboratory in ECE Department
- Teaching courses on as needed basis in ECE Department since 1991.

Moe Wasserman, *EK307 Electric Circuit Theory, EK410 Introduction to Electronics (Summer 1999)*

- Ph.D., University of Michigan, 1955
- Semiconductor processing, electronic circuits

2.3 Scientists

Name	Title	Sponsor
Boyce, Suzanne	Research Affiliate	Carol Espy-Wilson
Chari, Venkatesh	Visiting Scientist	Carol Espy-Wilson
Cohen, Howard	Clinical Instructor	Allyn Hubbard
Dauler, Eric	Research Assistant	Alexander Sergienko
Emre, Erol *	Research Associate	David Castañon
Fage-Pedersen, Jacob *	Visiting Scholar	Scott Dunham
Ito, Akinori *	Visiting Scholar	Mari Ostendorf
Jaeger, Gregg *	Senior Research Associate	Alexander Sergienko
Jost, Bradley *	Research Associate	Malvin Teich
Kleptsyn, Vladimir	Instructor	Johannes Smits
Konrad, Janusz *	Research Associate	Thomas Little
Lowen, Steven *	Senior Research Associate	Malvin Teich
Redjda, Makhoul	Research Associate	Floyd Humphrey
Rice, Dean	Visiting Scholar	Alexander Sergienko
Schoendorf, Jacqueline *	Research Associate	William Oliver
Taibi, Giuseppe	Visiting Scholar	Hamid Nawab
Tsegaye, Tedros	Research Assistant	Alexander Sergienko
Veilleux, Nanette *	Research Affiliate	Mari Ostendorf
Vibe-Rheymer, Karin *	Research Associate	Malvin Teich

*Completed Appointment during 1998/99

2.4 Technical Staff

Yuri Fedyunin	<i>Wide Band Gap Semiconductors Laboratory Manager</i>
Dencho Kojucharov	<i>VLSI Laboratory Manager</i>
Yefim Levin	<i>Microprocessor Laboratory Manager</i>
Raul Rodriguez	<i>Electronics Laboratory Manager</i>
Open Position	<i>Distributed Semiconductor Processing Lab Engineer</i>

2.5 Administrative Staff

Curtis Nordstrom	<i>Administrative Assistant</i>
Joy Field	<i>Academic Programs Administrator</i>
Wayne Rennie	<i>Department Director</i>
Open Position	<i>Grants Administrator</i>
Adam DiNicola	<i>Financial Administrator</i>
Loretta Hawkes	<i>Senior Administrative Secretary</i>

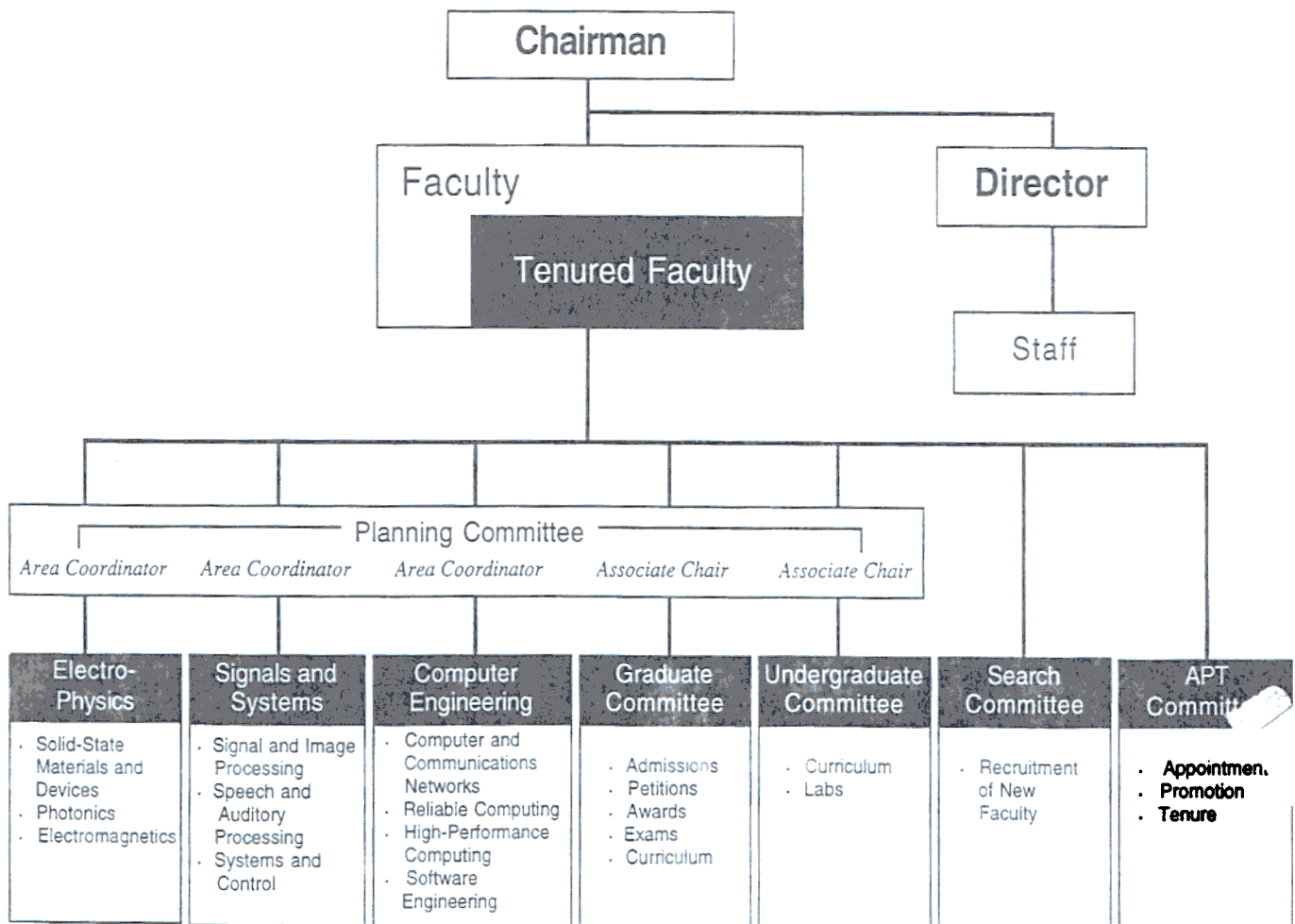
2.6 Department Administration & Committees

Bahaa Saleh	<i>Department Chair</i>
Hamid Nawab	<i>Associate Chair for Undergraduate Studies</i>
William Oliver	<i>Associate Chair for Graduate Studies</i>

Faculty committees direct the academic operations and planning for the ECE Department. The Undergraduate and Graduate Committees are responsible for curricular and student affairs. The Planning Committee comprises the coordinators of the three areas of research and instruction (electro-physics, signals and systems, and computer engineering), the Chairman, Director, and the two Associate Chairs, and is responsible for strategic initiatives.

Planning Committee	Graduate Committee	Undergraduate Committee	Search Committee	APT Committee
Saleh (Chair) Oliver (Assoc. Chair) Nawab (Assoc. Chair) Ruane (Electro-Physics) Karl (Systems) Vidale (Computer Eng.) Rennie (ex-officio)	Oliver (Chair) Nguyen (Admissions) Perreault (LEAP) Avresky Carruthers Castanon Dunham Lee Levitin	Nawab (Chair) Horenstein (transfer advisor) Fahim Eddy Giles Kincaid Perreault Roziner Ruane Sergienko Skinner	Saleh (Chair) Castanon Hubbard Schubert Suri Teich Vidale Rennie (ex-officio)	Saleh (Chair) Brower Karpovsky Moustakas Ostendorf Teich Rennie (ex-officio)

2.7 Organizational Chart



2.8 ECE Representation in College of Engineering Committees

COMMITTEE	FACULTY
COE GRADUATE COMMITTEE	Oliver (Chair); Brackett; Carruthers; Castañon Dunham; Lee; Levitin; Nguyen; Perreault
COE SCHOLARSHIP EXAM COMMITTEE	Horenstein (Chair)
COE UNDERGRADUATE COMMITTEE	Eisenberg (Chair); Nawab
COE STUDENT CONDUCT COMMITTEE	Smits
COE PROFESSIONAL PRACTICE ADVISORY GROUP	Nawab
ADVISOR TO MINORITY ENGINEERS' SOCIETY (MES)	Giles
ADVISOR TO STUDENT ASSOCIATION OF GRADUATE ENGINEERS (SAGE)	Ruane
ADVISOR TO SOCIETY OF HISPANIC PROFESSIONAL ENGINEERS (SHPE)	Castañon
ADVISOR TO TAU BETA PI	Nawab
ADVISOR TO ALPHI PHI OMEGA	Ruane
ENGINEERING HOUSE ADVISOR	Nawab

3. Undergraduate Programs

3.1 Highlights

ECE Advising Day

A major initiative was launched this year to enhance the advising system for ECE students. Each semester an "ECE Advising Day" was held just prior to the commencement of the telephone registration period for the next term. Many ECE faculty members volunteered up to 4 hours of advising time for their students. Each day also included a 90-minute advising workshop for all ECE undergraduates. The Fall workshop included presentations by Profs. Saleh, Perrault, and Nawab on topics such as "Career Paths in Electrical/Computer Engineering" and "How to Choose Technical Electives." The Spring workshop featured videotape presentations produced by IEEE on preparation for careers in Electrical and Computer Engineering. Both workshops also included question and answer sessions in which ECE faculty responded to general advising questions from students. Students were generally pleased with the workshops and they offered suggestions for future improvements. We anticipate that ECE Advising Day will become another important tradition within the ECE Department.

Recommended Changes in Degree Programs

This year the ECE Undergraduate Committee focused its work on examining how our undergraduate degree programs are faring in meeting their respective objectives and to propose changes which would lead to further improvements in this regard. A major impetus for giving this issue such importance is that the Accreditation Board for Engineering and Technology (ABET) has recently instituted a new set of guidelines (commonly referred to as ABET2000) for the re-accreditation of engineering programs in the new millenium. These guidelines give each institution greater flexibility in defining its own program objectives but they also require a well-defined evaluation/assessment process for ensuring that program objectives are being met. In its report (presented at the ECE faculty retreat in May), the ECE Undergraduate Committee recommended the following program changes for immediate implementation:

- 1) An expanded senior design project requirement from 4 units over one semester to 8 units over two or three semesters. Motivations for this change included the desire to make the projects more ambitious, to give ample time for completion of projects, and to institute an "apprenticeship" mechanism in which students

may learn from the experiences of others who are further along in the design process.

- 2) An explicit monitoring of how each offering of an ECE core course is structured to distribute student effort along dimensions such as design, writing, laboratory skills etc. The purpose here is to ensure that each student's overall program includes sufficient education/training along each of these dimensions while allowing for the variations in individual offerings of core courses.

The general thrust of these recommendations were supported by the department faculty in an informal vote at the faculty retreat. Formal consideration of these proposals will take place during faculty meetings in Fall 1999. Also, next year the ECE Undergraduate Committee will continue its focus on ABET2000 issues in connection with ECE degree programs.

Teaching Workshop

Over the last few years, the ECE Department has held teaching workshops for graduate teaching fellows and faculty. The success of these workshops was in part responsible for the offering this year in the Fall and the Spring of a new 2-credit Pass/Fail seminar course (SC850) on graduate teaching. This course is now required of all new graduate teaching fellows in the department.

Elements from past teaching workshops, such as panel and solo discussions and play-acting scenarios on teaching methodology, presentation techniques, pedagogy, ethics etc. have been incorporated into the new course. In addition, the course includes faculty presentations on their research interests in order to better acquaint the graduate teaching fellows with the research opportunities available to them in the Department.

ECE Teaching Award

During the 1997-98 academic year, the ECE Department instituted an award to recognize innovation and excellence in teaching in the department. The award, based on nominations from College students, faculty, and staff, carries with it a \$1000 prize to be used towards instructional activities. A committee of ECE faculty and students evaluated the nominees. They looked at teaching statements and classroom material, sat in on classes, and collected comments from students.

This year's winner was Professor Michael Ruane. He was cited for his "introduction of an innovative and highly acclaimed freshman module that emphasizes design, teamwork, and professional communications in the context of a real world problem." Professor Ruane is highly regarded in the Department for his commitment to excellence in engineering education through a balance of the knowledge, skills, and attitudes needed for continued learning, growth, and professional success. This commitment is also reflected in the excellent teaching evaluations students have given him not only in his freshman courses but also in his Senior Design and graduate level courses.

ECE Day 1999

The ECE Project Conference Day, an annual feature at the end of the Spring term, once again was successful in showcasing the work of our seniors and graduate students to other students, faculty, alumni, and company representatives. This year, the Senior Project presentations were held in two parallel sessions from 9am to 1pm.

The parallel sessions were chaired respectively by Profs. M. Ruane and M. Horenstein, the two Senior Design instructors for Spring 1999. From 1pm to 2pm, ten ECE graduate students presented posters on their respective research projects. An awards ceremony was held from 2pm to 3pm to recognize outstanding oral and poster presentations and to announce the ECE Faculty and GTF teaching awards.

P.T. Hsu Award

See Section 3.7.

ECE Teaching Award:

Professor Michael Ruane is the winner of the 1998/1999 ECE Faculty Award for Excellence in Teaching, for the introduction of an innovative and highly acclaimed freshman module that emphasizes design, teamwork, and professional communications in the context of a real world problem.



Michael Ruane received the Ph.D. in Systems Engineering from M.I.T. in 1980. He joined the faculty of the Department of Electrical and Computer Engineering at Boston University in 1980 and was promoted to Associate Professor in 1989. In 1996-97 he served the College of Engineering as ad interim Associate Dean for Graduate Studies. In 1993-94, he held a visiting appointment at the Optical Sciences Center, University of Arizona. His research interests include magneto-optic materials and devices and fiber optic sensors. He has led a number of innovative programs in photonics education. He is a Senior Member of IEEE and a member of LEOS and SPIE.

Enrollment

Fall 1998

	Electrical	Computer	Systems	Comp. Sys.	TOTAL
Freshmen*	31	—	—	62	93
Sophomores*	30	—	—	45	75
Juniors	45	2	5	70	122
Seniors	44	7	—	74	125
TOTAL	150	9	5	251	415

Spring 1999

	Electrical	Computer	Systems	Comp. Sys.	TOTAL
Freshmen*	31	—	—	61	92
Sophomores*	39	—	—	53	92
Juniors	45		4	71	121
Seniors	38	6	—	60	104
TOTAL	153	7	4	245	409

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

Degrees Awarded

Degrees Awarded

Electrical Engineering	36
Computer Engineering*	6
Systems Engineering*	0
Computer Systems Engineering*	56
TOTAL	98

Honors Students

Summa Cum Laude	23
Magna Cum Laude	7
Cum Laude	9
TOTAL	39

*Note: The Systems Engineering program is no longer offered. The Computer Engineering program was renamed Computer Systems Engineering in 1996.

3.4 Instructional Labs

Circuits and Electronics Laboratory

The Circuits and Electronics lab includes a full line of Hewlett-Packard bench top instruments linked by HP-VEE software. This continually updated facility, which supports ECE courses in circuits and electronics, enables us to offer traditional lab experiments in circuits in electronics in a modern laboratory setting that emulates those found in industry. The lab also can support more advanced experiments in signals and systems, communications, electromagnetics, and photonics. *Horenstein*

Control Systems Laboratory

This laboratory houses four ECP Model 220 Industrial Emulator/Serve Trainers for studying control of practical systems. *Vidale*

Distributed Semiconductor Processing Laboratory

This laboratory contains equipment for the fabrication of silicon integrated circuits. Facilities include wet etching and cleaning stations, diffusion/oxidation furnaces, a mask aligner, film deposition systems, and wafer probing and characterization stations. The core equipment in this laboratory was donated through the Massachusetts Microelectronics Center. *Smits*

High Performance Computing Laboratory

The High Performance Computing Laboratory at Boston University was created with support from the National Science Foundation (NSF) in order to support the 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 at high speed to the supercomputers at the Center for Computational Science and the Scientific Computing and Visualization Lab. *Giles*

Microprocessor and PC Laboratory

This lab features instruction in the programming and interfacing of microcomputers and digital controllers. Higher-level courses emphasize the design of systems using microprocessors. For networking studies, the laboratory contains four PC systems connected in a local loop with access to a larger local loop in the nearby microprocessor lab and to the campus area network.

