

CAN BAYRAM
Research Assistant, Ph.D. Candidate

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RESEARCH INTERESTS

Condensed Matter Physics	Semiconductor Material Characterization and Quality Analysis
Semiconductor Device Physics, Simulation and Design	Semiconductor Device Processing
Wide Bandgap Materials (AlGaInN, ZnO)	Semiconductor Device Packaging
MOCVD of III-Nitride Materials	Device Test Setups and Device Testing

EDUCATION

Ph.D. candidate in [Electrical Engineering, Northwestern University](#), Evanston, IL, USA

B.S. in [Electrical Engineering](#), 2005, [Bilkent University](#), Ankara, Turkey

Izmir Science High School, 1998-2001, Izmir, Turkey

Izmir Bornova Anatolian High School, 1994-1998, Izmir, Turkey

RESEARCH EXPERIENCE

- **Graduate Research Assistant**, 2005-present, at [Center for Quantum Devices](#), Northwestern University. He is working under the supervision of [Prof. Manijeh Razeghi](#).

His Ph.D. research area is wide bandgap semiconductor devices including III-N materials (AlGaInN) and II-VI materials (ZnO). His PhD work includes semiconductor device design/simulation, material growth/characterization, device processing/packaging/measurement.

He has performed more than 2000 MOCVD growths up-to-date. He has improved $\text{Al}_x\text{Ga}_y\text{In}_{(1-x-y)}\text{N}$ layers (where $[0,0] < [x, y] < [1,1]$), and integrated them into self-designed nitride optoelectronic devices. By using state of the art material characterization techniques such as atomic force microscopy, scanning electron microscopy, photoluminescence measurements, X-ray diffraction measurements, and Hall effect measurements, he has correlated the material growth, characterization and (structural (surface, crystallographic), optical, electrical) material quality that led to **world's first and world's highest performance nitride optoelectronic devices**.

By using conventional and state-of-the-art semiconductor fabrication techniques

and equipments (such as rapid thermal annealing, electron cyclotron resonance reactive ion etching, electron beam metal evaporator, plasma-enhanced chemical vapor deposition, photo- and e-beam-lithography systems), he has fabricated more than 300 wide bandgap semiconductor devices ranging from UV APDs to blue and green LEDs. Combining the device performance with the material growth, a unique blend of semiconductor knowledge is gathered in-house, and being implemented.

His current tasks are the growth, characterization, fabrication and measurement of (Al,Ga,In)N based optoelectronic devices. He is responsible for the MOCVD growth of AlGaInN based all optoelectronic devices ranging from electro-optical modulators to ultraviolet single photon detectors, ultraviolet to visible LEDs and LDs, and transistors. He is currently developing high quality Al(Ga)N/GaN superlattices for intersubband devices operating in near-, mid-, far-infrared, and THz regime.

• **Undergraduate Research Assistant**, 2004-2005, in Electrical Engineering Department, Bilkent University (Ankara, Turkey). [Prof. Abdullah Atalar](#) was his senior project supervisor.

He has conducted research in the field of micromachined sensors. He has improved the design of the capacitive Micromachined Ultrasonic Transducers (cMUTs). His results have been published in IEEE - UFFC 2005 Rotterdam. He is the recipient of the 500\$ Student Travel Award at IEEE - UFFC 2005 Rotterdam with this research.

• **Summer Internship**, 2003 Summer, in [ASELSAN](#) (Ankara, Turkey), which is one of the biggest electronic firms in Turkey.

He has worked in the Communications Division and focused on the network systems, and their utilities in the communications. Particularly, he has examined IP, ATM, and MPLS, GMPLS and focused on new technological network systems MPLS and GMPLS mostly.

• **Visiting Researcher**, 2002 Summer, in [Khuri-Yakub's Ultrasonic Group](#), Stanford University (CA, USA). [Prof. Butrus \(Pierre\) T. Khuri Yakub](#) was his research supervisor.

He has worked as a member of Ultrasonic Group and developed a technique to make 3-D field analysis of transducers with 1 mm accuracy. A 3-D moving mechanical structure software, necessary high accuracy arm designs (in ANSYS), Lab view codes for coordination of the mechanical (Unidex Positioning System), AC supply, DC supply and oscilloscope are created and developed. The project was successfully completed. The set-up he developed in Stanford University was used in ultrasonic field characterization, was referenced in published papers (Proc. IEEE Ultrason. Symp., 2004, pp. 252-255, IEEE Trans. Ultrason., Ferroelect., Freq. Cont., vol. 52, no. 2, pp. 326-339, Feb. 2005).

