

# Saranga Perera: Curriculum Vitae

## CONTACT INFORMATION

**Full Name:** Dr. H.A.D. Saranga Dilruk Perera

**Current Position:** Senior Lecturer

Department of Physics, University of Ruhuna, Matara.

**Mail:** 69/4, Mangala road, Meddawatta, Matara.

**Phones:** Mobile: 071-909-1183

**E-mail:** [pererasd@gmail.com](mailto:pererasd@gmail.com)

## EDUCATION

- **PhD. University of Cincinnati, Cincinnati, Ohio, USA (Fall 2012)**  
*Major Concentration:* Experimental Condensed Matter Physics  
*Ph.D. Thesis:* **Investigation of exciton dynamics and electronic band structure of InP and GaAs nanowires.**  
*Thesis Advisor:* Prof. Leigh M. Smith
- **B.Sc. Special Degree in Physics (First Class Honors), University of Ruhuna, Matara, Sri Lanka (1998 – 2002)**  
*Major:* Physics  
*Minor:* Computer Science

## SCHOLARSHIPS, AWARDS & CERTIFICATE COURSES

- **Certificate course for professional development in higher education**-Staff development center, University of Ruhuna, Matara. (CCPDHE-2013)
- **University Graduate Scholarship** - University of Cincinnati, OH(Fall 2005-Spring 2012)
- **2011 Graduate Student Research Fellowship** - University Research Council, University of Cincinnati.
- **Henry Laws & Mary J. Hanna Fellowship** (summer 2011) – Department of Physics University of Cincinnati.
- **‘Vasantha Mohotti’ memorial gold medal** - Highest score in B.Sc. special degree in Physics, University of Ruhuna, Sri Lanka(2002)

## RESEARCH EXPERIENCE

- Investigation of electric potential profile in semiconducting heterostructures placed in an external electric field. (2013)
- *Graduate Research Assistant*, Physics Department, University Of Cincinnati (2007 – 2012)
  - Performed detailed studies on GaAs/AlGaAs core-shell nanowires using photoluminescence and time-resolved photoluminescence Spectroscopies.

These studies show exciton lifetimes in these nanowires of  $\sim 1$ ns, equivalent to high quality two-dimensional heterostructures. State filling and many-body interaction effects were observed by increasing the carrier densities using pulsed laser excitation. *Perera et al. Applied Physics Letters 93, 053110 (2008)*.

- Polarized time-resolved photoluminescence used to study exciton dynamics in GaAs/AlGaAs core-shell nanowires at  $\sim 20$ K. Since the diameter of the nanowire is much larger than the exciton Bohr radius, the exciton dipoles are degenerate regardless of orientation. Thus in thermal equilibrium the density of excitons parallel and perpendicular dipoles should be equal. At low excitation intensities the excitons are created out of thermal equilibrium, but relax within several hundred picoseconds. At higher excitation powers, the exciton dipoles relax much more rapidly within a time. This suggests that exciton dipole relaxation is very sensitive to carrier-carrier scattering. <http://meetings.aps.org/link/BAPS.2009.MAR.L10.8>
- Time-resolved photoluminescence spectroscopy was used to study the photoluminescence (PL) of wurtzite InP nanowires at  $\sim 12$ K with various diameters of 5, 20, 30, 50, 100 and 150nm. In the 5, 20, 30nm diameter NW samples, a PL peak around 1.511~1.530eV was observed at early times which decays rapidly leaving a long-lived defect-related emission peak. In the 50,100 and 150nm samples at early times a PL peak was observed around 1.504eV(band edge) that evolves at later times to a long-lived defect emission line around 1.457~1.475eV. This investigation suggests some quantum confinement for the NWs with smaller radius than the Bohr radius. <http://meetings.aps.org/link/BAPS.2010.MAR.Q14.7>
- Photoluminescence excitation (PLE), time-resolved photoluminescence (PL), and CW photoluminescence were used to investigate the electronic structure of wurtzite InP nanowires (NWs) as a function of diameter (50, 100 nm) at 10 K. The laser was polarized parallel and perpendicular to the nanowire and the PL was collected with circular polarization. PLE spectra showed three peaks for the A, B and C hole bands. Currently I am extending these PLE measurements to probe transitions between the A, B and C valence bands to the higher level conduction band recently proposed by *De et al. Physical Review B 81, 155210\_2010*.  
*Perera et al. Applied Physics Letters 97, 023106\_2010*.
- Photocurrent measurements on individual WZ and ZB InP nanowires were performed at room and low temperatures to verified the valence band structure measurement produced by PLE experiment.  
<http://meetings.aps.org/link/BAPS.2011.MAR.J32.2>
- PL and exciton lifetime of a GaAs quantum well tube nanowire were carried out in the presence of an external electric field. Also developed a theoretical model to demonstrate the potential profile in the vicinity of the nanowire due the applied electric field by using finite element calculations.
- *Undergraduate Research*, University of Ruhuna, Matara, Sri Lanka (2002)
  - Satellite reflectance Data was processed and analyzed to investigate the vegetation index on wet and dry zone in Sri Lanka.