Networking software, various simulators, and analysis packages are available. *Perreault*

Modern Communications Laboratory

This lab is under development to support experimental work in physical layer communications, including analog and digital modulation, encoding, channel characterization and noise, optical communications, and systems issues. Simulation tools, using the MATLAB Communications Toolbox, are being incorporated. *Ruane*

Network Computing Laboratory

The Network Computing Laboratory studies 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 interconnect (SCI), and distributed shared memory; network of workstations (NOW), case studies of high performance scalable networks, and cluster computing. *Avresky*

Networks Laboratory

This laboratory provides facilities for experiments involving data communication links, local-area networks, and wide-area networks. 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. *Carruthers*

Photonics Laboratory

The Photonics Laboratory serves the introductory and intermediate photonics courses—Introduction to Photonics, SC560; Fiber Optic Communication Systems, SC563; and Lasers, SC570. The lab is equipped with lasers, vibration-isolated optical tables, optical fiber components and systems, and facilities for experiments in diffraction, interferometry, holography, and acousto- and electro-optic modulation and scanning. *Ünlü*

Radio Communication Laboratory

The Radio Communication Laboratory supports lab experiments for courses in electrodynamics, waves and antennas, and wireless communication. Equipment includes a transmission line training station, benchtop receiving/transmitting antenna, radio receivers covering the radio spectrum from 1.6 MHz to 440 MHz, and two radio transmitters. Several antennas, including a four element rotating beam, a long-wave trap dipole, and a two-meter vertically polarized directional antenna, are

located on the roof of the photonics building. The Radio Communication Laboratory also serves as the home of the ECE-sponsored Boston University Amateur Radio Club. *Horenstein*

Senior Project Laboratory

This lab is operated as a virtual company, serving real-world customers such as NASA, Analog Devices, Boston and Brookline Public Schools, social service agencies, and 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 cross-compilers for DSP and micro-controller development. *Ruane, Horenstein*

Signals Laboratory

This laboratory houses numerous workstations for digital signal processing, image processing, and various real-time applications covering the complete audio frequency spectrum. Equipment includes PC's, 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), SC416 (Intro to Digital Signal Processing), SC 512 (Digital Signal Processing), and some ECE modules in EK130 (Introduction to Engineering). *Nawab*

Software Engineering Laboratory

An instructional and research lab, the Software Engineering Laboratory (SEL) supports courses and research on the economical design of reliable software for large-scale, computer-based systems. The lab includes a group of Silicon Graphics and Gateway 2000 networked workstations and provide students with state-of-the-art development tools for the design, implementation, and testing of software systems. *Vidale*

VLSI/CAD Laboratory

In this lab, students design circuits using state-of-the-art computer automated design systems. Facilities include four HP B180L workstations, eight DEC Micro VAXs, seven DECstation 3100's, two DECstation 5000's, six DEC Alphas, and four HPs, plus chip-testing electronics, and associated display and software systems. Software tools include ViewLogic, Synopsis, Mentor Graphics, and Cadence. *Hubbard*

Expenditures for Instructional Laboratories 1998/99

FACILITY	EQUIPMENT	APPROXIMATE COST
Electronics Lab	Amplifiers, Etherlink, etc.	\$8,200
Semi-conductor Lab	Photo-resist spinner, Upgrades	\$9,400
Senior Project Lab	Logic Analyzer, KIDSA Software, QuickCircuit, PC's	\$14,600
Signals/Networks Lab	PC's, Software	\$20,200
Microprocessing Lab	Printer, Co-axials, etc.	\$10,000
Software Design Lab	LCD Projector	\$14,300
VLSI Lab	Network Upgrades, etc.	\$25,100
TOTAL		\$101,800

3.5 Undergraduate Courses

Course	Course Title	Fall 1998	Spring 1999	Summer 1999
EK 100	Freshman Seminar	Faculty		
EK 130	Intro. to Engineering	Kincaid Horenstein Smits	Kincaid Ruane Smits	
EK 241	Directed Study	Horenstein		
EK 307	Electric Circuit Theory	Lee Kotiuga	Kotiuga Fahim Kincaid	Wasserman
EK 317*	Electronic Circuit Theory I	Oliver		
EK 318*	Electronic Circuit Theory II		Oliver	
EK 420	Intro. Parallel Computing	Giles		
EK 501	Math Methods I	Brower		
EK 502	Math Methods II		Brower	
EK 521	Parallel Computing		Giles	
SC 311	Intro. Logic Design	Roziner Perreault	Roziner	Roziner
CS 312	Small Computer Systems	Suri	Suri	
SC 330	Applied Algorithms/Data Structures	Castanon	Castanon	
SC 401	Signals and Systems	Nawab	Ostendorf	Nawab
SC 402	Control Systems	Vidale	Gevelber	
SC 410	Intro. to Electronics	Sergienko Unlu Eddy	Eddy	Wasserman
SC 412	Analog Electronics		Sergienko	
SC 415	Communication Systems	Roziner	Roziner	
SC 416	Intro. to Digital Signal Processing	Kincaid	Nawab	Nawab
SC 440	Intro. to Operating Systems	Skinner	Skinner	Skinner
SC 447	Software Design	Skinner	Skinner	Skinner
SC 450	Microprocessors	Perreault	Perreault	
SC 451	Directed Study	Faculty	Faculty	Faculty
SC 453	Intro. to Electromagnetics	Fahim	Kotiuga	Levin
SC 454	Electrodynamics	Kotiuga	Horenstein	Horenstein
SC 466	Senior Design Projects	Ruane	Ruane Horenstein	Ruane
SC 467	Senior Honors Thesis		Ruane Saleh	
SC 471	Physics of Semiconductor Devices	Schubert	Moustakas	

*MET courses taught by ECE professors to support the MET SEP program.

3.6 Freshman Research Opportunity Program (FROP)

Name	Lab/Professor
Oleg Gusyatin	Photonics Educational Lab/Goldberg
Daryl Khoo	Reliable Computing Lab/Karpovsky
Ilya Lipovsky	Quantum Optics Lab/Sergienko
Jon Llaguno	Quantum Optics Lab/Sergienko
Eric Rackauskas	Optoelectronic Device Characterization Lab/Schubert
Martin Schubert	Magnetic and Optical Devices Lab/Ruane



An ECE student completes his Senior Design Project.



ECE students present their projects at the 1999 ECE Day

3.7 Senior Design Projects

The Senior Project Laboratory, located on the first floor of the Photonics Building, supports the ECE Department's capstone senior design course, required of all ECE students. This course, first introduced in 1990, provides graduating seniors with an engineering apprenticeship that models the experience of a real engineering company. Students work in teams of two to four to design a product, electronic device, or software system for a real-life corporate or social-service client. Students make presentations to their customer, write inter- and intra-office memos, design their project to meet customer specifications, manage the project budget, and deliver the working product, complete with a detailed instruction manual. The ECE Department has made a major investment in space and equipment to provide every team with 24-hour access to its own dedicated, fully-equipped laboratory bench. Although the course has been offered for nearly a decade, much has changed since its early days. Student design teams now work for the department's official company – Xebec Technologies of Boston University. Students gain valuable practical skills and training in project management, product development, and engineering design by working on projects for real-life clients.

1999 P.T. Hsu Award

The winners of the 1999 P.T. Hsu award for best senior project in the ECE department were the Carter Touch Screen project. The team members were Charbel Abdul-Massih, Munirah Al-Duajj, and Ahmed El-Shimi. The Carter Touch Screen project developed a web server and web tools for the teachers of the Carter School in Boston, a school for severely and multiply handicapped students. With the Carter Touch Screen a teacher can assemble a series of images and sounds accessible over the web in their classroom. Each student has their own series, controlled by a touch screen, and used for planning activities, communicating, playing games, and working on language skills. The system was developed, extensively documented, delivered to the Carter School and installed last May.

Notable Fall 1998 Senior Projects

Team Members

Alan Chan, Asaf Fishov, Raj Patel
Jay Hancock, Eduardo Joo, Tibor Trunk

Project Name

AWGN, Inc., Locator Pager, Carter School
JET Launch, SPECTRE Rocket, BU Astronomy

Notable Spring 1999 Senior Projects

Team Members

Alexander Nasman, Anson Wooding,
Allyson Yarbrough
Kyle Glossy, Magdalene Merritt, Laura Tuck

Project Name

Mit'Ki, microfluidic control
MiLK, web interface

4. Graduate Programs

4.1 Course & Program Development

Curriculum Development

In AY 1998-1999 we made a thorough review of the graduate curriculum and planned changes and additions needed to enhance our course offerings. We noted an insufficient number of advanced (700-level) courses in Photonics and an irregular schedule for course offerings. During the past year, two 700-level Photonics courses were developed (or updated) and taught. Also, extensive tables of past offerings of all graduate courses were developed, patterns noted, and future plans suggested for their offerings.

New Courses

Eight new graduate courses were approved during the year.

EK502 Math Methods II, developed during the previous year, was formally approved as a permanent course.

EK502, highly computational in nature, is taken primarily to develop computational skills needed in research.

Professor Brower taught this course in Spring 1999.

SC500 Electromechanical Energy Conversion was developed to introduce students to a topic once required, now hard to find, modern electrical machines, the principles of their operation, design, and control, and their applications in modern technology. Professor Fahim plans to offer this course in Fall 1999.

MN/SC567 Computational Electromagnetics was developed by Professor Yeung of Manufacturing Engineering and cross-listed in ECE.

SC574 Quantum Mechanics and its Application to Semiconductor Devices was developed to offer students a quantum-mechanical perspective on semiconductor materials and devices. Professor Schubert plans to offer this course in Fall 1999.

SC754 Dependable Distributed Systems was developed to provide students the opportunity to develop, design, and analyze capabilities for fault-tolerant distributed systems, and to foster research and to develop employment potential in this area. Professor Suri plans to offer this course in Spring 2000.

SC760 Advanced Topics in Photonics, taught previously as an SC700 Special Topics Course, was placed in the permanent registry of courses. This course may change its topic every offering, and students will be able to take SC760 each time a new topic is addressed. Professor Saleh taught the topic Nonlinear & Ultrafast Optics in Fall 1998.

SC770 Guided-Wave Optoelectronics was introduced to update and succeed SC770 Integrated Optoelectronics. Professor Unlu taught the new course in Spring 1999.

SC850 Graduate Teaching Fellow Seminar was introduced to instruct our graduate students in their teaching duties. Professor Nawab, who has led a Teaching Fellow Workshop in previous years, organized this course. Graduate Teaching Fellows from the other Engineering Departments attended the ECE version of this course (AM850, BE850, and MN850 exist). It will be mandatory each semester for first-time GTFs. The teaching seminar included several ECE research talks (see below).

Graduate Student Recruitment

Following a mediocre recruiting year for 1998-1999, we had an excellent year for the incoming 1999-2000 graduate student class. All 5 of our PUGF (Presidential University Graduate Fellows) nominees competed successfully at the University level, and 4 accepted the University offer. Three of our 6 ENG Dean's Fellow nominees were approved at the Dean's level, and 2 of those accepted the Dean's offer. 15 of 31 GTF (Graduate Teaching Fellow) and 5 RA (Research Assistantship) offers were accepted. A most promising note was that we attracted several top women applicants to top (PUGF) positions. The large ENG undergrad enrollment of women and the fact that the majority of the ENG Awards Ceremony awards went to women this year indicates that we have an environment attractive to women engineers, a circumstance that we may wish to exploit further.

Separately, we decided to try to recruit more of our own top undergrads to our grad program. We identified several specific measures that would make the MS program more attractive to them or give them a positive taste of grad student experience in their undergrad days:

- 1) Reduce the MS program requirements from 36 to 32 credits (to be debated by the faculty).
- 2) Award GTF early decisions to our top Juniors.
- 3) Create UTF (Undergrad Teaching Fellow) positions to provide our top undergrads the opportunity to operate at this advanced level and thereby gain an appreciation of grad student life.
- 4) Hold a fellowship application workshop in early Fall to inform the students of their opportunities to apply for NSF, DoD, NASA, DoE, NIH, etc.

- fellowships to fund their graduate education.
- 5) Create a combined Senior-Design/MS-Project path for top undergrads who wish to develop their Senior Design projects into real graduate substance.

Graduate Student Seminars

The former weekly or bi-weekly series of ECE Graduate Student Seminars was absorbed this year into SC850, the Graduate Teaching fellow Seminar (see above). The first half of each semester was devoted to teaching instruction while the latter half was devoted to research talks by ECE professors, aimed at facilitating the placement of students into the professors' research programs. The research talks given for the year are listed below.

- October 9 - William Oliver
entire SC850 class
How to Find a Research Home
- October 16 - Mark Karpovsky
17 students, 7 professors
Reliable Computer Networks
- October 23 - Carol Espy-Wilson
20 students, 2 professors
Research in the Speech Communication Group
- November 6 - Bahaa Saleh
13 students, 2 professors
Thoughts on Selecting an Advisor
- November 6 - Alexander Sergienko
13 students, 2 professors
Optical Metrology and Quantum Cryptography with Polarized Entangled Photons
- February 26 - Theodore Moustakas
11 students, 1 professor, 1 staff
Wide Band-gap Semiconductors and Their Applications
- March 19 - Robert Kotiuga
7 students, 1 professor
*Three Dimensional Computational Electromagnetics:
Vignettes of Theory vs. Design Practice*
- March 26 - Michael Ruane
7 students, 1 professor
*Attractive or Repulsive:
Research in the Magnetic and Optical Devices Lab (MODL)*

April 2 - Eric Schwartz
13 students, 2 professors, 2 family
Brain Architecture and Computer Vision

April 9 - Alexander Sergienko
7 students
Quantum Cryptography with Entangled Photons

ECE Colloquium

The ECE Colloquium series continued for a second year. Prominent speakers from both outside and inside the University gave research talks on issues of current prominence. Graduate students were expected to attend these talks. A listing of speakers during the 1997/98 Academic Year is given later in this section.

Graduate Teaching Assistants

For AY 1998-99, ECE's allocation of ENG's 53 GTF slots remained at 17 during the year, but our growing enrollment (centered in Computer Systems Engineering) and the expanding instructional-lab environment created such a need that the Dean funded two additional slots from his discretionary funds. Those growing enrollments have caused ECE's allocation to rise from 17 to 22 in this year's allotment process (for implementation in AY 1999-2000). This more than justifies the Dean's increase to 19 this year, while the college allotment from the University remained at 53. As this huge change posed a real difficulty for the departments who would lose GTFs, the allotment formula was revisited (issues of whether we count undergraduate courses only or also graduate courses, independent study courses, lab factors, etc.), and the ECE allotment was reduced to 20. ENG will make a case for an increased allotment from the University in the future but felt it could not during this year of decreased ENG enrollment.

Within ECE we have recruited graduate student applicants to our three broad areas of faculty research interest - Electro-Physics, Signals & Systems, and Computer Engineering - in proportion to the RA support available for continued support in succeeding years. As the Computer Engineering group has the fewest RAs but the majority of the undergrads to teach, we decided to award two GTF slots to Computer Engineering to fill critical teaching needs (e.g., Software Engineering Lab, Microprocessors) and allot the remaining pool according to RAs.