TEACHING EXPERIENCE

Mentor, Center for Quantum Devices, Northwestern University, 2005-present

- Teaching visiting (under)graduate interns semiconductor device growth, processing and measurement (more than 20 students).
- Working with Northwestern University undergraduates for their independent study courses (more than 5 students).
- Mentoring incoming graduate students (more than 20 students).

Mentor, Electrical Engineering Department, Bilkent University, 2002-2005.

- Teaching physics and mathematics to more than 40 undergraduates throughout the university years.

Mentor, Izmir Science High School, 1998-2001.

- Training new team members for Physics Olympics (more than 7 students).

PERSONAL SKILLS

Self-motivated, team player, good time-manager, multi-tasking, analytical thinker, creative, very fast and keen learner, can set, meet and exceed goals, can see different aspects of a situation.

PHYSICAL SKILLS

Good volleyball player, a keen tennis, table tennis, squash, soccer and basketball player. Enjoys chess, and backgammon. His popular winter sports are skiing and skating. He practices Ju-Jutsu.

COMPUTER SKILLS

LabView Programming (intermediate), Matlab (intermediate), FEMLAB (intermediate), ANSYS (intermediate), Magic Programming (intermediate), Java Programming (intermediate), Fortran Programming (intermediate), Assembly Language (intermediate), Xilinx (intermediate), SPICE (intermediate), Simulink (intermediate), Autocad (intermediate), PIC (basic).

TECHNICAL SKILLS

class 1000 cleanroom experience (> 15,000 hr), metalorganic chemical vapor deposition (expert), MOCVD and supporting mechanics maintenance (expert), scanning electron microscopy (expert), high resolution X-ray diffraction (expert), atomic force microscopy (expert), photoluminescence measurement (expert), Hall measurement (expert), rapid thermal annealing (expert), photolithography (expert), wire bonder (expert), metal e-beam evaporator (expert), electron cyclotron resonance dry etching (expert), plasma enhanced chemical vapor deposition (expert), photodiode measurement (expert), light emitting diode measurement (expert), intersubband absorption measurement (expert), die bonder (medium), dicing system (medium), lapping & polishing (basic), ellipsometer (basic), controlled decomposition oxidation toxic gas scrubber (basic).

AWARDS AND DISTINCTIONS

- **(FIRST PLACE WINNER IN THE WORLD)** Recipient of **2009 Boeing Engineering Student of the Year Award** (by Boeing Company, Boeing Integrated Defense Systems) [along with complimentary registration and accommodation costs to attend Annual Airshow in Dubai](#) in recognition of his impact, and potential for impact on current and future aeronautical and space technology.
 - **Press Releases** related to **2009 Boeing Engineering Student of the Year Award (complimentary registration and accommodation costs to attend Annual Airshow in Dubai)**
 - (“[Northwestern University EECS Department News](#)”)
 - (“[Boeing Company Press Release](#)”)
 - (“[Flight Global Press Release](#)”)
 - (“[Official Boeing Award Letter](#)”)