## RESEARCH SKILLS

- **Low Temperature Optical Measurements**

- Optical setups, optical alignment techniques and the use of various optical components like mirrors, lenses, babinet compensators, polarizers and spectrometers.
- Various optical spectroscopy methods such as Photoluminescence, Time resolved photoluminescence, photoluminescence excitation, and resonant excitation using tunable Ti:Sapphire laser and Ar<sup>2+</sup> laser.
- **Device fabrication**
  - Fabrication of single nanowire devices using photolithography methods.  
ZB and WZ InP single NW devices were fabricated to use in the photo-current measurements in a cleanroom facility. These devices were fabricated by forming metal contacts between NW. Packaging was done by using a chip carrier.
  - Experienced in using spin coaters, mask aligners and microscopes.
- **Instrumentation and General Labs**
  - General cryogenics and vacuums skills.
  - Optical cryostat assemble and sample mounting and manual wire bonding.
  - Familiar with computer control and automatic data acquisition (Labview).
- **Computer Software and Programming**
  - Origin for data analysis and programming, Labview for data acquisition and analysis.
  - Familiar with Mathematica, C, C++, Fortran and Microsoft Office software

<b>TEACHING EXPERIENCE</b>
----------------------------

- Senior lecturer, University of Ruhuna, Sri Lanka (2013-Up to date)
  - Conducting lectures for level I General Science Degree undergraduate physics students, covered courses: Waves & Vibrations, Optics
  - Conducting lectures for level III general science degree undergraduate physics students, covered courses: Statistical Physics.
  - Senior Lecturer -In-charge –level I -General Science Degree and level II- Special degree in Physics
- College Physics Recitation (2012-Spring)
  - Conducted large undergraduate physics recitation classes with Prof. Leigh Smith and Prof. David Mast. These courses cover Solid & fluids, Thermal physics, Energy in thermal physics, Laws of thermodynamics, Vibrations & waves, Sounds, Optics, Electric forces & fields, Electrical energy and capacitance, Current and resistance, Direct current circuits, Magnetism, and Induce voltages & Inductance.
- College Physics Lab, University of Cincinnati (2011/12-Winter)
  - Participated in an experimental section of laboratory classes that seek to include more inquire and modeling into our current first year labs.
- General/College Physics Recitation, University of Cincinnati (2006-2011)
  - Supervised undergraduate physics students. This class is an innovative way to learn physics by inquiry in which the primary emphasis is on discovery rather than on memorizing and in which teaching is by questioning rather than by telling. This course covers Mechanics, Electricity & Magnetism, Waves, Optics and Thermodynamics.

- General/College Physics Lab, University of Cincinnati (2006-2012)
  - Instructed undergraduate science and engineering majors in a calculus-based/algebra based physics lab. The course covers Mechanics, Electricity & Magnetism, Waves, Optics and Thermodynamics.
- Probationary lecturer, University of Ruhuna, Sri Lanka (2004-2005)
  - Conducted lectures for First & Third Year General Degree undergraduate physics students, covered courses: Electricity & Magnetism and Quantum mechanics.
- Assistant lecturer, University of Ruhuna Sri Lanka (2002-2004)
  - Conducted Laboratory classes for undergraduate physics students. Course covered Mechanics, Electricity & Magnetism, Waves, Optics, Thermodynamics and Hydrostatics. Assisted special degree physics student with their laboratory classes.

#### FUNDED PROPOSALS

- Project Title: **Investigation of electronic structure in wurtzite InP nanowires**  
Funded by University Research Council - University of Cincinnati (2011)

#### PUBLICATIONS

- 1) Determining wurtzite band structure using optical spectroscopies on single InP nanowires, Karunananda Pemasiri, Saranga Perera, Yuda Wang, Mohammad Montazeri, Howard Jackson, Leigh Smith, Jan Yarrison-Rice, Qian Gao, Hoe Tan, Chennupati Jagadish, *AIP Conf. Proc.* 1566, 476 (2013)
- 2) Illuminating the Second Conduction Band and Spin-Orbit Energy in Single Wurtzite InP Nanowires, Saranga Perera, Teng Shi, Melodie A. Fickenscher, Howard E. Jackson, Leigh M. Smith, Jan M. Yarrison-Rice, Suriati Paiman, Qiang Gao, Hark Hoe Tan, and Chennupati Jagadish, *Nano Lett.*, 2013, 13 (11), pp 5367–5372
- 3) Photocurrent Spectroscopy of ZB and WZ InP Nanowire Ohmic devices, K Pemasiri, S Perera, HE Jackson, LM Smith, JM Yarrison-Rise, S Paiman, Q Gao, HH Tan, C Jagadish, *Bulletin of the American Physical Society APS March Meeting 2013 Volume 58, Number 1*
- 4) Probing the valence band structure of wurtzite InP nanowires by photoluminescence excitation spectroscopy, HE Jackson, S Perera, K Pemasiri, LM Smith, J Yarrison-Rice, JH Kang, Q Gao, HH Tan, C Jagadish, Y Guo, J Zou, *AIP Conf. Proc.* 1399, 481 (2011)
- 5) Photoreflectance measurements of single wurtzite InP nanowires, M Montazeri, A Wade, S Perera, K Pemasiri, LM Smith, HE Jackson, JM Yarrison-Rice, S Paiman, Q Gao, HH Tan, C Jagadish, *Bulletin of the American Physical Society APS March Meeting 2011 Volume 56, Number 1*
- 6) Investigation of Electronic Structure in Wurtzite InP Nanowires, Saranga Perera, K Pemasiri, M Fickenscher, A Wade, LM Smith, HE Jackson, JM Yarrison-Rice, S Paiman, Q Gao, H Tan, C Jagadish, *Bulletin of the American Physical Society APS March Meeting 2011 Volume 56, Number 1*
- 7) Photocurrent Spectroscopy of single ZB, WZ InP Nanowire devices, K Pemasiri, S Perera, A Wade, HE Jackson, LM Smith, JM Yarrison-Rice, S Paiman, Q Gao, HH Tan,