4.2 New Matriculants

New Students Entering Fall 1998

		Male	Female	FT	PT	GTF	RA	Fellow	Other
MS	US	9	0	8	1	1	2	0	0
	Intl.	12	4	15	1	5	2	0	0
Ph.D.	US	2	0	1	1	0	0	0	0
	Intl.	13	3	15	1	4	7	0	0
TOTAL		36	7	39	4	10	11	0	0

New Students Entering Spring 1999

		Male	Female	FT	PT	GTF	RA	Fellow	Other
MS	US	5	2	5	2	2	0	0	0
	Intl.	4	2	5	1	1	1	0	0
Ph.D.	US	0	0	0	0	0	0	0	0
	Intl.	3	1	3	0	1	1	0	0
TOTAL		12	5	13	3	4	2	0	0

4.3 GRE Scores

Fall 1998 Mean GRE Scores

		Verbal	%	Quantitative	%	Analytical	%
MS	US	546	63	717	83	696	83
	Intl.	496	52	757	91	684	83
Ph.D.	US	470	48	760	92	670	81
	Intl.	534	51	763	92	696	85
Mean		512	54	749	90	687	83

Spring 1999 Mean GRE Scores

		Verbal	%	Quantitative	%	Analytical	%
MS	US	557	69	688	77	632	68
	Intl.	457	45	698	79	587	58
Ph.D.	US	NA	NA	NA	NA	NA	NA
	Intl.	410	22	717	76	653	75
Mean		475	45	701	77	624	67

4.4 MS Students

Electrical Engineering

<i>Student Name</i>	<i>Advisor</i>	<i>Advisor Type</i>	<i>Research Area or Thesis</i>
Abram Yong, Rodolfo	Kincaid	Both	Digital Signal Processing
Aggarwal, Nitin	Karl	Both	Statistical Signal Processing
Al-Ameri, Ahmed	Castañon	Both	Design Furnace Temperature Control
Bakhash, David	Ruane	Research	Signal Processing and Recognition
Barrientos, Laura	Espy-Wilson	Research	Speech Communication
Bevis, George	Lee	Both	Signal Processing
Chaitanya Kumar, Divya Swaroop	Kincaid	Academic	Electrical Engineering
Chan, Wai	Eddy	Academic	Electrical Engineering
Clark, Tricia	Mendillo	Research	Image Studies in Equatorial Aeronomy
Craft, Eric	Espy-Wilson	Academic	Speech Recognition
Dekow, Gary	Horenstein	Academic	Electrical Engineering
Demirel, Pelin	Espy-Wilson	Research	Improvement of Electrolaryngeal Speech
Dosummu, Olufemi	Ünlü	Academic	"Modeling and Simulation of Intrinsic and Measured Response of High-Speed Photodiodes"
Emsley, Matthew	Dunham	Both	Fabrication of Resonant Cavity Enhanced Silicon Photodectors
Fishov, Asaf	Carruthers	Academic	Electrical Engineering
Govardhanagiri, Subbarao	Karl	Both	Electrical Engineering
Haque, Anwar	Carruthers	Academic	Electrical Engineering
Hebsur, Shashidhar	Nawab	Both	Knowledge Based Signal Processing of Musical Signals
Jade, Sachin	Smits	Both	Solid State Devices
Kahric, Zoran	Smits	Academic	Electrical Engineering
Khouri, Yousif	Ruane	Academic	Electrical Engineering
Li, Yun-li	Schubert	Academic	Electrical Engineering
Lobacheva, Yuliya	Ostendorf	Both	"Discourse Mixture Language Modeling"
Ma, Kun	Espy-Wilson	Both	Speech Processing
Malish, Michael	Perreault	Academic	Electrical Engineering
Mandal, Arindam	Espy-Wilson	Research	Speech Communication/Signal Processing

Electrical Engineering

<i>Student Name</i>	<i>Advisor</i>	<i>Advisor Type</i>	<i>Research Area or Thesis</i>
McCaffrey, Zachariah	Espy-Wilson	Research	"Deadlock and Livelock-Free Wormhole Routing for 2-D Toruses"
Mishra, Apurva	Hubbard	Both	"Development of a Dynamically Adapting Filter Bank Model of the Cochlea, and its VLSI Implementation"
Mwangi, Owen	Espy-Wilson	Research	Signal Processing and VLSI Design
Nasr, Magued	Hubbard	Research	Electrical Engineering
Ng, Chung Shan	Oliver	Academic	Electrical Engineering
Padma, Sachin	Carruthers	Research	Capacity of Wireless Infrared Channels
Pandey, Ajay	Ostendorf	Academic	Electrical Engineering
Perreault, Julie	Castañon	Both	MEMS
Read, Timothy	Ostendorf	Research	Separation of Speakers for Improved Speech Recognition
Rodney, Jonathan	Kotiuga	Both	Application of a Galvanometric Scanner to Data Storage and Retrieval with Phase-Change Materials
Salomon, Ariel	Espy-Wilson	Both	Knowledge-Based Speech Representation
Seth, Kshitij	Moustakas	Both	Development of III-V Nitrides by HVPE
Shah, Gaurav	Dunham	Academic	Electrical Engineering
Shanbhag, Prashant	Bifano	Research	Electrical Engineering
Shao, Peijun	Carruthers	Academic	Networking
Song, Jae	Vidale	Academic	Electrical Engineering
Stern, Alvin	Horenstein	Academic	Electrical Engineering
Tinkler, Rosanne	Hubbard	Academic	Novel Digital to Log Current Device
Toussaint, Kimani	Ruane	Both	Electrical Engineering
Velikin, Peter	Ünlü	Research	Hyperpolarized Noble Gas MRI
Weng, Chengjian	Nguyen	Both	Electrical Engineering
Wilson, Danielle	Gevelber	Research	Control Systems
Xing, Xinyu	Hubbard	Both	Analog Circuit Design
Xiong, Yufeng	Castañon	Academic	Electrical Engineering
Zhang, Qian	Espy-Wilson	Research	Electrical Engineering

4.5 Ph.D. Students

Electrical Engineering

<i>Student Name</i>	<i>Research Advisor</i>	<i>Research Area or Thesis Title</i>
Abouraddy, Ayman	Little	Nonlinear and Quantum Optics
Adhikary, Rajiv	Nawab	Electrical Engineering
Aleksanyan, Arnak	Dunham	Electrical Engineering
Bacchiani, Michael	Ostendorf	“Speech Recognition System Design Based on Automatically Derived Units”
Bates, Rebecca	Ostendorf	Hidden Mode Modeling in Spontaneous Speech Recognition
Cetin, Mujdat	Karl	“A Statistical Tomographic Approach to Synthetic Aperture Radar Signal Processing”
Cetin, Ozgur	Ostendorf	Statistical Dependence Models for Rapid Speaker Adaptation
Chen, Ying-Jui	Nguyen	Electrical Engineering
Colerico, Marlene	Mendillo	Atmospheric Modeling
Fastenko, Pavel	Dunham	Solid State Materials (Extended Defects Modeling Using Molecular Dynamics)
Feng, Haihua	Castañon	Signal, Image Processing
Fish, Randall	Ostendorf	Statistical Acoustic Modeling for Manufacturing Fault Classification
Fujimoto, Koji	Smits	Electrical Engineering
Gencer, Alp	Dunham	“Modeling and Simulation of Transient Enhanced Diffusion Based on Interactions of Point and Extended Defects”
Goepfert, Ian	Schubert	Semiconductor Material and Devices
Gokkavas, Mutlu	Ünlü	High Speed Photodetectors
Graff, John	Schubert	Tunable Photonic Devices
Guo, Xiaoyun	Schubert	Micro-Opto-Electro-Mechanical Systems
Herzog, William	Ünlü	Near-Field Scanning Optical Microscopy of Laser Diodes
Hinck, Todd	Hubbard	Design and Development of Analog and Digital Circuits for Neuromorphic Vision Systems
Iliopoulos, Eleftherios	Moustakas	“Growth, Modeling and Optoelectronic Properties of Ordered III-V Nitride Alloys”
Jastrzebski, Piotr	Lee	Ionospheric Plasma Physics
Kamalabadi, Farzad	Oliver	Atmospheric Optical Tomography
Karra, Maria	Fritz	Energetic Particles in the Earth’s Magnetosphere
Ke, Wang	Little	Multimedia Networks, Video-on-Demand Systems
Khan, Naved	Karpovsky	Computer Networking
Lin, Bosheng	Mendillo	Signal Processing and Communication
Litvin, Andrey	Oliver	Hot Oxygen in the Upper Atmosphere
Meng, Lingmin	Nguyen	“Template-based Approaches for Human Face Detection and Classification”
Misra, Mira	Moustakas	“Ultraviolet Photodetectors Based on GaN and Al _x Ga _{1-x} N Films Grown by Plasma-Assisted Molecular Beam Epitaxy”
Morrissey, Ronald	Humphrey	Grooved Magnetic Materials
Murphy, Brendon	Dunham	“Modeling of Dopant Dose Loss at the Silicon-Silicon Dioxide Interface”

Electrical Engineering

<i>Student Name</i>	<i>Research Advisor</i>	<i>Research Area or Thesis Title</i>
Narayanan, Santosh	Nguyen	"Growth of GaN on Pre-Patterned Substrates by Vapor Phase Epitaxy for Optoelectronic Applications"
Nelson, Kenric	Ruane	Electrical Engineering
Ng, Hock	Moustakas	Phase-Change Optical Data Storage
Oraintara, Soontorn	Nguyen	"The Development of Nitride Laser Screens by Molecular Beam Epitaxy"
Palmer, David	Ostendorf	Electrical Engineering
Sampath, Anand	Moustakas	Language Processing for Information Extraction
Shaik, Izhak	Ostendorf	Solar-blind P-i-n AlGaIn Photodetectors
Shivakumar, Hariharan	Ostendorf/Castanon	Acoustic Modeling in Large Vocabulary Continuous Speech Recognition
Singh, Rajwinder	Eddy	Estimating Confidence of Milling Tool Wear Classification
Sivaramakrishnan, Kamakshi	Nguyen	III-Nitride Semiconductor Devices and Processing
Weisenseel, Robert	Karl	Electrical Engineering
Xie, Gang	Levin	Information Fusion
Yang, Zibing	Mountain	"Numerical Properties of First Kind Fredholm Operator"
Ying, Zhengrong	Karl	Electrical Engineering
Younis, Waheed Ahmad	Castañon	Target Recognition and Image Processing
		"Robust Tracking of Maneuvering Targets"

Computer Engineering

Acosta, Juan	Avresky	Computer Engineering
Basu, Prithwish	Little	Multimedia Networks, Wireless Networks
Beriont, Walter	Little	Computer Engineering
Bulyko, Ivan	Ostendorf	Speech Synthesis for Human-Computer Dialog Systems
Bynoe, Wayne	Carruthers	Broadband Wireless LANs
Choi, Jeeyac	Brackett	Development of Guidelines in the Medical Domain
Hasan, Qadeer-ul	Levitin	Computer Engineering
Howell, Geoffrey	Baillieul	Analysis of Simple Biped Robots
Jaiswal, Sharad	Karpovsky/Suri	Fault Tolerance/Routing in Computer Networks
Jones, Lawrence	Carruthers	Computer Engineering
Kazmi, Ahmad Shabbar	Giles	Efficient Demagnetizing Field Calculations
Krishnan, Rajesh	Little	Aggregation Theory—A Framework for Modeling Resource Sharing in Computer Systems
Liu, Chenhui	Saleh	Computer Engineering
Liu, Tong	Carruthers	"Predictive Mobility Management for Wireless Mobile Networks"
Mao, Junjie	Perreault	Computer Engineering
Mustafa, Mehmet	Perreault	Reliable Computing
Natchev, Natcho	Avresky	Network Computing

Computer Engineering

<i>Student Name</i>	<i>Research Advisor</i>	<i>Research Area or Thesis Title</i>
Ravichandran, Hari		Dynamic Order Based Routing for Massively Parallel SMP Machines
Schaeffer, Thomas	Perreault	"Distributed Fuzzy Logic in Ring Networks"
Shurbanov, Vladimir	Avresky	Network Simulation, Performance Analysis and Optimization
Sinha, Purnendu	Suri	"A Framework for Formal Methods Driven Verification and Validation of Dependable Real-Time Protocols"
Sivarasa, Sriram	Avresky	Computer Engineering
Tian, Yi	Perreault	Computer Engineering
Vassilaras, Spyridon	Paschalidis (MFG)	Estimation of the Effective Bandwidth of Variable Bit Rate (VBR) Data Sources
Walton, Zachary	Sergienko	"Quantum Cryptography Using Entangled Photons"
Zakrevski, Lev	Karpovsky	Fault-Tolerant Message Routing in Computer/Communication Networks
Zuo, Yingtao	Castañon	Multimedia Networks

Systems Engineering

Ahanger, Gulrukh	Little	"Techniques for Automatic Digital Video Composition"
Alpin, Boris	Karpovsky	Systems Engineering
Eakman, Gregory	Brackett	"Integration Testing of Object-Oriented Systems"
Varoglu, Yavuz	Avresky	Systems Engineering

M.S. Degrees Awarded

Electrical Engineering	23
Computer Systems Engineering	18
TOTAL	41

Ph.D. Degrees Awarded

Electrical Engineering	3
Computer Engineering	1
Systems Engineering	1
TOTAL	5

4.6 Fellowships and Awards

The ECE Department is pleased to announce the awards and fellowships received by our graduate students in 1998/99.

<u>Name</u>	<u>Award</u>
Michael Bacchiani	ECE Travel Grant
Gabriela Bunea	ECE Travel Grant
Gary Garber	GAANN Fellow
John Graff	GAANN Fellow
William Herzog	ECE Travel Grant
Kenric Nelson	GAANN Fellow
Anand Sampath	GAANN Fellow

4.7 Graduate Teaching Fellows

Fall 1998

Student Name	Course
Xiong, Yufeng	EK 307
Shukla, Barti	EK 311
Kshitij, Seth	EK 317
Guo, Xiaoyun	SC 311
Zakrevski, Lev	SC 311
Chipolone, Michael	SC 312
Sivaramakrishnan, Kamakshi	SC 401
Abouraddy, Ayman	SC 410
Emsley, Matthew	SC 410
Jade, Sachin	SC 410
Khan, Naved	SC 410
Sampath, Anand	SC 410
Padma, Sachin	SC 415
Cetin, Ozgur	SC 416
Natchev, Natcho	SC 447
Jastrzebski, Piotr	SC 453
Ng, Hock Min	SC 466
Choi, Jeeyae	SC 546
Rodney, Jonathan	SC 560
Govardhanagiri, Subbarao	SC 571
Mishra, Apurva	SC 571
Shukla, Bharti	AS 101

Spring 1999

Student Name	Course
Aleksanyan, Arnak	EK 307
Nam, Kyung	EK 307
Khan, Naved	EK 307
Shanbhag, Prashant	EK 307
Xing, Xinyu	EK 307
Shukla, Bharti	SC 311
Chipolone, Michael	SC 312
Choi, Jeeyae	SC 330
Sivaramakrishnan, Kamakshi	SC 401
Emsley, Matthew	SC 410/412
Jade, Sachin	SC 410/412
Padma, Sachin	SC 410/415
Abouraddy, Ayman	SC 416
Natchev, Natcho	SC 440/447
Trunk, Tibor	SC 450
Jastrzebski, Piotr	SC 453/454
Fishov, Asaf	SC 466
Seth, Kshitij	SC 471
Xiong, Yufeng	SC 546
Rodney, Jonathan	SC 563/570
Govardhanagiri, Subbarao	SC 571
Sayed, Sohail	AS 101

Summer 1999

Khan, Naved	EK 307
Zakrevsky, Lev	SC 311
Dasika, Vasant	SC 401
Lewis, Michael	SC 410
Adhikary, Rajiv	SC 416
Natchev, Natcho	SC 447
Toussaint, Kimani	SC 466
Aleksanyan, Arnak	SC 453

4.8 Research Assistants

Student	Advisor	Student	Advisor
Aggarwal, Nitin	Karl	McCaffrey, Zachariah	Espy-Wilson
Atature, Mete	Sergienko (Physics Student)	Meng, Lingmin	Nguyen
Bacchiani, Michael	Ostendorf	Mishra, Apurva	Hubbard
Basu, Prithwish	Little	Misra, Mira	Moustakas
Bates, Rebecca	Ostendorf	Murphy, Brendon	Dunham
Booth, Mark	Teich	Nam, Kun Jun	Moustakas
Bulyko, Ivan	Ostendorf (BME Student)	Nasr, Magued	Hubbard
Bunea, Gabriela	Ünlü	Ng, Hock	Moustakas
Bunea, Marius	Dunham	Oraintara, Soontorn	Nguyen
Bynoe, Wayne	Carruthers	Read, Timothy	Ostendorf
Cetin, Mujdat	Karl	Salomon, Ariel	Espy-Wilson
Cetin, Ozgur	Ostendorf	Sampath, Anand	Moustakas
Chakravarthi, Srinivasan	Dunham	Seth, Kshitij	Moustakas
Chen, Ying-Jui	Nguyen (MFG Student)	Shaik, Izhak	Ostendorf (AME Student)
Clark, Tricia	Mendillo	Shanbhag, Prashant	Bifano
Colerico, Marlene	Mendillo	Shivakumar, Hariharan	Ostendorf
Demirel, Pelin	Espy-Wilson	Shivakumar, Priya	Espy-Wilson
Doppalapudi, Dharanipal	Moustakas (MFG Student)	Shurbanov, Vladimir	Avresky
Emsley, Matthew	Dunham	Singh, Rajwinder	Eddy
Fastenko, Pavel	Dunham	Sinha, Purnendu	Suri
Feng, Haihua	Castanon	Sodhi, Ashish	Chakrabarti
Fish, Randall	Ostendorf	Srinivasan, Karthikeyan	Little (Physics Student)
Goepfert, Ian	Schubert	Stocker, Dean	Schubert
Gökkavas, Mutlu	Ünlü	Tian, Yi	Perrault
Govardhanagiri, Subbarao	Karl	Toussaint, Kimani	Ruane (Physics Student)
Graff, John	Schubert	Ulu, Gokhan	Ünlü (Physics Student)
Guo, Xiaoyun	Schubert	Vander Rhodes, Gregory	Ünlü
Hebsur, Shashidhar	Nawab	Velikin, Peter	Ünlü
Herzog, William	Ünlü	Walton, Zachary	Sergienko
Hinck, Todd	Hubbard	Weisenseel, Robert	Karl
Iliopoulos, Eleftherios	Moustakas	Weng, Chengjian	Nguyen
Karra, Maria	Fritz	Xie, Gang	Levin
Ke, Wang	Little	Yang, Zibing	Hubbard
Kamalabadi, Farzad	Chakrabarti	Yeh, Chih Chien	Hubbard
Litvin, Audrey	Oliver	Ying, Zhengrong	Castanon
Lin, Bosheng	Mendillo	Younis, Waheed	Castanon
Liu, Chenhui	Saleh	Zakrevski, Lev	Karpovsky
Lobacheva, Yuliya	Ostendorf	Zhang, Qian	Espy-Wilson
Ma, Kun	Espy-Wilson/Nawab	Zuo, Ying Tao	Castanon
Mandal, Arindam	Espy-Wilson		