- Recipient of **NU EECS Departmental Travel Grant**.
- **Invited Press Release** related to UV DETECTORS: III-Nitrides benefit UV detection with small size, high sensitivity, efficiency
 (“[Laser Focus World - Issue: September, Page: 47-51, 2009](#)”)
 (“[Laser Focus World - November 01, 2009](#)”)
- Recipient of **2009 IEEE Photonics Society Graduate Student Fellowship** along with **\$5,000 honorarium, complimentary registration and travel grant of \$2,500** to attend Photonics Society 2009 Annual Meeting in recognition of his scholarly achievements in the field of lasers and electro-optics.
 - **Press Releases** related to **2009 IEEE Photonics Society Graduate Student Fellowship (\$5,000 honorarium, complimentary registration, and travel grant of \$2,500 to attend Photonics Society 2009 Annual Meeting)**
 (“[IEEE Top Award Winner Web Release](#)”)
 (“[Northwestern University EECS Department News](#)”)
 (“[Northwestern University McCormick Engineering Faculty News](#)”)
- Recipient of **2009 SPIE Laser Technology, Engineering, and Applications Scholarship** along with **\$6,000 honorarium** in recognition of his scholarly achievement in laser technology, engineering, and applications.
 - **Press Releases** related to **2009 SPIE Laser Technology, Engineering, and Applications Scholarship (\$6,000 honorarium)**
 (“[Optics.org Newsfeed](#)”)
 (“[SPIE Press Release](#)”)
 (“[Northwestern University EECS Department News](#)”)
- Recipient of **2009 Dow Sustainability Innovation Award** along with **\$10,000 honorarium** for his work on high-energy efficient Novel **Green** LEDs.
 - **Press Releases** related to **\$10,000 Dow Sustainability Innovation Award 2009**
 (“[Northwestern University EECS Department News](#)”)
 (“[Northwestern University McCormick Engineering Faculty News](#)”)
 (“[Northwestern University News](#)”)
 (“[Northwestern Institute for Sustainable Practices Press Release](#)”)
 (“[Dow Chemical Company Press Release](#)”)
- **Registration Fee Waiver** for 2009 SPIE Photonics West Conference.
- Applied Physics Letters, Vol. 93, 221104 (2008) – World’s First Demonstration of GaN nanostructured *p-i-n* photodiodes becomes the **3rd most downloaded article** (among 80620 articles) in Applied Physics Letters -- December 08.
- **Invited Press Release** related to world’s first hybrid green LED
 (“[Laser Focus World - Issue: November, Page: 32, 2008](#)”)
- **Invited Press Release** related to world’s first hybrid green LED
 (“[Laser Focus World - November 01, 2008](#)”)

- **Invited Press Release** related to world's first hybrid green LED
(“Compoundsemiconductor.net - September 03, 2008”)
- Applied Physics Letters, Vol. 93, 081111 (2008) – World's First Demonstration of hybrid green light-emitting diode becomes the **19th most downloaded article** (among 79348 articles) in Applied Physics Letters -- September 08.
- **Invited Press Release** related to world's first UV single photon detector
(“[ScienceDaily](http://ScienceDaily.com), [Science Centric](http://ScienceCentric.com), [SPIE Newsroom](http://SPIENewsroom.com) - February 01, 2008”)
- **Invited Press Release** related to world's highest performing GaN APDs
(“[McCormick News](http://McCormickNews.com), [Science Daily](http://ScienceDaily.com) - September 29, 2005”)
- **Full Scholarship** awarded from Northwestern University as a research assistantship in Center for Quantum Devices (advisor: Prof. Manijeh Razeghi) from 2005-Present.
- **\$500 Student Travel Award** recipient at IEEE - UFFC 2005 Rotterdam.
- **High Honor** Graduation from Electrical Engineering in Bilkent University.
- **Scholarship** is awarded by Bilkent University Electrical Engineering in 2003, and continued through undergraduate study.
- Due to his outstanding success (**1st in rank**) in Physics Department, he was accepted to Electrical Engineering Department as an undergraduate.
- **High Honor** Student in all semesters in Bilkent University Physics Department.
- **Highest GPA** (3.95 / 4.00) (rank 1) in 2002 in Bilkent University Physics Department in both terms. First term GPA is 3.94, and second term GPA is 3.95. These GPAs are the highest in the Physics Department for each corresponding terms, and in overall two terms.
- **Invited as a Visiting Researcher** to Stanford University, CA, USA.
- **Full scholarship** awarded by Bilkent University for undergraduate study in Physics Department in 2001.
- Ranked in the first 2200 among approximately 1.5 million candidates in the University Entrance Examination in 2001.
- Several (September, December, February, and March) National Physics Olympiad Camps Attended (qualified at each step by examination that is arranged by TUBITAK (The Scientific and Technical Research Council of Turkey)).
- IFL (Izmir Science High School) Appreciation Certificate due to success in December National Physics Olympiad Exam.
- Mansion prize in essay competition of ECEV (Modern Education Association) in 2001.
- Honor Certificate Awarded by National Industrial and Businessman Union due to success in essay about the use of native products (2nd prize awarded).
- IFL Appreciation Certificate and National Industrial and Businessman Union Appreciation Certificate due to success in the essay about the use of native products. (2nd essay award rewarded).
- 4th best essay prize among 2544 nationwide essays in the subject of “Earthquake and the Message” in 2000. Plaque and money prize are won.
- TUBITAK Attendance Certificate attained for September National Physics Olympiad Camp in 1999.
- Attendance Certificate attained for 23 April National Sovereignty and Children's Day essay competition.

