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Hua Tong

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Contact Information

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Education

Jan. 2001 – present, Lehigh University (Bethlehem, Pennsylvania, USA)

Ph.D. Candidate in Electrical Engineering, Department of Electrical and Computer Engineering

- Research Assistant, PhD Advisor: Prof. Nelson Tansu (ECE, Lehigh), since November 2006.
- Research Areas: theoretical/computational simulations of III-Nitride optoelectronics and thermoelectrics semiconductor alloys and nanostructures, epitaxy (MOCVD), fabrication and characterization of novel III-Nitride semiconductor devices.

Sep. 1998 – Dec. 2000, Tsinghua University (Beijing, China)

Master of Sciences (M.S.) in Electronics Engineering, Department of Electronics Engineering

- Specialization: Micro-Opto-ElectroMechanical Systems (*Key project of the 863 National High Tech R&D Plan of China*)
- Thesis: Fabrication of widely tunable detectors based on MOEMS technology

Sep. 1994 – Jul. 1998, Tsinghua University (Beijing, China)

Bachelor of Science (B.S.) in Electronics Engineering, Department of Electronics Engineering

- Thesis: Simulation of light propagation in Y branch waveguide using Full Vector Finite Difference Beam Propagation method

Awards & Honors Received

- **Tsinghua Excellent Student Scholarship** (1995,1996,1997), Tsinghua University
- **Tsinghua Outstanding Student Awards** (1995,1996,1997,1998), Tsinghua University

Professional Experiences

Jan 2001 – present, Lehigh University (Bethlehem, PA, USA)

Ph.D. Candidate and Research Assistant

Department of Electrical and Computer Engineering (ECE)
P. C. Rossin College of Engineering and Applied Science
& Center for Optical Technologies (COT)

- **InN/InGaN/AlInN/AlGaN/AlInGaN based Thermoelectric Material and Devices**
 - Thermoelectric properties simulation of InN/InGaN/AlInN/AlGaN/AlInGaN thin film and super lattice
 - MOCVD epitaxy of Nitride-based thermoelectric semiconductors
 - Thermoelectric properties measurement of InN/GaN/AlN and ternary/quaternary Nitride compounds

- **III-Nitride Semiconductor Nanostructures for Intersubband Transition and Resonant Tunneling Diode**
 - Conduct intersubband simulation and device physics of the semiconductor nanostructures
 - MOCVD epitaxy of III-Nitride semiconductor nanostructure and device fabrication of RTD
- **Surface Plasmonics on III-Nitride Semiconductors**
 - Conduct simulation and device physics of the surface plasmonic polariton on III-Nitride semiconductors
 - Device fabrication of surface plasmonics enhanced PD
- **Ab-initio study of III-Nitride Semiconductors**
 - Conduct first principle study and simulation of the III-Nitride semiconductor material
- **Photonic Crystals: theoretical analysis and numerical simulation.**
 - Conduct accurate simulation and device analysis of the photonic crystal structures

May. 2002 – Sep. 2002 **Anadigics, Inc. (Warren, NJ, USA)**

- **Working in Device Characteristic and testing group**
 - Load Pull and Source Pull measurement of HBT using Maury ATS
 - Ruggedness Test
 - Two Tone measurement
 - DC IV and pulsed IV measurement
 - Resistance measurement
 - Side gate measurement

May. 2001 – Sep. 2001 **Anadigics, Inc. (Warren, NJ, USA)**

- **Working in Opto-electronics group**
 - Design an Echelles grating DMUX for WDM
 - Help in the design of coplanar electrodes for traveling-wave EO modulator and in the processing of MZ modulators

Sep. 1998 – Dec. 2000 **Tsinghua University (Beijing, China)**

- **Design and fabrication of widely tunable detectors based on MOEMS technology**
 - Structure and characteristic design
 - Device Fabrication: optical Lithography, non-selective and selective etching, electrode coating
 - Device measurement and characterization

Skills

- Experienced in programming languages and software packages:
 - C/C++, FORTRAN, Assembly language, Matlab, Maple, Mathematica, MathCAD, Labview, Verilog/VHDL, Rsoft, Optiwave, Tanner L-Edit, DesignCAD, HTML/XML
- Proficient in different Operation Systems: Windows, UNIX, Linux,
 - IBM Certified Specialist – AS/400 Associate System Operator
- Proficient in computer networks
- Experienced in RF and optical characterization equipments and computer hardwares
- Experienced in MOCVD, PECVD, metal evaporation, RTA, SEM, photomask design, e-beam lithography, photolithography, filmetrics, photoluminescence, Hall measurement.