4.9 Graduate Courses

Course Number and Title	Fall 98	Spring 99	Summer 99
SC 501 Dynamic Systems Theory	Dupont		
SC 504 Advanced Data Structures	Guerrieri	Guerrieri	
SC 505 Stochastic Processes	Ostendorf	Karl	
SC 508 Process Control	Gevelber		
SC 509 Simulation	Vakili		
SC 511 Software Systems Design	Vidale	Brackett /Vidale	
SC 512 Digital Signal Processing	Nguyen	Nguyen	
SC 513 Computer Architecture	Skinner		
SC 518 Software Project Management	Brackett	Brackett	
SC 520 Math Methods I	Brower		
SC 533 Intro Disc Math	Levitin		
SC 534 Stochastic Models in Engineering		Levitin	
SC 546 Computer Communications and Networks	Carruthers	Carruthers	
SC 560 Introduction to Photonics	Teich		
SC 561 Error-Control Codes	Karpovsky		
SC 562 Digital Communication	Ruane		
SC 563 Fiber Optic Communication Systems		Schubert	
SC 570 Lasers		Teich	
SC 571 VLSI Principles and Applications	Hubbard	Hubbard	
SC 572 VLSI Design Project	Hubbard		
SC 575 Semiconductor Devices	Dunham	Dunham	
SC 577 Solid State Devices	Moustakas		
SC 578 Fabrication Technology for Integrated Systems		Smits	
SC 700 Advanced Special Topics	Saleh	Schubert	Carruthers/Nguyen
SC 710 Dynamic Programming and Stochastic Control	Caramanis		
SC 712 Advanced Software for Computer Engineers		Skinner	
SC 714 Software Performance Engineering		Vidale	
SC 716 Advanced Digital Signal Processing	Nawab		
SC 717 Image Reconstruction and Restoration	Karl		
SC 725 Queuing Systems	Hu		
SC 730 Information-Theoretical Design of Algorithms		Levitin	
SC 741 Network Computing		Avresky	
SC 748 Multimedia Computer System Design		Little	
SC 749 Interconnection Networks for Multicomputers	Avresky		
SC 752 Theory of Computer Hardware Testing		Karpovsky	
SC 753 Fault-Tolerant Computing		Karpovsky	
SC 757 Advanced Microprocessor Design		Perreault	
SC 761 Information Theory and Coding	Levitin		
SC 770 Integrated Optoelectronics		Ünlü	
SC 772 VLSI Graduate Design Projects		Hubbard	Hubbard
SC 775 VLSI Devices/Models	Dunham		

Course Number and Title	Fall 98	Spring 99	Summer 99
SC 891 Seminar: Computer Systems Engineering	Karpovsky	Karpovsky	
SC 892 Seminar: Electro-Physics	Dunham		
SC 892 Seminar: Electro-Physics	Schubert		
SC 892 Seminar: Electro-Physics	Teich		
SC 892 Seminar: Electro-Physics	Teich		
SC 892 Seminar: Electro-Physics	Dunham		
SC 892 Seminar: Electro-Physics	Moustakas		
SC 893 Seminar: Signals and Systems	Ostendorf	Ostendorf	
SC 900 Research	Faculty	Faculty	Faculty
SC 901 Thesis	Faculty	Faculty	Faculty
SC 910 Computer Engineering Design Project	Faculty	Faculty	Faculty
SC 911 Systems Design Project	Faculty	Faculty	Faculty
SC 912 Software Eng. Design Project	Faculty	Faculty	Faculty
SC 913 Electrical Engineering Design Project	Faculty	Faculty	Faculty
SC 939 Continuing Study	Faculty	Faculty	Faculty
SC 951 Independent Study	Faculty	Faculty	Faculty
SC 991 Dissertation	Faculty	Faculty	Faculty

Course Number and Title	Fall 98	Spring 99	Summer 99
SC 891 Seminar: Computer Systems Engineering	Karpovsky	Karpovsky	
SC 892 Seminar: Electro-Physics	Dunham		
SC 892 Seminar: Electro-Physics	Schubert		
SC 892 Seminar: Electro-Physics	Teich		
SC 892 Seminar: Electro-Physics	Teich		
SC 892 Seminar: Electro-Physics	Dunham		
SC 892 Seminar: Electro-Physics	Moustakas		
SC 893 Seminar: Signals and Systems	Ostendorf	Ostendorf	
SC 900 Research	Faculty	Faculty	Faculty
SC 901 Thesis	Faculty	Faculty	Faculty
SC 910 Computer Engineering Design Project	Faculty	Faculty	Faculty
SC 911 Systems Design Project	Faculty	Faculty	Faculty
SC 912 Software Eng. Design Project	Faculty	Faculty	Faculty
SC 913 Electrical Engineering Design Project	Faculty	Faculty	Faculty
SC 939 Continuing Study	Faculty	Faculty	Faculty
SC 951 Independent Study	Faculty	Faculty	Faculty
SC 991 Dissertation	Faculty	Faculty	Faculty

4.10 ECE Colloquium - List of Speakers

Fall 1998

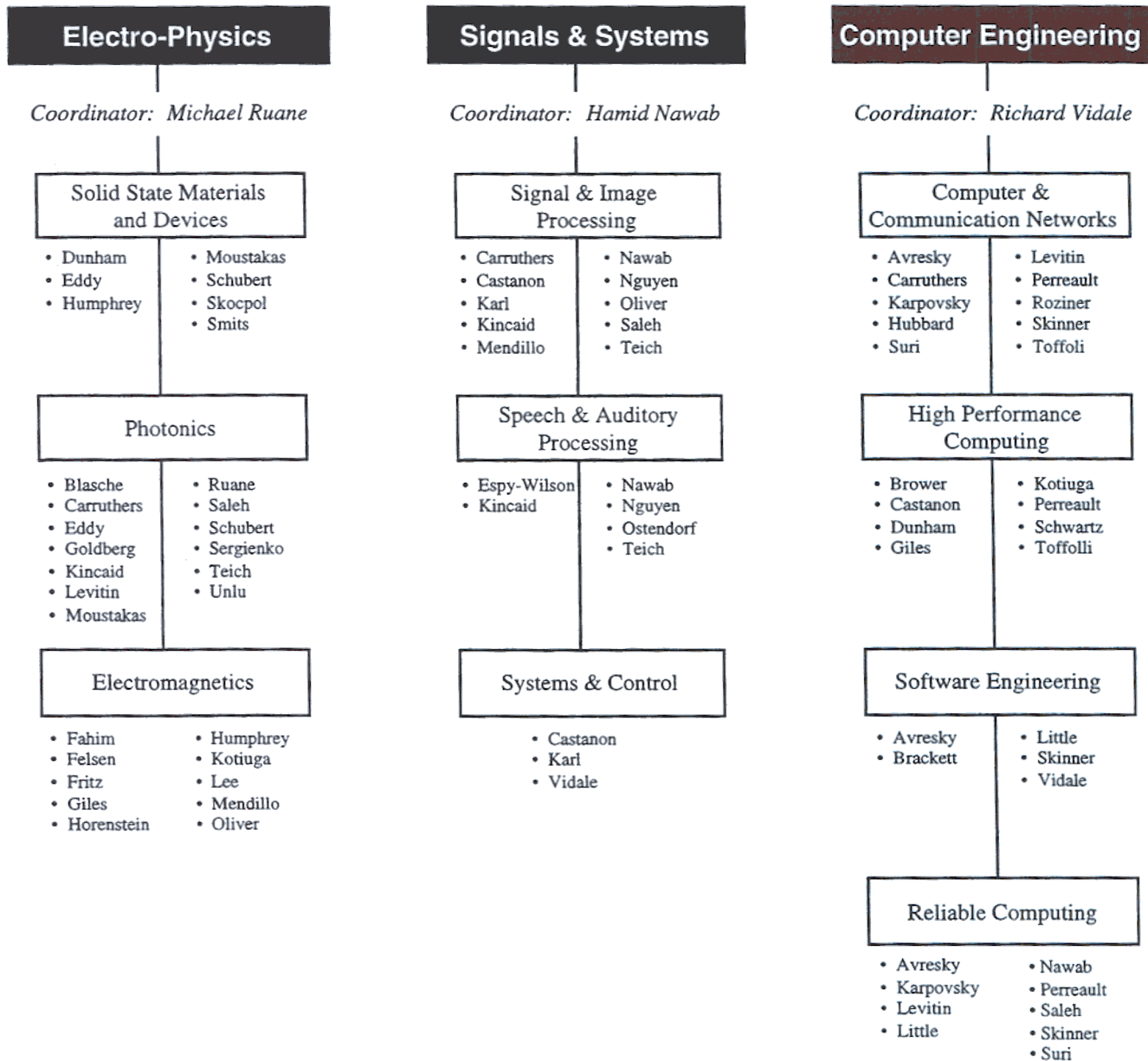
Date	Speaker	Title
September 16	Allyn Hubbard ECE Department Boston University	A Novel Traveling-Wave Amplifier
September 23	Gregory Sonek Formerly of ECE Department University of California, Irvine	Optical Tweezers: Physiological Monitoring of Optically Trapped Cells
October 14	Mari Ostendorf ECE Department Boston University	It's Not Just What You Say, But How You Say It! Computational Modeling of Prosody for Speech Processing
October 21	Roscoe Giles ECE Department Boston University	Computational Science: The Real World of Ideas
October 28	Ahmed Tewfik EE Department University of Minnesota	E-Commerce, Multimedia, and Signal Processing
November 4	Stanley Sclaroff CS Department Boston University	ImageRover: Content-Based Image Retrieval for the WWW
November 18	Stephen Senturia EE/CS Department Massachusetts Institute of Technology	Microelectromechanical Systems (MEMS): Past Successes and Future Challenges
December 9	John Byers CS Department Boston University	Digital Fountains and Their Applications

Spring 1999

Date	Speaker	Title
January 20	Robert White Stanford University	Ultra-High Density Magnetic Recording: What are the Fundamental Physical Bounds?
February 3	Eric Schwartz CNS Department Boston University	Brain Architecture and Computer Vision
February 17	Hamid Nawab ECE Department Boston University	Approximate Signal Processing
March 3	Ronald Knepper IBM Microelectronics	The CMOS-Driven Semiconductor Industry: Technology Roadmap and Future Projections
March 17	Scott Dunham ECE Department Boston University	Process Modeling for Current and Future VLSI Technologies
April 7	John Baillieul AME Department Boston University	Averaging Second-Order Control Systems: Spatial Invariance
April 14	Humphrey Maris Brown University	Picosecond Optics Measurement of Mechanical and Thermal Properties of Small Structures
April 28	Rajarshi Roy Georgia Tech University	Clocks, Chaos, and Communication
May 5	Nathan Cohen Metropolitan College Boston University	Fractal Antennas

5. Research

5.1 Areas of Research



5.2 Publications

Books

M. N. Horenstein, *Design Principles for Engineers*, Prentice Hall, Upper Saddle River, NJ (1999).

J.I. Pankove and T.D. Moustakas (eds.), *Gallium Nitride (GaN) II, Semiconductors and Semimetals*, Vol. 57, Academic Press, NY (1998).

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Book Chapters

D.A. Castañón, "Multivariable Linear Systems," *Encyclopedia of Electrical and Electronics Engineering*, J. G. Webster, John Wiley, (eds.) NY, (1998).

C.R. Eddy, Jr., "Mass Spectrometric Characterization of Plasma Etching Processes," *Advanced Plasma Processing Techniques*. S.J. Pearton and R.J. Shul, eds., Springer-Verlag Publishers, pp. 411-463, (1999).

R.G. Allen, S.R. Eisenberg, and M.L. Gray, "Quantitative measurement of the biological response of cartilage to mechanical deformation," *Methods in Molecular Medicine*, 18: *Tissue Engineering Methods and Protocols*, J.R. Morgan and M.L. Yarmush (eds.) Humana Press, Totowa, NJ, pp. 521-542, (1998).

A.M. Jorgensen, K.L. Hirsch, M.J. Alothman, S. Braginsky, and T.A. Fritz, "Electrical Field Instrument Using Radiated Electrons (E-FIRE): An Innovative Approach to the Measurements of Electric Fields in the Earth's Magnetosphere," *Measurement Techniques in Space Plasmas Fields*, AGU Geophysical Monograph 103, R.F. Pfaff, J.E. Borovsky, D.T. Young (eds.), American Geophysical Union, pp. 59-64, (1998).

L.B. Levitin, "Quantum Generalization of Conditional Entropy and Information," *Quantum Computing and Quantum Communications*, Springer Verlag, pp. 269-275, (1999).

G. Ahanger and T.D.C. Little, "Automatic Digital Video Production Concepts," *Handbook of Internet and Multimedia Systems and Applications*, CRC Press, Boca Raton, FL (December 1998).

M. Carrer, L. Ligresti, G. Ahanger, T.D.C. Little, "An Annotation Engine for Supporting Video Database Population," *Multimedia Technologies and Applications for the 21st Century*, B. Furht, ed., Kluwer Academic Publishers, pp. 161-184, (1998). (Reprint from *Multimedia Tools and Applications*, Vol. 5, No. 3, pp. 233-258, November 1997).

T.Q. Nguyen, chapter in *QCD and Hadronic Interactions*, J. Tran Thanh Van, ed., Universite Paris-Sud, (1999).

M. Ostendorf, A. Kannan, and O. Ronen, "Tree-based Dependence Models for Speech Recognition," *Computational Models of Speech Pattern Processing*, K. Ponting (ed.), Springer-Verlag, pp. 40-53, (1998).

M. Ostendorf, "Segmental Acoustic Models," *Computational Models of Speech Pattern Processing*, K. Ponting (ed.), Springer-Verlag, pp. 157-172, (1998).

E.F. Schubert and J.N. Miller, "Light-Emitting Diodes - An Introduction," *Encyclopedia of Electrical Engineering*, John G. Webster (ed.), 11, p. 326, John Wiley and Sons, New York, (1999).

E.F. Schubert and N.E.J. Hunt, "Enhancement of Spontaneous Emission in Microcavities," *Vertical Cavity Surface Emitting Lasers*, H. Temkin L. Coldren and C. Wilems (eds.), Cambridge University Press, Cambridge, (1999) (invited).

S. B. Lowen, T. Ozaki, E. Kaplan, and M.C. Teich, "Information Exchange Between Pairs of Spike Trains in the Mammalian Visual System," *Computational Neuroscience: Trends in Research 1998*, J. M. Bower (ed.), Plenum, New York, pp. 447-452, (1998).

Journal Articles

D.R. Avresky, Karl E. Grosspietsch, Barry W. Johnson, and Fabrizio Lombardi, "Embedded Fault-Tolerant Systems," *IEEE Micro* (1999).

D.R. Avresky and Jean Alat, "Functional Programming for Fault-Tolerance in Parallel Computing Systems," *ISCA*, 5, (1998).

D.R. Avresky and K. Altawil, "Embedding and Reconfiguration of Spanning Trees in Faulty Hypercube," *IEEE Trans. on Parallel and Distributed Systems*, 10, pp. 211-222, (1999).

M. Karpovsky, L. Levitin, K. Chakrabarty, and D.R. Avresky, "The Covering of Vertices for Fault Diagnosis in Hypercubes," *Information Processing Letters*, 69, pp. 99-103, (1999).

D.R. Avresky, V. Shurbanov, R. Horst et. al., "Maximum Delivery Time and Hot Spots in ServerNet Topologies." *Computer Networks*, 31, pp. 1891-1919, (1999).