- IFL Appreciation Certificate due to success in National Physics Olympiad 1st Qualifying Exam.
- Entered in IFL (Izmir Science High School).
- Ranked the 108th among approximately half million candidates in the Science High School Entrance Examinations in 1998.
- 30th in Government Scholarship Examination among 110,000 students in Turkey in 1998.
- 2nd in Government Scholarship Examination among 105,000 students in Turkey in 1997.
- 293rd in Private School Examination among 200,000 students in 1994.
- 265th in Anatolia Entrance Examination among 1 million students in 1994.

AFFILIATIONS

- 2009 – present: Member of the American Association for the Advancement of Science (AAAS)
- 2009 – present: Member of the IEEE Electron Devices Society (IEEE - EDS)
- 2008 – present: Member of the American Physical Society (APS)
- 2008 – present: Member of the Materials Research Society (MRS)
- 2007 – present: Member of the IEEE Photonics Society
- 2006 – present: Member of the International Society for Optics and Photonics (SPIE)
- 2005 – present: Member of the Optical Society of America (OSA)
- 2005 – present: Member of Institute of Electrical and Electronics Engineers (IEEE)
- An active referee of Applied Physics Letters, Journal of Applied Physics, Journal of the Electrochemical Society, Solid State Electronics, and Thin Solid Films.
- Acts as the “Treasurer” of the Northwestern University SPIE Chapter, and NU Photonics Society.

JOURNAL PAPERS

- (18) **C. Bayram**, N. Péré-Laperne, and M. Razeghi, “*Effects of well width and growth temperature on optical and structural characteristics of AlN/GaN superlattices grown by metal-organic chemical vapor deposition,*” Applied Physics Letters 95, 201906 (2009).
- (17) N. Péré-Laperne, **C. Bayram**, L. Nguyen-Thê, R. McClintock, and M. Razeghi, “*Tunability of Intersubband absorption from 4.5 to 5.3 μm in a GaN/Al_{0.2}Ga_{0.8}N superlattices grown by metalorganic chemical vapor deposition,*” Applied Physics Letters 95, 131109 (2009).
- (16) **C. Bayram** and M. Razeghi, “*ULTRAVIOLET DETECTORS: Nitrides push performance of UV photodiodes,*” Laser Focus World 45(9), p. 47-51 (2009).
- (15) **C. Bayram**, D. Rogers, F. H. Teherani, and M. Razeghi, “*Fabrication and Characterization of Novel Hybrid Green LEDs Based on Substituting n-type ZnO for n-type GaN in an Inverted p-n Junction,*” Journal of Vacuum Science and Technology B 27, 1784 (2009).

- (14) V. E. Sandana, D. J. Rogers, F. H. Teherani, R. McClintock, **C. Bayram**, M. Razeghi, H.-J. Drouhin, M.C. Clochard, V. Sallet, G. Garry, and F. Falyouni, "Comparison of ZnO Nanostructures Grown Using pulsed layer deposition, metalorganic chemical vapor deposition, and physical vapor transport", Journal of Vacuum Science and Technology B 27, 1678 (2009).
- (13) **C. Bayram**, N. Péré-laperne, R. McClintock, B. Fain and M. Razeghi, "Pulsed Metalorganic Chemical Vapor Deposition of High Quality AlN/GaN Superlattices for Near-Infrared Intersubband Transitions," Applied Physics Letters 94, 121902 (2009).
- (12) **C. Bayram** and M. Razeghi, "Stranski-Krastanov growth of InGaN quantum dots emitting in green spectra," Applied Physics A: Materials Science & Processing 96, 403 (2009).
- (11) **C. Bayram**, J. L. Pau, R. McClintock, and M. Razeghi, "Comprehensive study of blue and green multi-quantum-well light emitting diodes grown on conventional and lateral epitaxial overgrowth GaN," Applied Physics B: Lasers and Optics 95, 307 (2009).
- (10) J. L. Pau, **C. Bayram**, P. Giedraitis, R. McClintock, and M. Razeghi, "GaN nanostructured p-i-n photodiodes," Applied Physics Letters 93, 221104 (2008).
- (9) **C. Bayram**, J. L. Pau, R. McClintock, M. Razeghi, M. P. Ulmer, and D. Silversmith, "High Quantum Efficiency Back-illuminated GaN Avalanche Photodiodes," Applied Physics Letters 93, 211107 (2008).
- (8) **C. Bayram**, F. H. Teherani, D. Rogers, and M. Razeghi, "A hybrid green light-emitting diode comprised of n-ZnO/(InGaN/GaN) multi-quantum wells/p-GaN," Applied Physics Letters 93, 081111 (2008).
- (7) **C. Bayram**, J. L. Pau, R. McClintock, and M. Razeghi, "Performance enhancement of GaN ultraviolet avalanche photodiodes with p-type delta-doping," Applied Physics Letters 92, 241103 (2008).
- (6) **C. Bayram**, J. L. Pau, R. McClintock, and M. Razeghi, "Delta-doping optimization for high quality p-type GaN," Journal of Applied Physics 104, 083512 (2008).
- (5) J. L. Pau, **C. Bayram**, R. McClintock, D. Silversmith, and M. Razeghi, "Back-illuminated separate absorption and multiplication GaN avalanche photodiodes" Applied Physics Letters 92, 101120 (2008).
- (4) J. L. Pau, R. McClintock, **C. Bayram**, K. Minder, D. Silversmith, and M. Razeghi, "High Optical Response in Forward Biased (In,Ga)N-GaN MultiquantumWell Diodes under Barrier Illumination," IEEE Journal of Quantum Electronics 44, 346 (2008).