Research Interests

My research areas cover the fundamental material/device physics, epitaxy (MOCVD), and fabrication of semiconductor optoelectronics devices based on semiconductor nanostructures. My research works include fundamental studies of III-Nitride material, theoretical/computational simulations of III-Nitride semiconductor optoelectronics materials and nanostructures, AlInGaN based thermoelectric devices, surface plasmonics, epitaxy

(MOCVD) and fabrication of novel III-Nitride semiconductor devices, and novel approaches to enhance figure of merit of AlInGaN based thermoelectric devices, absorption coefficient of PDs, gain coefficient of intersubband transitions based on III-Nitride semiconductors.

Refereed Journal and Conference Publications

1. J. H. Wang, **H. Tong**, et al, "Surface micromachining techniques in InP based Micro-Opto-Electro-Mechanical system," *Molecular Crystals and Liquefied Crystals*, vol.371, pp.481-484, 2001.
2. J. Mao, **H. Tong**, et al, "III-V semiconductors based surface-micromachined cantilevers for micro-opto-electro-mechanical systems," *Apoc 2001: Asia-Pacific Optical and Wireless Communications: Optoelectronics, Materials, and Devices for Communications*, vol.4580, pp257-261, 2001.
3. **H. Tong**, A. D. McAulay, "Using Photonic Crystals in Adaptive Optic Wavefront Measurement," *ICATHS 2003: International Conference on Advanced Technologies for Homeland Security*, 2003.
4. **H. Tong**, A. D. McAulay, "Wavefront Measurement by using Photonic Crystals," *SPIE 5435-13: Enabling photonic technologies for Aerospace Applications VI Conference*, 2004.
5. M. Jamil, Y. K. Ee, R. A. Arif, **H. Tong**, and N. Tansu, "Study of Nucleation and Growth Modes of InN films by MOCVD on Sapphire Substrate for Photovoltaic Applications," in *Proc. of the MRS Spring 2007: Symposium Y: Thin-Film Compound Semiconductor Photovoltaics*, San Francisco, CA, April 2007.
6. M. Jamil, R. A. Arif, Y. K. Ee, **H. Tong**, J. B. Higgins, and N. Tansu, "MOCVD Epitaxy of InN Films on GaN Templates Grown on Sapphire and Silicon (111) Substrates," in *Proc. of the 13th Biennial Workshop on Organometallic Vapor Phase Epitaxy (OMVPE) 2007*, Salt Lake City, UT, August 2007.
7. Y. K. Ee, P. Kumnorkaew, R. A. Arif, **H. Tong**, J. F. Gilchrist, and N. Tansu, "Comparison of Numerical Modeling and Experiments of InGaN Quantum Wells Light Emitting Diodes with SiO₂ / Polystyrene Microlens Arrays," in *Proc. of the SPIE Photonics West 2008, Light-Emitting Diodes: Research, Manufacturing, and Applications XII*, San Jose, CA, Jan 2008.
8. Y. K. Ee, P. Kumnorkaew, R. A. Arif, **H. Tong**, J. F. Gilchrist, and N. Tansu, "Size Effects and Light Extraction Efficiency Optimization of III-Nitride Light Emitting Diodes with SiO₂ / Polystyrene Microlens Arrays," in *Proc. of the IEEE/OSA Conference on Lasers and Electro-Optics (CLEO) 2008*, paper CMKK6, San Jose, CA, May 2008.
9. (**Invited Conference Paper**) N. Tansu, R. A. Arif, Y. K. Ee, H. Zhao, **H. Tong**, M. Jamil, and G. S. Huang, "Nano-Engineering of III-Nitride Semiconductor Optoelectronics and New Applications," in *Proc. of the International Conferences of Materials and Technologies (CIMTEC) 2008 – 3rd International Conference on Smart Materials, Structures and Systems*, Sicily, Italy, June 2008.
10. M. Jamil, R. A. Arif, Y. K. Ee, **H. Tong**, J. B. Higgins, and N. Tansu, "MOCVD Epitaxy of InN Films on GaN Templates Grown on Sapphire and Silicon (111) Substrates," *Physica Stat. Solidi (a)*, vol. 205 (7), pp. 1619-1624, July 2008.
11. **H. Tong**, H. Zhao, Y. K. Ee, V. A. Handara, J. A. Herbsommer, and N. Tansu, "Analysis of Thermoelectric Characteristics of III-Nitride Semiconductors," in *Proc. of the SPIE Photonics West 2009, Physics and Simulation of Optoelectronics Devices XVII*, San Jose, CA, Jan 2009.
12. Y. K. Ee, P. Kumnorkaew, R. A. Arif, **H. Tong**, J. F. Gilchrist, and N. Tansu, "Enhancement of Light Extraction Efficiency of InGaN Quantum Wells Light-Emitting Diodes with Polydimethylsiloxane Concave Microstructures," in *Proc. of the SPIE Photonics West 2009, LEDs: Materials, Devices, and Applications for Solid State Lighting XIII*, San Jose, CA, Jan 2009.
13. H. Zhao, M. Jamil, G. S. Huang, **H. Tong**, A. M. Driscoll, and N. Tansu, "Characteristics of InN Semiconductors Grown on Ga-Polar and N-Polar GaN Templates by Pulsed Metalorganic Vapor Phase Epitaxy," in *Proc. of the SPIE Photonics West 2009, Gallium Nitride Materials and Devices IV*, San Jose, CA, Jan 2009.
14. Y. K. Ee, P. Kumnorkaew, R. A. Arif, **H. Tong**, J. F. Gilchrist, and N. Tansu, "The Use of Polydimethylsiloxane Concave Microstructures Arrays to Enhance Light Extraction Efficiency of InGaN Quantum Wells Light-Emitting Diodes," in *Proc. of the IEEE/OSA Conference on Lasers and Electro-Optics (CLEO) 2009*, Baltimore, MD, May 2009.
15. H. Zhao, M. Jamil, G. Liu, G. S. Huang, **H. Tong**, G. Xu, Y. J. Ding, and N. Tansu, "Pulsed Metalorganic Vapor Phase Epitaxy of In-Polar and N-Polar InN Semiconductors on GaN / Sapphire Templates for Terahertz Emitters," in *Proc. of the IEEE/OSA Conference on Lasers and Electro-Optics (CLEO) 2009*, Baltimore, MD, May 2009.