S. Geoghegan and D.R. Avresky, "Designing and Validation of Error Detection Software," *Int. Journal of Reliability, Quality, and Safety Engineering*, 6, 1, (1999).

D. Avresky, V. Shurbanov, and R. Horst, "Optimizing Router Arbitration in Point-to-Point Networks," *Computer Communications Journal*, 22, pp. 608-620, (1999).

J. W. Brackett, "Satellite-Based Distance Learning Using Digital Video and the Internet," *IEEE Multimedia*, (1998).

R. Brower, S. Chandrasekharan, and U.J. Wiese, "Green's Functions from Quantum Cluster Algorithms," *Physica A*, 261, pp. 520-533, (1998).

D. L. Pepyne, and C.G. Cassandras, "Design and Implementation of an Adaptive Dispatching Controller for Elevator Systems During Uppeak Traffic," *IEEE Trans. on Control Systems Tech.*, 6, pp. 635-650, (1998).

C.G. Cassandras, and S. Lafortune, "Discrete Event Systems: The State of the Art and New Directions," *Applied and Comput. Control, Signals, and Circuits*, (1999).

D. L. Pepyne, and C.G. Cassandras, "Performance Optimization of a Class of Discrete Event Dynamic Systems Using Calculus of Variations Techniques," *Journal of Optimization Theory and Applic.*, 100, pp. 599-622, (1999).

C.G. Cassandras, and C. G. Panayiotou, "Concurrent Sample Path Analysis of Discrete Event Systems," *Journal of Discrete Event Dynamic Systems*, (1999).

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D. P. Bertsekas and D.A. Castañon, "Rollout Algorithms for Stochastic Scheduling Problems," *Journal of Heuristics*, 5, pp. 93-112 (1999).

N. Denis, D. Looze, J. Huang and D.A. Castañon, "H-infinity control design for an adaptive optics system," *Kybernetika*, 35, pp. 69-81, (1999).

G.E. Buenea, S.T. Dunham, and T.D. Moustakas, "Modeling of a GaN based Static Induction Transistor," *MRS Internet J. Nitride Semicond.* 4S1, G6.41 (1999).

M. Navi and S.T. Dunham, "Investigation of Boron Penetration Through Thin Gate Dielectrics Including Role of Nitrogen and Fluorine," *J. Electrochem. Soc.*, 145, (1998).

S.T. Dunham, J. Dabrowski, H.-J. Mussing, M. Duane, R. Goosens, and H.-H. Vuong, "Basic Science and Challenges in Process Simulation," *Advances in Solid State Physics*, 38, (1998).

S.T. Dunham and M. Bunea, "Lattice Monte Carlo simulations as link between ab-initio calculations and macroscopic behavior of dopants and defects in silicon." *Journal of Computer-Aided Materials*, 5, pp. 81-88 (1998).

S. T. Dunham, A. H. Gencer, and Srinivasan Chakravarthi, "Modeling of Dopant Diffusion in Silicon," *IEICE Trans*, 6, (1999).

C.R. Eddy, Jr., D. Leonhardt, S.R. Douglass, B.D. Thoms, V.A. Shamamian, and J.E. Butler, "Characterization of Cl₂/Ar High Density Plasmas for Semiconductor Etching," *Journal of Vacuum Science and Technology A*, 17, pp. 38-51, (1999).

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C.R. Eddy, Jr. and B. Molnar, "Etch-induced Damage in Gallium Nitride," *Journal of Electronic Materials*, 28, pp. 314-318 (1999).

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M.E. Levenston, S.R. Eisenberg, and A.J. Grodzinskyn, "A variational formulation for coupled physicochemical

flows during finite deformations of charged porous media," *Int. J. Solids and Structures*, 35, pp. 4999-5019, (1998).

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D.A. Stocker, E.F. Schubert, K.S. Boutros, and J.M. Redwing, "Fabrication of smooth GaN-based laser facets," Fifth Wide Bandgap Nitride Semiconductor Workshop, St. Louis MO, (August 5-7, 1998).

K. Toussaint, L.D. Goepfert, and E.F. Schubert, "Differential Hall-effect measurement technique on lightly doped p-type GaN," Fifth Wide Bandgap Nitride Semiconductor Workshop, (1998).

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D.A. Stocker, E.F. Schubert, and J.M. Redwing, "Optically pumped InGaN/GaN lasers with photo-electrochemically and crystallographically wet-etched facets," Connecticut Symposium on Microelectronics and Optoelectronics, Yale University, New Haven, Connecticut, (March 16, 1999).

I.D. Goepfert and E.F. Schubert, "Superlattice doping p-type GaN to efficiently activate the deep acceptor magnesium," Connecticut Symposium on Microelectronics and Optoelectronics held at Yale University, New Haven, Connecticut, (March 16, 1999).

M. Atature, A.V. Sergienko, B. M. Jost, J. Perina Jr., B. E. A. Saleh, and M.C. Teich, "High Intensity Source of Entangled Photons Using Femtosecond Downconversion," Optical Society of America Annual Meeting, Baltimore, Maryland, (October 4-9, 1998).

A. F. Abouraddy, B. M. Jost, A.V. Sergienko, B.E.A. Saleh, and M.C. Teich, "Quantum Spatial Correlation Measurements of Down Converted Photon Pairs Using a CCD Camera," Optical Society of America Annual Meeting, Baltimore, Maryland, (October 4-9, 1998).

M. Atature, A.V. Sergienko, B. M. Jost, B.E.A. Saleh, and M.C. Teich, "Measurement of Ultraviolet Femtosecond Laser Pulse Width Using Quantum Interference," Optical Society of America Annual Meeting, Baltimore, Maryland, (October 4-9, 1998).

A.V. Sergienko, M. Atature, B. M. Jost, B.E.A. Saleh, and M.C. Teich "Quantum Cryptography With Femtosecond Down Conversion", Optical Society of

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M. Booth, B. M. Jost, M. Atature, A.V. Sergienko, B.E. A. Saleh, and M.C. Teich, "Experiments in Entangled-Photon Absorption," Optical Society of America Annual Meeting, Baltimore, Maryland, (October 4-9, 1998).

J. Perina Jr., A.V. Sergienko, B.E.A. Saleh, and M.C. Teich, "Quantum Interference With Femtosecond Entangled Two-photon Fields," Proceedings of XIth Slovak-Czech-Polish Optical Conference, Stara Lesna, Slovakia, (September 21-25, 1998).

A. Czitrovsky and A.V. Sergienko "Measurement of Quantum Efficiency of Avalanche Photodetectors Based on Quantum Two-Photon Field", Proceedings of 5th Congress on Modern Optics, SPIE 3573, Budapest, Hungary, (September 14-17, 1998).

N. Gisin, J. Brendel, H. Zbinden, A.V. Sergienko, and A. Muller "Twin-Photon Techniques for Fiber Measurements," Proceedings of Symposium on Optical Fiber Measurements, NIST Boulder, Colorado, (September 15-17, 1998).

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A.V. Sergienko, M. Atature, B. M. Jost, J. Perina Jr., B.E.A. Saleh, and M.C. Teich, "Quantum Cryptography With Femtosecond Pulses and Polarized Entangled Photons," TAMU/ONR Workshop on Quantum Optics, Jackson Hole, Wyoming, (August 2-6, 1998).

A.V. Sergienko, M. Atature, B.E.A. Saleh, and M.C. Teich, invited talk on "Dispersion-Insensitive Femtosecond Quantum Interference," 6th International Conference on Squeezed States and Uncertainty Relations, Napoli, Italy, (May 24-29, 1999).

A.V. Sergienko, invited talk on "Nonstationary Quantum Interference in Femtosecond Optical Spontaneous Parametric Down-Conversion," Adriatico Research Conference "Quantum Interferometry III," Trieste, Italy, (March 1-5, 1999).

A.V. Sergienko, invited talk on "New Experiments with Entangled Photons," 5th Congress on Modern Optics, Budapest, Hungary, (September 14-17, 1998).

M.C. Teich and B.E.A. Saleh, "Cascaded Stochastic Processes in Optics," *Traitement du Signal (France)* 15, 457-465, (1998).

C. Heneghan, S. B. Lowen, and M.C. Teich, "Analysis of Spectral and Wavelet-Based Measures Used to Assess Cardiac Pathology," in Proc. 1999 IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP) paper SPTM-8.2, Phoenix, AZ, (1999).

M.C. Teich, "Multiresolution Wavelet Analysis of Heart-Rate Variability for Heart-Failure and Heart-Transplant Patients," Proc. Int. Conf. IEEE Eng. Med. Biol. Soc 20, 1136-1141 (1998).

Patents and Patent Disclosures

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Y.H. Hu, T.Q. Nguyen, and S. Oguz, "Method and Apparatus for the elimination of Ringing artifacts in decompressed electronic images", Invention Disclosure, (March 1999).

S. Yang, Y.H. Hu, T.Q. Nguyen, and D. Tull, "Image ringing artifact reduction using non-linear robust filtering", Invention Disclosure, (May 1999).

D.A. Stocker and E.F. Schubert, "Crystallographic wet chemical etching on GaN," (patent application, June 1999).

J. Graff, X.Y. Guo, and E.F. Schubert, "Photon recycling semiconductor light emitting diode," (provisional patent application, November 1998).

M.S. Unlu and B. M. Onat, "Resonant Cavity Enhanced SOI Photodetectors," (provisional patent filed February 1999).

M.S. Unlu and M. Emsley, "Repeated SOI Process for Optoelectronics Devices and Circuits," (provisional patent filed May 1999).

M.S. Unlu, B. B. Goldberg, and G. Garber, "Silicon-Insulator Waveguides for Sensing," (provisional patent filed 1999).

S. B. Ippolito, M.S. Unlu, and B. B. Goldberg, "Numerical Aperture Increasing Lens Techniques for High-resolution Sub-surface Imaging," (provisional patent filed June 1999).

M. S. Unlu, M. Gokkavas, and G. Ulu, "Resonant Cavity Enhanced Photodetectors with a Flat Peak Spectral Response," (provisional patent filed August 1999).

Invited Talks

R. Brower, "QCD ABACUS: A New Lattice Formulation for Gauge Field Theories," Physics Department, University of Florida, Gainesville, FL (October 1999).

R. Brower, "The COTS+ Approach to Parallel Architectures for QCD," Thomas Jefferson National Acceleration Facilities, Newport News, VA (March 1999).

R. Brower, "QCD and the 5-th Dimensions," XXXIVth Rencontres de Moriond: QCD and High Energy Hadronic Interactions, Les Arcs, France (March 1999).

R. Brower, "Quantum Link Approach to Gauge Theory," Riken Institute Workshop on "Numerical Algorithms at Non-zero Chemical Potential" at Brookhaven National Laboratory, Upton, NY (April 1999).

D.A. Castañón, "Progress in Reduced Signature Target Recognition," Air Force Scientific Advisory Board, Dayton, OH (September 1998).

D.A. Castañón, "Dynamic Search Strategies for Unknown Objects," Massachusetts Institute of Technology Electrical Engineering Seminar, Cambridge, MA (April 1999).

D.A. Castañón, "Rollout Strategies for Risky Planning Problems," AFOSR New World Vistas Meeting, Syracuse, NY (May 1999).

C. Espy-Wilson, "A Speech Signal Representation Based on Phonetic Features," Lexical Access Group at Massachusetts Institute of Technology, Cambridge, MA (September 1998).

C. Espy-Wilson, "Acoustic Modeling of American English /r/, " Ohio State University, Electrical Engineering Department, Columbus, OH (February 1999).

C. Espy-Wilson, "Acoustic Modeling of American English /r/, " Massachusetts Institute of Technology, Speech Communication Group, Cambridge, MA (March 1999).

C. Espy-Wilson, "Acoustic Modeling of American English /r/," Boston University Hearing Research Group, Boston, MA (April 1999).

C. Espy-Wilson, "Knowledge-based Speech Recognition," Georgia Institute of Technology, College of Computing, Atlanta, GA (June 1999).

C. Espy-Wilson, "Knowledge-based Speech Recognition," University of Maryland, Electrical and Computer Engineering Department, College Park, MD (April 1999).

T.D. Moustakas, "Epitaxial Growth and Properties of III-V Nitrides," Summer School on Advanced Materials for Industrial Application, Kavala, Greece, (June 1999).

B.E.A. Saleh, "Quantum Limits in Optical Communication, Imaging, and Computing," Drexel University Fiber Optics and Photonics Manufacturing Engineering Center, Philadelphia, PA (March 1999).

E.F. Schubert, "Demonstration optically pumped GaInN/GaN lasers with smooth facets," Hewlett Packard Optoelectronics Division, San Jose, CA (January 1999).

E.F. Schubert, "Demonstration optically pumped GaInN/GaN lasers with smooth facets," Xerox Palo Alto Research Center, Palo Alto, CA (January 1999).

E.F. Schubert, "P-type doping in GaN and demonstration optically pumped GaInN/GaN lasers with smooth facets," Army Research Laboratory, Adelphi, MD (February 1999).

E.F. Schubert, "P-type doping in GaN and demonstration optically pumped GaInN/GaN lasers with smooth facets," University of Maryland, College Park, MD (February 1999).

A. Sergienko, "Quantum Cryptography and Optical Metrology With Polarized Entangled Photons," Department of Physics, University of Milan, Italy (July 1998).

A. Sergienko, "Polarized Entangled Photons in Quantum Communications and Optical Metrology," "Frontiers in Photonics" seminar series, Photonics Research Ontario Center, Department of Physics, University of Toronto, Canada (January 1999).

A. Sergienko, "Quantum Cryptography and Optical Metrology With Polarized Entangled Photons," Physics Colloquium, Department of Physics, University of Genoa, Italy (February 1999).

A. Sergienko, "Quantum Cryptography and Optical Metrology With Polarized Entangled Photons," Department of Physics, University of Bari, Italy (May 1999).

A. Sergienko, "Femtosecond Parametric Down Conversion and Quantum Entanglement," Department of Physics, University of Vienna, Austria (July 1999).

M.C. Teich and B.E.A. Saleh, "Entanglement Microscopy," 36th Annual New Horizons in Science Briefing, Council for the Advancement of Science in Writing, Boston, MA (November 1998).

M.C. Teich, "Two-Photon Photoemission and Photoluminescence," Optical Physics Seminar, Boston University Photonics Center, Boston, MA (February 1999).

M.C. Teich, "Entangled-Photon Absorption and Imaging," Photomedicine Lecture Series, Wellman Laboratories of Photomedicine, Massachusetts General Hospital, Boston, MA (April 1999).

M.C. Teich, "Spike-Time Reliability and Fractal Variability in Sensory Neurons," Lecture in Quantitative Neurobiology, Harvard University, Cambridge, MA (April 1999).

M.C. Teich, "Cascaded Stochastic Processes in Optics," Colloquium in Honor of Bernard Picinbono, Ecole Supérieure d'Electricité and Centre National de la Recherche Scientifique, Paris, France (May 1999).

M.S. Unlu, "High-speed Photodetectors for Optical Communications," EG&G Optoelectronics, Montreal, Canada (March 1999).