- (3) K. Minder, J. L. Pau, R. McClintock, P. Kung, **C. Bayram**, M. Razeghi, and D. Silversmith, “*Scaling in GaN avalanche photodiodes designed for back-illumination*,” Applied Physics Letters 91, 073513 (2007).
- (2) J. L. Pau, R. McClintock, K. Minder, **C. Bayram**, P. Kung, M. Razeghi, E. Munoz, and D. Silversmith, “*Gieger-mode operation of back-illuminated GaN avalanche photodiodes*,” Applied Physics Letters 91, 041104 (2007).
- (1) R. McClintock, J. L. Pau, K. Minder, **C. Bayram**, P. Kung, and M. Razeghi, “*Hole-initiated multiplication in back-illuminated GaN avalanche photodiodes*,” Applied Physics Letters 90, 141112 (2007).

CONFERENCE PAPERS&PRESENTATIONS

- (20) (Invited Poster) **C. Bayram**, F. H. Teherani, D. Rogers, and M. Razeghi, “*Novel Green Light Emitting Diodes*”, Dow Chemical Company Sustainability Innovation Student Challenge Recognition Event, University of Michigan Ann Arbor, Oct. 19 (2009).
- (19) (Invited Talk) F. H. Teherani, **C. Bayram**, D. J. Rogers, M. Razeghi, and R. McClintock, “*Hybrid Green LEDs with n-type ZnO Substituted for n-type GaN in an Inverted p-n Junction*”, 2009 Annual Meeting of IEEE Photonics Society, Antalya - Belek, Turkey, Oct. 4-8 (2009).
- (18) (Invited GOLD Session) **C. Bayram** and M. Razeghi, “*III-Nitride Optoelectronic Devices*”, 2009 Annual Meeting of IEEE Photonics Society, Antalya - Belek, Turkey, Oct. 4-8 (2009).
- (17) (Invited Talk) **C. Bayram**, F. H. Teherani, D. Rogers, R. McClintock, and M. Razeghi, “*Novel Green Light Emitting Diodes: Innovating Droop-free Lighting Solutions for Sustainable Earth*”, 2009 symposium of the Chicago AIChE (American Institute of Chemical Engineers), Chicago, IL, Oct. 4-5 (2009).
- (16) (Plenary Talk) M. Razeghi, **C. Bayram**, R. McClintock and N. Péré-Laperne, “*III-Nitride Optoelectronic Devices: High Performance GaN Avalanche Photodiodes, Novel Green Light Emitting Diodes and III-Nitride Intersubband Devices*”, AFOSR Joint Electronics Program Review, Arlington, VA, May 27 (2009).
- (15) M. Razeghi and **C. Bayram**, “*Material and design engineering of (Al)GaN for high-performance avalanche photodiodes and intersubband applications*,” Proc. SPIE 7366, 73661F (2009).
- (14) **C. Bayram**, B. Fain, N. Péré-Laperne, R. McClintock, and M. Razeghi, “*Pulsed metalorganic chemical vapor deposition of high quality AlN/GaN superlattices for intersubband transitions*,” Proc. SPIE 7222, 722212 (2009).