16. Y. K. Ee, P. Kumnorkaew, R. A. Arif, **H. Tong**, H. Zhao, J. F. Gilchrist, and N. Tansu, "Optimization of Light Extraction Efficiency of III-Nitride Light-Emitting Diodes with Self-Assembled Colloidal-based Microlenses," *IEEE J. Selected Topics in Quantum Electronics*, vol. 15(4), pp.1218-1225, July-August 2009.
17. Y. K. Ee, P. Kumnorkaew, R. A. Arif, **H. Tong**, J. F. Gilchrist, and N. Tansu, "Light Extraction Efficiency Enhancement of InGaN Quantum Wells Light-Emitting Diodes with Polydimethylsiloxane Concave Microstructures," *Optics Express*, vol. 17(16), pp.13747-13757, August 2009.
18. (**Invited Conference Paper**) N. Tansu, H. Zhao, R. A. Arif, Y. K. Ee, G. Liu, X. H. Li, **H. Tong**, and G. S. Huang, "Novel Approaches for Efficiency Enhancement in InGaN-Based Light Emitting Diodes," in *Proc. of the 2nd International Conference on White LEDs and Solid State Lighting 2009*, Taipei, Taiwan, December 2009.
19. **H. Tong**, J. A. Herbsommer, V. A. Handara, H. Zhao, G. Liu, and N. Tansu, "Thermal Conductivity Measurement of Pulsed-MOVPE InN Alloy Grown on GaN / Sapphire by 3ω Method," in *Proc. of the SPIE Photonics West 2010, Gallium Nitride Materials and Devices V*, San Francisco, CA, Jan 2010.
20. X. H. Li, **H. Tong**, H. Zhao, and N. Tansu, "Band Structure Calculation of Dilute-As GaNAs by First Principle," in *Proc. of the SPIE Photonics West 2010, Physics and Simulation of Optoelectronics Devices XVIII*, San Francisco, CA, Jan 2010.

Submitted Journal and Conference Publications

1. (**Invited Topical Review Article**) N. Tansu, R. A. Arif, Y. K. Ee, H. Zhao, G. S. Huang, **H. Tong**, and M. Jamil, "Recent Progress on High Efficiency InGaN Quantum Wells and Quantum Dots Light Emitting Diodes for Solid Lighting – A Review," *J. Phys. D: Appl. Phys.* (submitted).
2. (**Invited Review Article**) H. Zhao, R. A. Arif, Y. K. Ee, **H. Tong**, G. S. Huang, and N. Tansu "Physics of III-Nitride Gain Media for Laser Applications," *Lasers and Photonics Review* (submitted).
3. (**Invited Journal Article**) H. Zhao, R. A. Arif, Y. K. Ee, G. S. Huang, **H. Tong**, and N. Tansu, "Approaches for High Internal Quantum Efficiency in InGaN Quantum Well Light Emitting Diodes," *IEEE Photonics Journal* (submitted).
4. (**Invited Review Article**) H. Zhao, M. Jamil, G. Liu, G. S. Huang, **H. Tong**, G. Xu, Y. J. Ding, and N. Tansu "Pulsed MOCVD Growth of In-Polar and N-Polar InN Semiconductors for Terahertz Emitters," *Materials* (submitted).