5.3 Research Labs

Advanced Electronic Materials & Device Processing Research Laboratory

This laboratory is primarily concerned with the science of electronic materials processing and the effect of such processing on device characteristics. Devices of interests include: high temperature, high frequency and/or high power switching devices and photonic devices. Research activities include: 1) investigation of high density plasma-based processes including etching, passivation, implantation, and growth; 2) application of photolithographic and high density plasma processing techniques to realize novel devices; and 3) characterization of such devices. This group works in close collaboration with Prof. Theodore Moustakas in the area of materials growth and device application and Prof. Scott Dunham in the area of process and device modeling. *Eddy*

Applied Electromagnetics Laboratory

Work focuses on experimental problems in electromagnetics with emphasis on industrial processes, sensing and measurement, and micro-electromechanical systems (MEMS). Applications include electrostatic charge generation and neutralization for materials processing, adaptive optic mirrors, micro-valve arrays, fields in textile and polymer processing, and ESD protection. *Horenstein*

Biological Information Processing Laboratory

Work carried out in this laboratory is principally concerned with the wavelet analysis of biological signals. Particular examples include the analysis of fractal behavior of neural spike trains in hearing and

heart rate and the differentiation of pathological from normal heart rhythms; and information transmission in biological sensory systems. *Teich*

Broadband Wireless Communications Laboratory

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

Computational Electromagnetics Laboratory

This laboratory is devoted to the application of high performance computing and advanced mathematics to the solution of problems in engineering electromagnetics. Algorithmic issues in the calculation of three-dimensional electromagnetic fields are investigated and new methods for finite-element modeling are pursued. Applications range from magnetic materials and electric machines to biological systems. *Brower, Giles, Eisenberg, and Kottuga*

Imaging Science Laboratory (ISL)

Affiliated with the Boston University Center for Space Physics, the ISL applies state-of-the-art optical imaging technology to the study of the Earth, Moon, planets and comets. Activities include equipment design and fabrication, field campaigns to

observing sites world-wide, and digital signal processing. *Mendillo*

Integrated Circuit Fabrication Laboratory

This lab contains basic equipment for silicon integrated circuit fabrication. Research efforts are aimed at investigating fabrication processes and fabricating innovative device structures. *Dunham, Smits*

Integrated DSP Environments and Architectures Laboratory (IDEA)

This group conducts research in DSP and its integration with signal understanding. Applicable areas of interest include: auditory scene analysis; spread-spectrum communications; image encoding/decoding; and signal detection. This research integrates electrical engineering principles for signal processing and computer science principles for signal understanding. *Nawab*

Liquid Crystal Display (LCD) Laboratory

Liquid Crystal Display devices are fabricated and their optical characteristics are studied in this laboratory. Novel techniques for enhancing the angle of view and the color rendition of LCDs are investigated. New methods for characterization of such devices are developed, and applications of LCDs as spatial light modulators in optical image processing systems are pursued. *Saleh*

Magnetic and Optical Devices Laboratory (MODL)

Properties and applications of magnetic and magneto-optical

materials are studied using optical, electrical, and computational methods in the MODL. Recent work has included photoresist studies for CD stamper manufacturing, deposition of magnetic films on patterned substrates, investigation of X-Ray mirror materials, 3-D computational studies of GMR memory devices and eddy current losses in thin films, and development of extremely low cost, low-density optical disks and players. *Ruane, Humphrey*

Microprocessor Laboratory

In this lab, techniques for the rapid development, testing, and performance evaluation of microprocessor-based systems, including communication systems, are developed. *Perreault*

Multi-Dimensional Signal Processing (MDSP) Laboratory

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

Multimedia Communications Laboratory

The focus of this laboratory is the enabling technology for multimedia applications. Research includes investigation of distributed modes of group interaction; communication systems for continuous media; conceptual and physical database organizations; indexing schemes to support content specific queries and fast browsing; user interfaces; and applications. The laboratory is equipped with tools for real-time digital video capture, storage, conversion and playback. *Little*

Near-Field Spectroscopy Laboratory

Near-Field Microscopy/ Spectroscopy is being developed as a new technique to extend the resolution of optical imaging beyond the diffraction limit, bringing a new level of optical characterization. Near-field optical microscopy has application to many areas of materials and device development, and this laboratory will serve as a resource for researchers throughout Boston University as well as industry partners. Emphasis is currently placed on the optical characterization of semiconductor devices and biological materials. In particular, this includes imaging laser diode emission and material-defect and compositional analysis for semiconductor applications. *Goldberg, Ünü*

Network Computing Laboratory

The Network Computing Laboratory currently conducts research in the following fields: routing algorithms, performance evaluation, dependability of network-based computing systems, protocol verification and testing, and implementation complexity. *Avresky*

Picosecond Spectroscopy Laboratory (PSL)

This state-of-the-art optical characterization facility was recently established. The Picosecond Spectroscopy Laboratory provides excitation sources, spectrometers, and microwave electronic test equipment for the investigation of the linear and non-linear optical properties of materials and devices. The research emphasis in this laboratory is on high-speed photodetectors, particularly time-resolved characterization of photodiodes. *Ünlü*

Quantum Imaging Laboratory

Research in the Quantum Imaging Laboratory focuses on photonic imaging systems that make use of the special properties of nonclassical light. Experiments are conducted on nonlinear optical parametric down-conversion; quantum coherence; quantum imaging; quantum interferometry and microscopy; and quantum communications and cryptography. *Saleh, Sergienko, Teich*

Radio Communications and Plasma Research Laboratories

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

Reliable Computing Laboratory

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

Semiconductor Device Research Laboratory

This laboratory fabricates prototypes of next-generation optoelectronic devices such as semiconductor lasers and light-emitting diodes. Activities include photolithographic fabrication, optical and electrical characterization, and modeling of device and systems properties. *Schubert*

Sensors, Actuators, and Micromechanics Laboratory

Clean-room fabrication facilities in this lab are used to develop silicon sensors and actuators with integrated electronics. Silicon machining and piezoelectric sensor materials are integrated to create tactile sensors, strain gauges, optical scanners for helmet mounted displays or optical disk drives, micro-pumps for drug delivery and for gas pumps to be used in gas chromatographs for flights to Mars, and autonomous mobile "silicon ants" (micro-robots). *Smits*

Signal Processing and Interpretation (SPI) Laboratory

The SPI Lab supports several research projects involving stochastic modeling of signals for

synthesis and recognition/ understanding applications. Research currently focuses on speech processing, including acoustic and language modeling for spontaneous speech recognition, as well as computational modeling of prosody. The lab is equipped with a network of several workstations with audio recording and playback facilities, and is supported by several government and industrial grants. *Ostendorf*

Software Engineering Laboratory (SEL)

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 Silicon Graphics and Gateway 2000 networked workstations, plus four Motorola embedded computer development systems. The SEL provides students with state-of-the-art development tools for the design, implementation, and testing of significant software systems. *Vidale*

Speech Communication Laboratory

The Speech Communication Laboratory is concerned with understanding speech communication, including speech recognition, speech perception, speech production, and acoustic phonetics. *Espy-Wilson*

VLSI and Neural Networks Systems (VNNS) Laboratory

The VNNS group designs, builds, and tests innovative architectures that span a wide variety of VLSI applications in electrical and biological fields. 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. *Hubbard*

VLSI Process Modeling and Characterization Laboratory

Efforts in this lab focus on obtaining a basic understanding of integrated circuit fabrication processes and applying that knowledge to produce better models and simulators. Research is applied mainly to bulk processes, such as diffusion, activation, extended defect kinetics, and film growth. *Dunham*

Wide Band Gap Semiconductors Laboratory

In this laboratory we investigate the optoelectronic properties and device applications of III-Nitride materials. The materials are grown by Molecular Beam Epitaxy (MBE) and Vapor Phase Epitaxy. Device applications include emitters (lasers and LEDs), UV-solar blind detectors and transistors for high power and high temperature applications. The laboratory is equipped with clean room facilities for materials growth (MBE and VPE) and device fabrication (electron beam evaporator and sputtering units) as well as facilities for material and device characterization. This group collaborates closely with Professor C. Eddy in the area of device processing and Professor S. Dunham in the area of device modeling. *Moustakas*

5.4 Centers and Interdisciplinary Activities

Center for Computational Science (CCS)

The CCS at Boston University was chartered in 1989 as an interdisciplinary focal point for computational science research and education. In collaboration with the Office of Information Technology's Scientific Computing and Visualization Group (SCV), CCS has made leading edge computational resources available to researchers and students on a university wide basis since the installation of its first massively parallel supercomputer in 1988. The recent installation of the SGI/Cray Origin2000 represents the fourth generation parallel supercomputing technology at the University. Facilities also include an SGI Power Challenge Array, advanced graphics workstations, virtual reality stations and very high speed networking.

The University's support of computational research has been extended to institutions throughout New England by means of the NSF funded MARINER project, a collaboration between CCS and SCV. MARINER offers education and training programs, access to state-of-the-art computing facilities and opportunities for pilot projects, Internet connectivity and industrial partnerships.

The Center is a cooperative venture in which associated members come from a variety of disciplines in the academic and industrial communities to develop and take advantage of leading-edge computer and communications technologies. Under the auspices of MARINER, CCS takes its place as a leader in developing computational applications in collaboration with regional schools and companies.

Building on MARINER, the University is extending its programs on a national scale as a partner in the National Computational Science Alliance, one of two national Partnerships for Advanced Computational Infrastructure supported by the NSF.

Center for Space Physics

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 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

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 nearly a dozen companies to develop new products in data storage, environmental monitoring, opto-electronics, and biotechnology.

In 1997, the University completed the nine-story, 235,000 square-foot Photonics Building to house this ambitious initiative. The \$80 million facility includes a full complement of state-of-the-art laboratories as well as meeting rooms, lecture halls, and an entire floor devoted to incubator space for start-up companies that complements its existing incubator at 1106 Commonwealth Avenue. Faculty affiliated with the Center have in-depth expertise in all aspects of photonics technology,

including the core areas of opto-electronics, photonic materials, data storage, imaging systems, medical applications, and sensors.

Resources available to industry partners, government, 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, Photo-

chemical 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.

5.5 New Grants and Contracts

The table on the next four pages delineates the new grants awarded over the 1998/99 fiscal year. The funding level for new grants where an ECE faculty member is the Principal Investigator (PI) is approximately \$4,805k. ECE faculty members were also Co-PI's on grants with PI's from other departments, as noted in the table. Their share of the funding for new grants awarded is approximately \$466k. The total of new grants is therefore approximately \$5,271k.

Grants with ECE Principal Investigators

FACULTY	TITLE OF AWARD	SOURCE	BEGIN	END	AMOUNT
Avresky	Analysis of TNet: A Reliable System of Area Networks for I/O and IPC	Tandem Computers, Inc.	11/1/96	12/31/99	\$30,000
Avresky	Analysis of TNet: A Reliable System of Area Networks for I/O and IPC	Tandem Computers, Inc.	1/1/99	12/31/99	\$20,000
Carruthers	CAREER: High Bit Rate Wireless Infrared Communications	NSF	4/1/99	3/31/03	\$200,000
Castanon (PI), Karl (Co-PI), Brower (Co-PI)	Muri95 - A Comprehensive and Integrated Approach to Reduced Signature Target Recognition	Department of Defense/Air Force	12/1/97	11/30/99	\$700,000 \$630,000 \$70,000
Castanon (PI) Karl (Co-PI)	Sensor Management and Information Fusion for Detection, Localization and Classification of Mines (Subcontract via Northeastern University)	Department of Defense/Army	2/1/97	11/30/99	\$40,650 \$40,650
Castanon	Coordination and Optimization of Quality of Service end to end resources (CONQUER) for adaptive information flows (Subcontract via Honeywell)	Department of Defense/DARPA	1/15/99	12/1/99	\$40,000
Eddy (PI), Moustakas(Co-PI)	Gallium Nitride Static Induction Power Transistors \$120,000	Department of Defense/Navy	3/1/99	12/31/99	\$60,000 \$60,000
Espy-Wilson	Studies of Speech Communication	HHS/NIH/NIDCD	6/1/99	5/31/00	\$65,464
Espy-Wilson	Knowledge-Based Speech Signal Representation	NSF	7/1/98	6/30/99	\$69,025

FACULTY	TITLE OF AWARD	SOURCE	BEGIN	END	AMOUNT
Karl (PI), Castañon (Co-PI)	Multiresolution Information Fusion (Subcontract via Alphatech, Inc.)	Department of Defense/Army	11/1/97	6/30/99	\$17,500 \$17,500
Lee	University Resident Research Program	Air Force	10/15/98	10/14/99	\$90,701
Little	Dynamic Service Aggregatioin for Interactive info. Delivery	NSF	9/1/98	8/31/99	\$92,979
Moustakas	Investigation of Atomic Long Range Order in ALxGA1-xN Films (in conjunction with Photonics Center)	Department of Defense/Navy	12/1/97	11/30/99	\$60,000
Moustakas	III-V Nitride UV Detector Arrays Fabricated by Combining HVPE Lateral Epitaxial Overgrowth and MBE Methods	Department of Defense/Navy	1/1/99	1/31/00	\$50,000
Moustakas	DURIP: Nitrogen Gas Cluster Ion Beam For Transformation of GaN	Department of Defense/Navy	4/15/99	3/14/00	\$218,500
Moustakas	Aluminum Gallium Nitride Ultraviolet Photodectectors (Subcontract Via BlueLight, Inc.)	EG&G, Inc.	1/1/99	9/30/99	\$50,000
Moustakas	Gallium Nitride GaN UV Detectors (Subcontract via Blue-Light, Inc. in conjunction with Photonics Center)	Dept. of Defense/DARPA Lockheed-Martin, Inc.	1/2/97	9/30/98	\$7,692
Nawab	Acquisition of Computer Facilities	NSF	9/1/98	8/31/01	\$265,271
Nawab	Application-Specific Development of IPU's	Department of Defense/Air Force	10/1/98	9/30/99	\$21,500
Nguyen	Wavelet Design for Discrimination and Image Processing Lab	Department of Defense/Navy	5/1/98	4/30/98	\$80,000
Nguyen	Multiresolution Analysis of Epileptic Signals (Subcontract via Flint Hills Scientific L.L.C.)	HHS/NIH/NINDS	8/24/98	8/24/99	\$40,000
Nguyen	Multiresolution-Based Watermarking Algorithms	AT&T Engineering Technologies Group	9/1/98	12/31/99	\$10,000
Oliver	Upper-Atmosphere/Ionoshere Studies with the MU Radar (Center of Space Physics)	NSF	4/1/99	3/31/00	\$95,000
Ostendorf	Speech Generation for Human-Computer Interaction	NSF	5/1/96	1/31/00	\$119,985
Ostendorf	STIMULATE: Modeling Structure in Speech above the Segment for Spontaneous Speech Recovery	NSF	3/1/99	2/29/00	\$227,337
Ostendorf	REU: Predicting Confidence of Speech Recognition Output	NSF	6/1/98	2/28/99	\$6,150
Ostendorf	Multi-Level Lexical Modeling for Spontaneous Speech Recognition	ATR Interpreting Telecommunications Labs	9/1/98	5/31/99	\$20,000
Ostendorf	Speech Generation for Human-Computer Interaction	NSF	5/1/96	1/31/00	\$90,000

FACULTY	TITLE OF AWARD	SOURCE	BEGIN	END	AMOUNT
Ostendorf	Use of Multi-Domain Data in Dialog-Act Mixture Language Modeling for Conversational Speech Recognition	Department of Defense	10/22/98	9/30/99	\$31,594
Saleh (PI), Sergienko(Co-PI), Teich (Co-PI)	Imaging and Optical Information	NSF	5/1/99	4/30/99	\$33,334 \$33,333 \$33,333
Saleh	Interactive Spoken Language Understanding Systems (subcontract via BBN Corporation)	Department of Defense/DARPA	1/1/99	9/30/99	\$20,979
Saleh	Interactive Spoken Language Understanding Systems (subcontract via BBN Corporation)	Department of Defense/DARPA	1/1/99	9/30/99	\$2,457
Schubert	Enhancement of Deep Acceptor Activation in Semiconductors by Superlattice Doping	Navy	12/1/98	11/30/99	\$80,000
Schubert	Doping Engineering for High Conductivity in GaN and Related Compounds (subcontract via Cornell)	Department of Defense/Navy	4/1/99	3/30/00	\$60,000
Sergienko (PI), Teich (Co-PI), Saleh (Co-PI)	Quantum Ellipsometry	NSF	10/1/98	9/30/99	\$20,000 \$20,000 \$20,000
Sergienko	CAREER: Quantum Cryptography with Entangled Photons (in conjunction with Photonics Center)	NSF	2/15/99	1/31/03	\$200,000
Suri	USER?OS Transparent Fault Recovery Using Caches	NSF	9/1/98	5/31/00	\$105,000
Suri	Verification and Validatin of Dependable Real-time Protocols (Subcontract via University of Pittsburgh)	DARPA	9/1/98	9/30/99	\$53,994
Suri	Verification and Validatin of Dependable Real-time Protocols (Subcontract via University of Pittsburgh)	DARPA	9/1/98	12/26/99	\$90,000
Teich (PI), Saleh (Co-PI), Sergienko(Co-PI)	Entangled-Photon Absorption and Spectroscopy	NSF	6/1/99	5/31/00	\$43,334 \$43,333 \$43,333
Unlu	High Performance Ultrafast Photodetectors	Department of Defense/Navy	6/1/96	8/31/99	\$40,000
Unlu	NSF-Career: Innovative Optoelectronic Devices and Optical Characterization Techniques (REU Supplement)	NSF	9/1/98	8/31/00	\$75,000
Unlu (PI) Goldberg(Co-PI)	Development and Study of Hyper-Polarized Noble	NSF	5/1/98	4/30/99	\$17,991 \$11,994
Unlu (PI) Goldberg (Co-PI)	Satcon Biosensor Waveguide Project	Satcon Technology Corporation	10/1/98	3/31/99	\$7,466 \$4,978
Unlu	US-Turkey Cooperative Research; High Performance Photodetectors for Long-Haul Optical Communications	NSF	7/1/99	6/30/01	\$34,976
SUBTOTAL	Grants with ECE Principal Investigators				\$4,805,434

Grants with ECE Co-PI's

FACULTY	TITLE OF AWARD	SOURCE	BEGIN	END	AMOUNT
Giles (PI)	PACI: Education, Outreach, and Training (Subcontract via Univ. of Illinois)	NSF	10/1/97	9/30/99	\$100,000
Gaudiano (PI) Hubbard (Co-PI)	A MURI Center for Automated Vision and Sensign Systems (CAS Cognitive and Neural Systems)	Department of Defense/Navy	6/1/98	5/30/00	\$136,503
Rebbi (PI) Straub (Co-PI) Brower (Co-PI) Giles (Co-PI)	Integrating High Performance Computing into Research: Molecular Dynamics Simulation in Chemistry, Physics and Engineering (Center for Computational Science)	NSF	9/1/98	8/31/99	\$28,125 \$28,125
Rebbi (PI) Porter (Co-PI) Bestavros (Co-PI) Giles (Co-PI)	PACI: Partnerships for Advanced Computational Infrastructures (Center for Computational Science)	NSF	10/1/97	9/30/98	\$21,252
Rebbi (PI) Bresnahan (Co-PI) Giles (Co-PI) Porter (Co-PI)	PACI: Mariner, Mid-Level Alliance Resource in the NorthEast Region (subcontract with the Univ. of Illinois)	NSF	10/1/97	9/30/99	\$112,500
Vajda (PI) Delisi (Co-PI) Brower (Co-PI)	Computational Methods for Determining Binding Free Energies	NSF	12/1/97	11/30/99	\$39,658
SUBTOTAL Grants with ECE Co-PI's					\$466,164
GRAND TOTAL					\$5,271,598

6. Outlook

The last decade has witnessed the maturation of the ECE department from a primarily undergraduate program to a more balanced department with quality instruction, a substantial research program, and an increasingly distinguished faculty. Key statistics of enrollment, degrees awarded, faculty size, and grant funding in the last 10 years are exhibited in the following tables and charts.