- (13) R. McClintock, J. L. Pau Vizcaino, **C. Bayram**, B. Fain, P. Giedraitis, M. Razeghi, and M. P. Ulmer, "*III-nitride avalanche photodiodes*," Proc. SPIE 7222, 72220U (2009).
- (12) **C. Bayram**, D. J. Rogers, F. Hosseini Teherani, and M. Razeghi, "*Hybrid green LED based on nZnO/MQWInGaN/pGaN*," Proc. SPIE 7217, 72170P (2009).
- (11) J.L. Pau, **C. Bayram**, P. Giedraitis, R. McClintock, and M. Razeghi, "*GaN-based nanostructured photodetectors*," Proc. SPIE 7222, 722214 (2009).
- (10) V. E. Sandana, D. J. Rogers, F. H. Teherani, R. McClintock, **C. Bayram** M. Razeghi, H.-J. Drouhin, V. Sallet, G. Garry, F. Falyouni,, "*Comparison of ZnO Nanostructures Grown Using PLD, MOCVD & PVT*," Proc. of the 5th Int. Workshop on ZnO and Related Materials, Sept. 22-24, Michigan (2008).
- (9) **C. Bayram**, D. J. Rogers, F. Hosseini Teherani, and M. Razeghi, "*Novel Hybrid Green LEDs Based on Substituting n-type ZnO for n-type GaN in an Inverted p-n Junction*," Proc. of the 5th International Workshop on ZnO and Related Materials, Sept. 22-24, Michigan (2008).
- (8) (Invited Paper) M. Razeghi, J. L. Pau, **C. Bayram**, B. Fain, P. Giedraitis, and R. McClintock, "*UV Single Photon Detection Based on III-Nitride Geiger Mode Avalanche Photodiodes*," 2nd International Symposium on Growth of III-Nitrides (ISGN-2). Laforet Shuzenji Izu, Japan -- July 6, 2008.
- (7) M. Razeghi, J. L. Pau, **C. Bayram**, R. McClintock, K. Kim, P. Giedraitis, and B. Fain, "*GaN Avalanche Photodiodes and Green Emitters*," 2008 AFRL-AFOSR Nanotechnology Initiative Review. Dayton, OH -- May 6, 2008.
- (6) (Invited Paper) R. McClintock, J. L. P. Vizcaino, K. Minder, **C. Bayram** and M. Razeghi, "*III-nitride photon counting avalanche photodiodes*," Proc. SPIE 6900, 69000N (2008).
- (5) (Invited Paper) K. Minder, F. H. Teherani, D. Rogers, **C. Bayram**, R. McClintock, P. Kung, and M. Razeghi, "*Etching of ZnO towards the development of ZnO homostructure LEDs*," Proc. SPIE 6474, 64740Q (2007).
- (4) P. Kung, R. McClintock, J. L. P. Vizcaino, K. Minder, **C. Bayram**, and M. Razeghi, "*III-nitride avalanche photodiodes*," Proc. SPIE 6479, 64791J (2007).
- (3) R. McClintock, K. Minder, A. Yasan, **C. Bayram**, F. Fuchs, P. Kung, and M. Razeghi, "*Solar-blind avalanche photodiodes*," Proc. SPIE 6127, 61271D (2006).
- (2) **C. Bayram**, S. Olcum, M. N. Senlik, and A. Atalar, "*Bandwidth improvement in a cMUT array with mixed sized elements*," Proc. IEEE Ultrason. Symp., pp. 1956-1959. (2005).