Internal Scientific Lectures & Seminars

1. M. Jamil, R. A. Arif, Y. K. Ee, **H. Tong**, J. B. Higgins, and N. Tansu, "MOCVD Epitaxy of InN Films on GaN Templates Grown on Sapphire and Silicon (111) Substrates," Poster in *Lehigh Center for Optical Technologies (COT) Open House 2007*, **Lehigh University**, Bethlehem, Pennsylvania, USA, October 2007.
2. Y. K. Ee, P. Kumnorkaew, R. A. Arif, **H. Tong**, J. F. Gilchrist, and N. Tansu, "Size Effects and Light Extraction Efficiency of III-Nitride Light Emitting Diodes with SiO₂ / Polystyrene Microlens Arrays," Poster in *Lehigh Center for Optical Technologies (COT) Open House 2008*, **Lehigh University**, Bethlehem, Pennsylvania, USA, October 2008.
3. Y. K. Ee, P. Kumnorkaew, X. H. Li, R. A. Arif, **H. Tong**, H. Zhao, J. F. Gilchrist, and N. Tansu, "Light Extraction Efficiency Enhancement of III-Nitride LEDs with Colloidal-Microstructures," Oral Presentation in *Lehigh Center for Optical Technologies (COT) Open House 2009*, COT Workshop on NanoPhotonics, **Lehigh University**, Bethlehem, Pennsylvania, USA, October 2009.
4. Y. K. Ee, P. Kumnorkaew, R. A. Arif, **H. Tong**, J. F. Gilchrist, and N. Tansu, "Light Extraction Efficiency Enhancement of III-Nitride LEDs with Polydimethylsiloxane Concave Microstructures," Poster in *Lehigh Center for Optical Technologies (COT) Open House 2009*, COT Workshop on NanoPhotonics, **Lehigh University**, Bethlehem, Pennsylvania, USA, October 2009.
5. **H. Tong**, H. Zhao, V. A. Handara, J. Herbsommer, and N. Tansu, "Analysis of Thermoelectric Characteristics of AlGaIn and InGaIn Semiconductors," Poster in *Lehigh Center for Optical Technologies (COT) Open House 2009*, COT Workshop on NanoPhotonics, **Lehigh University**, Bethlehem, Pennsylvania, USA, October 2009.

Outreach Lectures and Seminars

Geared toward Students in the Middle School and High School

Note: For the outreach lectures / workshops done at Lehigh University, the session also includes laboratory session after the lecture.

1. Nelson Tansu, Ronald A. Arif, Hongping Zhao, **Hua Tong**, Muhammad Jamil, and Yik Khoon Ee, "Semiconductor Nanotechnology for High Energy Efficient Applications," Outreach Program, OptoCamp 2007 – Center for Optical Technologies, **Lehigh University**, Bethlehem, Pennsylvania, USA, August 13th 2007.
2. Nelson Tansu, Ronald A. Arif, Hongping Zhao, **Hua Tong**, Yik Khoon Ee, Xiaohang Li, and Guangyu Liu, "Semiconductor Nanotechnology for High Energy Efficient Applications," Outreach Program, OptoCamp 2008 – Center for Optical Technologies, **Lehigh University**, Bethlehem, Pennsylvania, USA, August 2008.
3. Nelson Tansu, Hongping Zhao, **Hua Tong**, Yik Khoon Ee, Xiaohang Li, and Guangyu Liu, "Semiconductor Nanotechnology for High Energy Efficient Applications," Outreach Program, OptoCamp 2009 – Center for Optical Technologies, **Lehigh University**, Bethlehem, Pennsylvania, USA, August 2009.

References

1. **Prof. Nelson Tansu** (PhD Advisor)
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2. **Prof. Yujie Ding**
Class of 1961 Professor
Department of Electrical and Computer Engineering
Lehigh University, Bethlehem, PA 18015, USA
Email: yud2@Lehigh.Edu
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3. **Dr. Juan Herbsommer**
Power Stage BU
Texas Instruments, Power Management
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