6-1 Enrollment

Fall enrollments in the BS, MS, and Ph.D. programs are listed in Table 6-1 and Chart 6-1:

	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98
BS	569	498	441	384	338	334	358	381	404	409	428
MS	231	276	281	247	201	171	135	103	68	70	83
Ph.D.	18	29	39	44	49	50	55	64	78	83	80
Total	818	803	761	675	588	555	548	548	550	562	591

Table 6-1: Enrollment

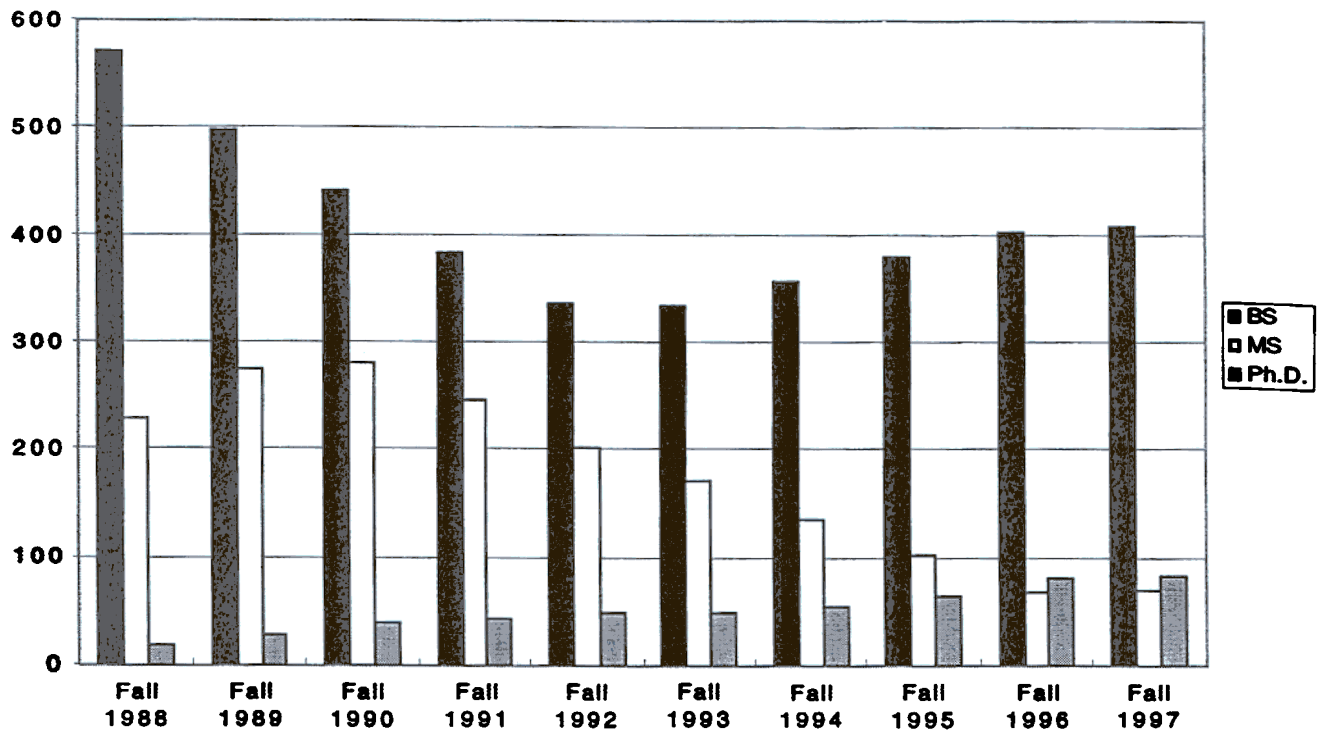


Chart 6-1: Undergraduate and Graduate Student Enrollment

Important undergraduate trends in ECE have tended to mirror national patterns. These include:

- A demographic decline in enrollment occurred mid-decade, followed by a slow steady increase.
- Enrollment shifted from EE to CSE, such that 64% of students now pursue CSE.
- A deliberate restriction on enrollment was implemented to attain a higher quality student body, as part of a college-wide effort.

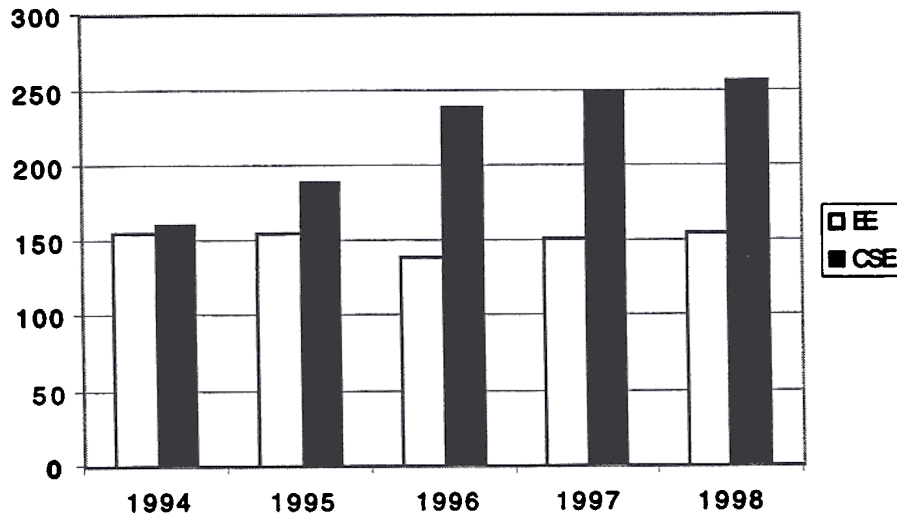


Chart 6-2: EE and CSE Enrollment in BS Program

At the graduate level, the emphasis has shifted from professional MS-oriented students to Ph.D. students:

- MS degree enrollments dropped sharply, mainly with the demise of the Corporate Classroom program. Few part-time or self-funded MS students remain.
- Ph.D. enrollment has risen substantially, but domestic candidates remain difficult to recruit.
- Graduate fellowship resources have remained fixed while RA support grew modestly with grant funding.

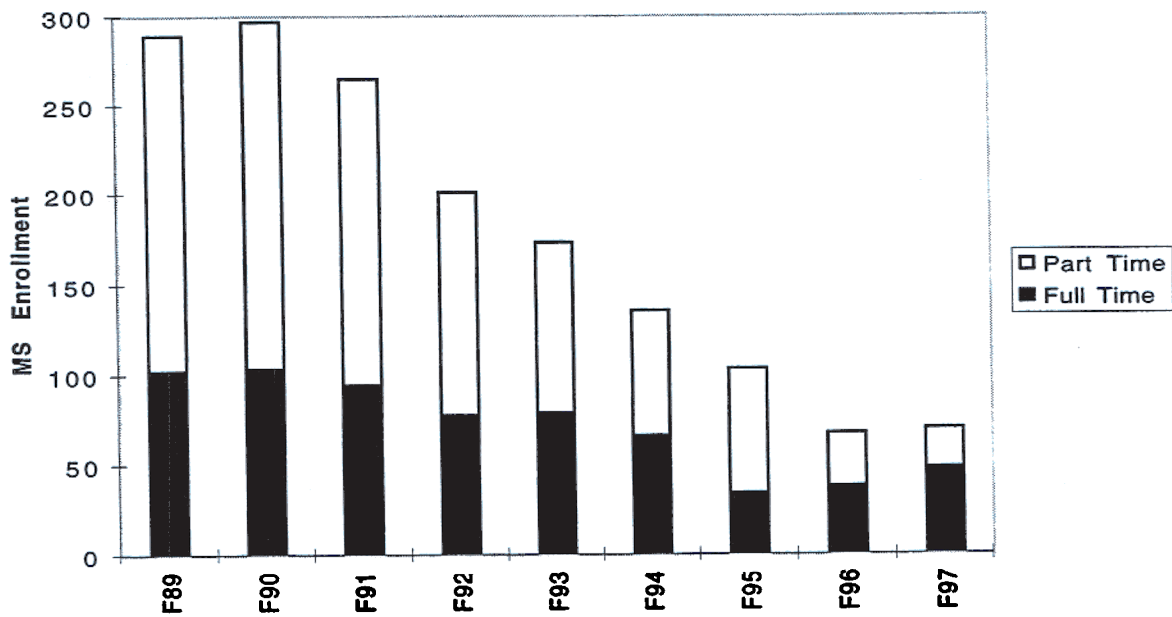


Chart 6-3: MS Enrollment

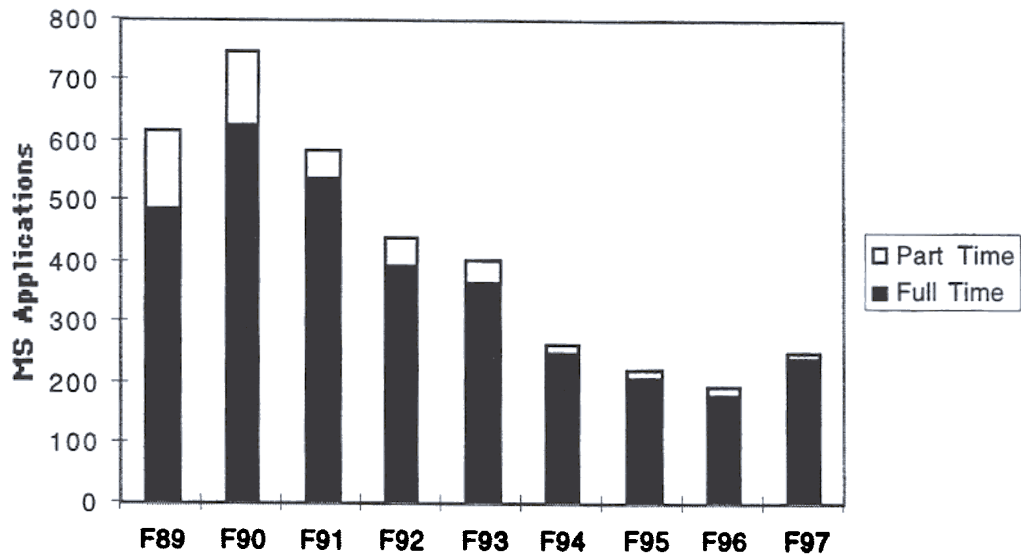


Chart 6-4: MS Applications

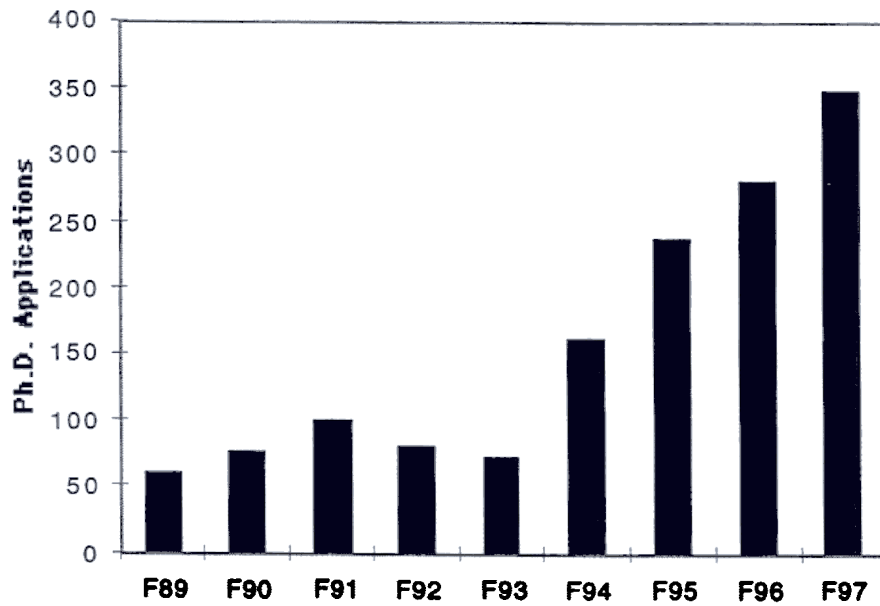


Chart 6-5: Ph.D. Applications

6.2 Degrees Granted

Data on the degrees granted by the department in the last ten years are shown in Table 6-2 and Charts 6-6 to 6-8.

	'88	'89	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99
BS	204	172	186	130	115	88	78	85	90	88	131	98
MS	91	111	133	130	136	109	91	92	70	52	34	21
Ph.D.	0	2	2	4	6	4	6	10	4	10	15	3
Total	295	285	321	264	257	201	175	187	164	150	180	122

Table 6-2: Degrees Granted

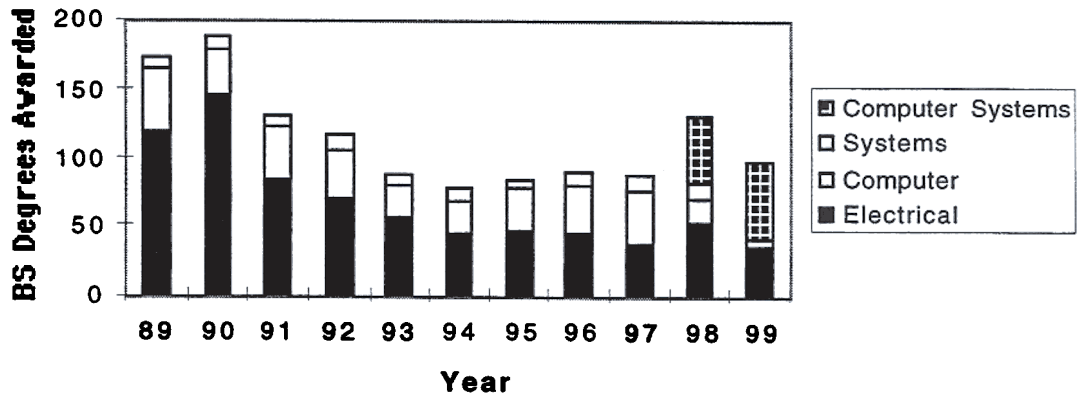


Chart 6-6: BS Degrees Awarded

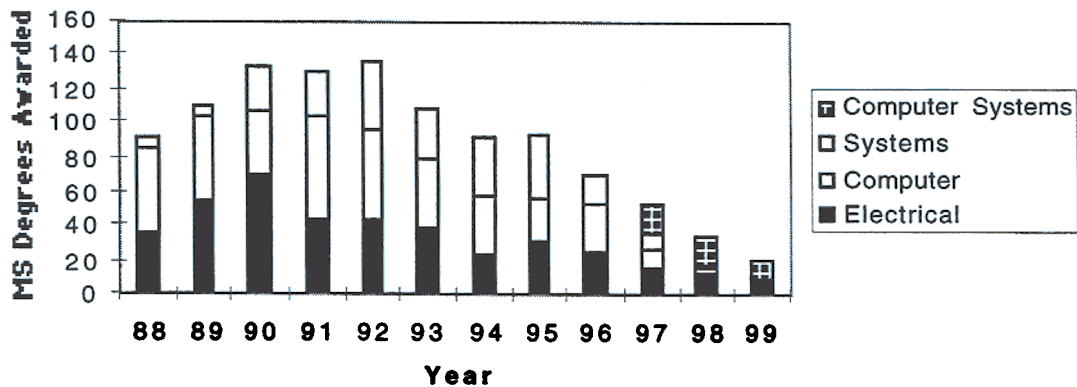


Chart 6-7: MS Degrees Awarded

The small number of Ph.D. degrees awarded this year is an anomaly inconsistent with the total enrollment in the doctoral program (80), and with the numbers in the last two years. A larger number is expected next year.