- (1) S. Olcum, M. N. Senlik, **C. Bayram** and A. Atalar, "*Design charts to maximize the gain-bandwidth product of capacitive micromachined ultrasonic transducers,*" Proc. IEEE Ultrason. Symp. pp. 1941-1944. (2005)

RELEVANT COURSES

Ph.D. Courses:

- Nanomaterials
- Solid State Electronic Devices
- Quantum Electronics
- Quantum Devices
- Quantum Semiconductors
- Semiconductor Lasers
- Advanced Photonics
- Crystallography and Diffraction
- Fundamentals of Thin Film Materials
- Special Topics –
Functional Metamaterials
- Microelectronic Technology
- Electronic Properties of Materials
- Condensed Matter Physics

Undergraduate Courses:

- Electromagnetics and Photonics,
- Telecommunications I,
- Telecommunications II,
- Introduction to CMOS VLSI design,
- Microwave Electronics,
- Microwave Engineering,
- Digital Electronics,
- Feedback Control Systems,
- Signals and Systems,
- Engineering Electromagnetics,
- Electronic Circuit Design,
- Circuit Theory,
- Analog Electronics,
- Complex Calculus and Transformations,
- Microprocessor,
- Linear Algebra and Differential Equations,
- Introduction to Probability,
- Computer-Aided Manufacturing,
- Java Programming I,
- Java Programming II,
- Introduction to Digital Design,
- Introduction to Electronics, Mechanics,
- Electricity and Magnetism,
- Programming for Physicists (Fortran Language),
- Principles of Chemistry I,
- Principles of Chemistry II,
- Single Variable Calculus,
- Multi Variable Calculus,
- Principles of Biology,
- Economic Theory I,
- Cultures, Civilizations and Ideas I,
- Cultures, Civilizations and Ideas II,
- Basic German I,
- Basic German II.

HIS PRIMARY CONTRIBUTIONS TO THE III-NITRIDE INTERSUBBAND RESEARCH

- (3) Demonstration of **world's first MOCVD-grown AlN/GaN SLs with intersubband absorbance in complete optical communications wavelengths** (2009).
- (2) Demonstration of **world's first MOCVD-grown AlGaIn/GaN SLs with intersubband absorbance as high as 5.3 μm** (2009).
- (1) Demonstration of **world's first MOCVD-grown AlN/GaN SLs absorbing at optical communication wavelengths (as low as at 1.5 μm)** (2009).

HIS PRIMARY CONTRIBUTIONS TO THE ULTRAVIOLET DETECTORS

- (7) Demonstration of **world's first nanopillar GaN photodiodes** (2008),
- (6) Demonstration of **world's highest quantum efficiency** inherently-ultraviolet APDs (2008),
- (5) Demonstration of **world's highest** linear gain in UV GaN APDs (2008),
- (4) Demonstration of **world's first** back-illuminated Separate Absorption & Multiplication GaN APDs (2008),
- (3) Demonstration of **world's first** UV Single Photon Detection with GaN APDs (2007),
- (2) Demonstration of **world's highest** linear gain in UV GaN APDs (2007),
- (1) Demonstration of **world's first** back-illuminated linear mode GaN APDs (2007).

HIS PRIMARY CONTRIBUTIONS TO THE SOLID STATE LIGHTING

- (3) Demonstration of **world's first** white light emitting diodes based on Stranski-Krastanov mode-grown InGaIn quantum dots (2009),
- (2) Demonstration of **world's first** green light emitting diodes grown on LEO GaN (2008),
- (1) Demonstration of **world's first** hybrid green LED based on n-ZnO / (In)GaIn MQW / p-GaN (2008).

HIS PRIMARY CONTRIBUTIONS TO THE MATERIAL GROWTH OF III-NITRIDES

- (7) Development of **high quality AlGaIn/GaN SLs with intersubband absorptions as high as 5.3 μm** (2009),
- (6) Establishment of a unique **pulsed growth scheme for high quality AlN/GaN SLs for intersubband absorption at near-infrared regime** (2009),
- (5) Development of **self-assembled InGaIn quantum dots emitting in green spectra at room temperature** (2009),
- (4) Establishment of a unique **five-step growth scheme for high quality and reproducible lateral epitaxial overgrowth (LEO) GaN** leading to **world's first green LEDs on LEO GaN** (2008),
- (3) Realization of **high quality AlGaIn** leading to **world's highest quantum efficiency** inherently-ultraviolet APDs (2008),
- (2) Realization of **highly doped high quality p-GaN via delta-doping on AlN/Sapphire** leading to **world's first** hybrid green LED based on n-ZnO / (In)GaIn MQW / p-GaN , and **world's highest** linear gain in UV GaN APDs by delta-doped p-GaN (2008),
- (1) Realization of **high quality GaN regrowth and inherit AlN templates** leading to **world's highest** linear gain in UV GaN APDs and **world's first** UV Single Photon Detector (2007).