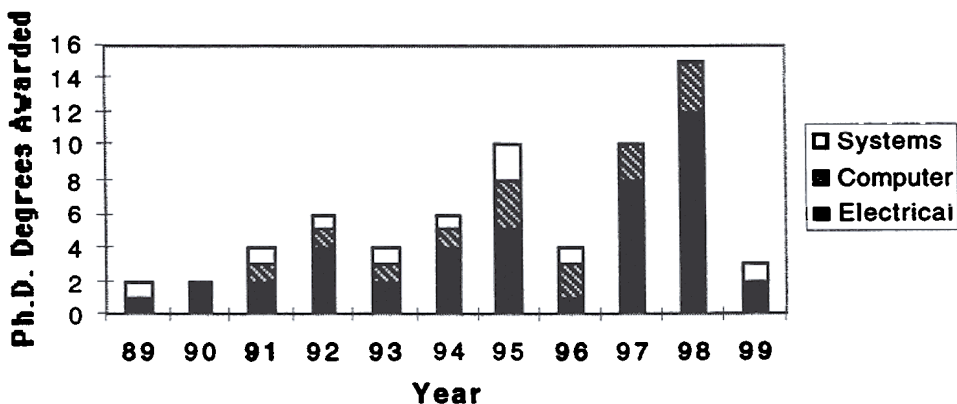


Chart 6-8: Ph.D. Degrees Awarded

6.3 Faculty

Faculty hiring has largely replaced departures, with small net growth:

- Department net growth has been only three positions in the last five years.
- 13 of the current faculty joined the department in the last five years.
- New hires have been directed both to strategic research thrusts and addressing shifting enrollments.
- Faculty quality and distinctions have increased significantly.
- The number of faculty that are not research active is diminishing, but still remains higher than we would like.

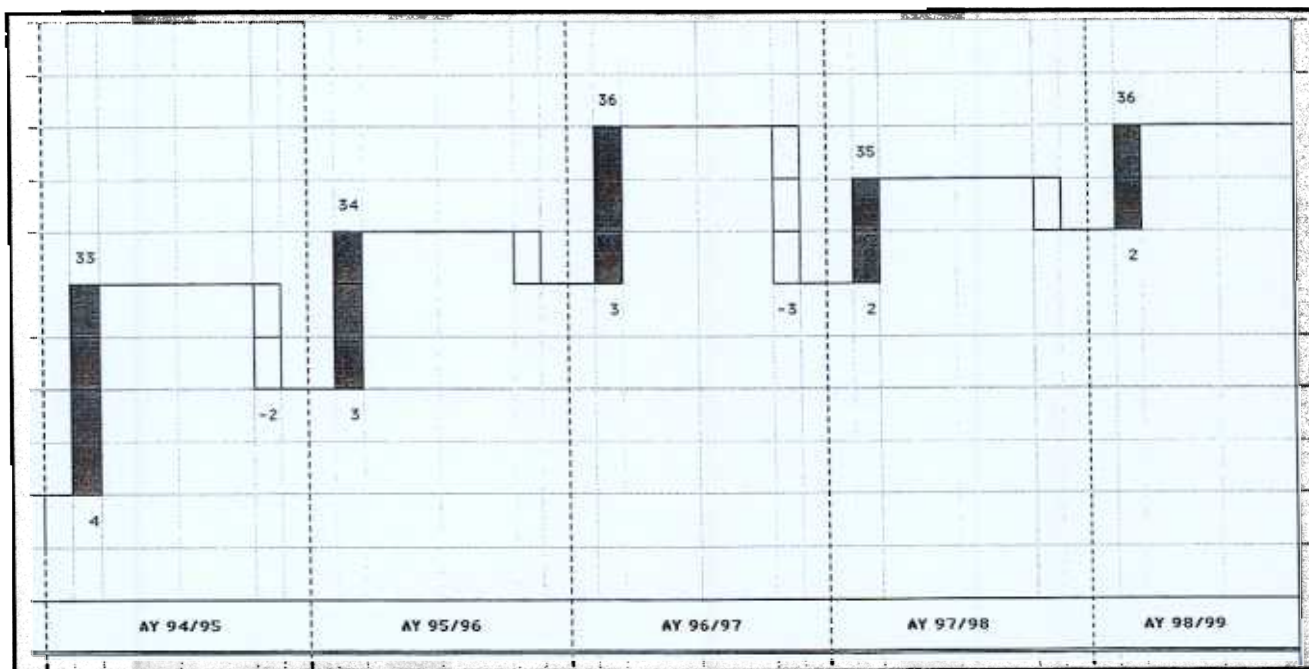


Chart 6-9: Faculty Head Count

Chart 6-9: Faculty turnover since 1994. Affiliate faculty and research faculty with no teaching responsibilities are not included.

Staff development has lagged behind the faculty and programmatic changes:

- Scientific staff (post docs, visitors) has increased with associated space and administrative demands.
- Teaching lab staff positions have remained at 6.
- Administrative staff has grown much slower than faculty/scientific staff head count and research volume.

6.4 Research Funding

Research funding has grown significantly in the last ten years, but this effort needs to be even more aggressive:

- New grant award growth averaged 15% per year for the last 5 years, to over \$5M in 1998-99.
- While respectable, the funding per faculty (\$144k) remains below Research I norms.

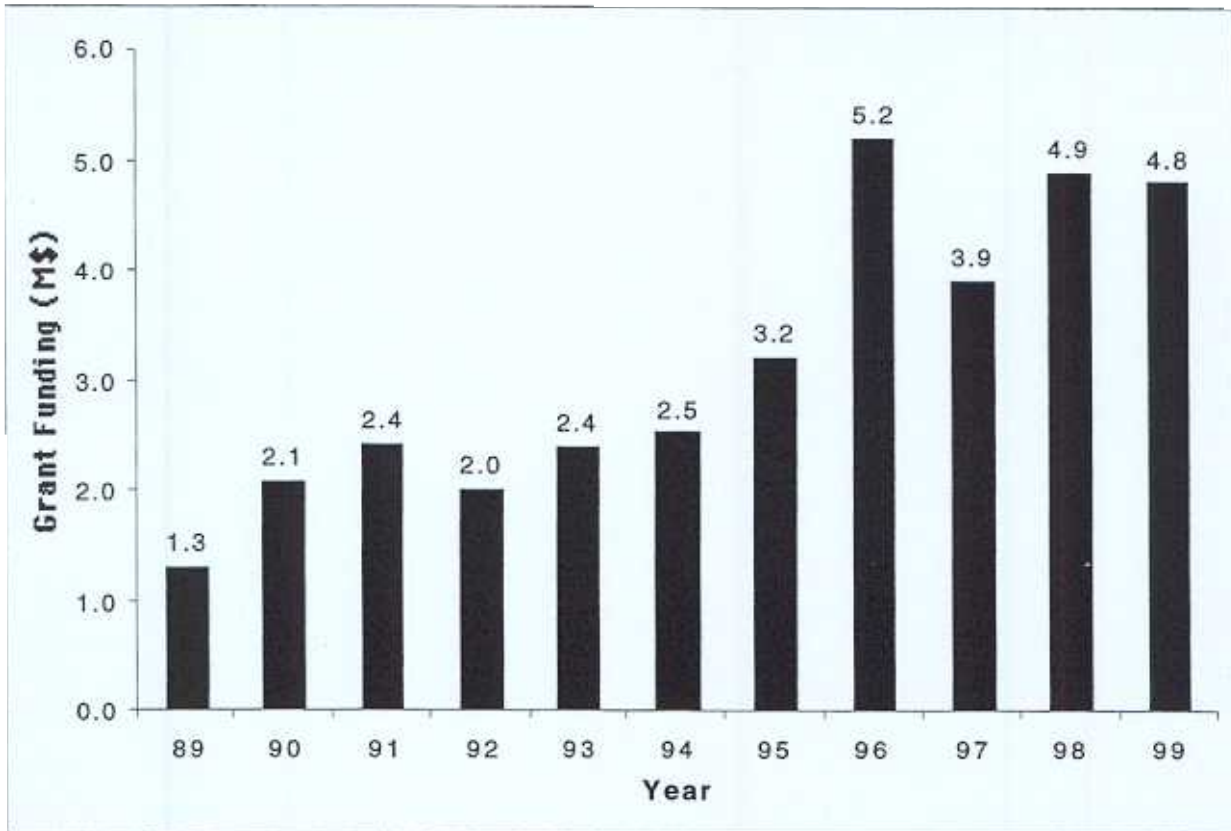


Chart 6-10: New Grant funding

Chart 6-10: New research grants and contracts. These figures include only grants and contracts for which the Principal Investigators (PI) were ECE faculty. The share of grants for which ECE faculty were Co-PI's totalled approximately \$0.5M in 1999.

6.5 Targeted Growth

The ECE faculty have held extensive discussions at various meetings and annual retreats in recent years to determine strategic areas for targeted growth. Plans for faculty growth have been motivated by the need to: strengthen existing research areas to make them more competitive at a national level, develop expertise in areas of ECE where important new technologies are expected to grow, and respond to shifting and growing student enrollments at both undergraduate and graduate levels. As described in Section 5, the department has three main divisions: *electrophysics* (which includes photonics, solid state materials and devices, and electromagnetics), *signals* (which includes speech and image processing, and control and communication systems), and *computer engineering* (which includes reliable computing, high performance computing, networks, VLSI, and multimedia). These areas overlap and are mutually supportive, and our growth must exploit synergies between these areas, as well as links to other departments and centers, which are exhibited in Fig. 6-1

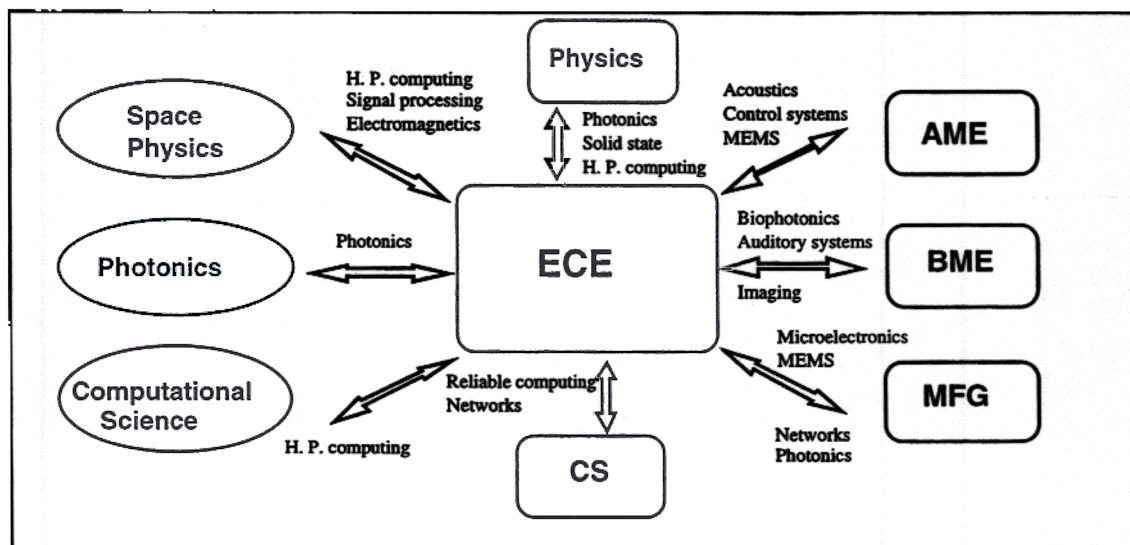


Figure 6-1: Links between the ECE Department and other departments and centers

The following areas have been selected for growth:

Computer Systems Engineering

Our most urgent need for growth is in computer systems engineering. This is immediately dictated by increasing undergraduate enrollment, reflecting the robust market for our graduates. Enrollment in CSE has surpassed that in EE, yet the number of faculty capable of teaching computer engineering courses, particularly in software engineering is alarmingly inadequate. Significant teaching is done by non-research active faculty and CSE research is weak. Failure to add new faculty in this area could cause severe course staffing problems and frustrate research growth. To achieve greater national visibility, CSE must keep up with the changing face of our profession, information revolution, and play a leading role in shaping future technological advances. Research funding in ECE is dominated by EE-related grants. This is not conducive to maintaining a balanced department and hurts CSE recruiting. Recruiting in CSE is not easy under the best of circumstances. The scarcity of qualified people and the strong competition with industry and other universities means that most ECE departments in the US are facing the same difficulty, and makes vigorous recruiting in computer engineering a necessity. We plan to coordinate this growth in computer systems engineering with the BU Department of Computer Science to benefit from synergies and to enhance our competitiveness in attracting new faculty members. Additionally, we should link our efforts to the Center for Computational Science. Another link offering particularly strong synergistic possibilities is that between the ECE High Performance Computing group and the Center for Space Physics (CSP). CSP is a BU research center with strong links to ECE (40% of its graduate students are from ECE).

Telecommunication and computer networks

Another area of high student demand and important research is telecommunication and computer networks. Telecommunications and networking have dramatically changed society and their economic impact will continue to grow. They drive much of the recent technology growth in computers and VLSI. To be a serious CSE department we must enhance the curriculum at both the undergraduate and graduate levels and increase the size of our research effort. Computer-network specialists would also help us in meeting some of our urgent teaching needs in the general computer systems engineering program. The Computer Science Department at BU has also targeted computer networks for growth, and our combined effort can foster a strong BU effort in this very important area.

Analog and digital VLSI electronics

Analog and digital VLSI electronics continues to be an area of fundamental importance. VLSI circuits constitute the principal hardware for computers and embedded systems. Maintaining a strong instructional program in this area is essential for both our degree programs. The application of VLSI electronics to biological sensors is an area of great potential,

and interests both the ECE and the Biomedical Engineering (BME) departments. The addition of more faculty is essential to meet increased teaching needs and to give this research area the critical mass needed to gain national recognition and competitiveness for research funds.

Photonics

When BU established the Photonics Center, it made a strategic commitment to become a national center of excellence in photonics. Senior and junior ECE faculty have been added in quantum optics, photonic materials and devices, and fiber-optic sensors. There is need to maintain the momentum and to continue to strengthen this program with new faculty. This will of course enrich the scientific base of the Photonics Center and its technical vitality. While we have outstanding research in photonic materials and devices and their applications, we lack strength in the systems area, particularly in high-speed optical communication, switching, and networks. Growth in these areas would also strengthen our effort in telecommunication and computer networks. Another area of importance in photonics and also solid state devices is micro-electromechanical systems (MEMS) and their optical applications in sensors, scanners, and actuators. MEMS is a thrust area for other engineering departments, and MEMS efforts will benefit from a well coordinated faculty recruiting campaign and a large research group in this important area. One of our early goals has been the establishment of a new MS degree program (or option) in photonics. Another goal has been to offer a program of short courses (including courses offered via distance learning). The addition of new faculty is necessary to acquire the critical mass for creating such programs.

Signal, speech, and image processing

ECE has an outstanding, and well-funded, group of faculty in signal, speech, and image processing. This group has established an excellent reputation and enjoys an unusually strong graduate student interest. The group includes leaders of a multi-university multi-million dollar MURI AFOSR grant, and a new proposal to establish a large four-university NSF Engineering Research Center for Subsurface Imaging and Sensing (with participants from other ECE groups and other departments of the College). It is essential to maintain the strength of this group and to seek opportunities to make it even stronger by enhancing its ties with other BU groups. The speech processing work is also linked to other activities within the college, such as the Hearing Research Center, the Center for BioDynamics, and the acoustics group in the AME Department.