*C Jagadish, Bulletin of the American Physical Society APS March Meeting 2011 Volume 56, Number 1*

- 8) Probing valence band structure in wurtzite InP nanowires using excitation spectroscopy, *S. Perera, K. Pemasiri, M. A. Fickenscher, H. E. Jackson, L. M. Smith, J. Yarrison-Rice, S. Paiman, Q. Gao, H. H. Tan, and C. Jagadish* *APPLIED PHYSICS LETTERS* **97**, 023106 (2010). "Probing valence band structure in wurtzite InP nanowires using excitation spectroscopy" published in *Applied Physics Letters* 97, 023106 (2010), has been selected for the August 2010 issue of *Virtual Journal of Ultrafast Science*. The *Virtual Journal* is published by the American Physical Society and the American Institute of Physics.
- 9) Variation of Wurtzite InP Nanowire Photoluminescence With Diameter, *Saranga Perera, K Pemasiri, A Wade, LM Smith, HE Jackson, JM Yarrison-Rice, S Paiman, Q Gao, H Tan, C Jagadish*, *Bulletin of the American Physical Society 2010 APS March Meeting Volume 55, Number 2*
- 10) Photoluminescence from core/multiple-shell GaAs/AlGaAs Nanowires, *MA Fickenscher, SD Perera, HE Jackson, LM Smith, JM Yarrison-Rice, HJ Joyce, Y Kim, Q Gao, HH Tan, C Jagadish*, *Bulletin of the American Physical Society 2009 APS March Meeting Volume 54, Number 1*
- 11) Polarization Dynamics of Twin Free GaAs/AlGaAs Core-Shell Nanowires, *S Perera, LM Smith, HE Jackson, JM Yarrison-Rice, HJ Joyce, Y Kim, Q Gao, HH Tan, C Jagadish, X Zhang, J Zou*, *Bulletin of the American Physical Society 2009 APS March Meeting Volume 54, Number 1*
- 12) Unexpected Benefits of Rapid Growth Rate for III/V Nanowires, *Hannah Joyce, Q. Gao, H.H. Tan, C. Jagadish, Y. Kim, M.A. Fickenscher, S. Perera, T.B. Hoang, L.M. Smith, H.E. Jackson, J.M. Yarrison-Rice, J. Zhang, and J. Zou*, *Nano Letters* **9**, 695-701 (2009).
- 13) High Purity GaAs Nanowires Free of Planar Defects: Growth and Characterization, *Hannah J. Joyce, Qiang Gao, H. Hoe Tan, Chennupati Jagadish, Yong Kim, Melodie A. Fickenscher, Saranga Perera, Thang Ba Hoang, Leigh M. Smith, Howard E. Jackson, Jan Yarrison-Rice, Xin Zhang and Jin Zou*, *Advanced Functional Materials* **18**, 1-7 (2008).
- 14) Optical properties of single InP and GaAs nanowire heterostructures, *HE Jackson, S Perera, MA Fickenscher, LM Smith, JM Yarrison-Rice, HJ Joyce, Q Gao, HH Tan, C Jagadish, X Zhang, J Zou*, *IEEE Lasers and Electro-Optics Society*, 2008. 10.1109/LEOS.2008.4688673
- 15) Nearly intrinsic lifetimes in twin-free GaAs/AlGaAs core-shell nanowire heterostructures, *S. Perera, M.A. Fickenscher, H.E. Jackson, L.M. Smith, J.M. Yarrison-Rice, H.J. Joyce, Q. Gao, H.H. Tan, C. Jagadish, X. Zhang, and J. Zou*, *Applied Physics Letters* **93**, 053110 (2008).
- 16) Growth, structural and optical properties of high quality GaAs nanowires for optoelectronics, *H. J. Joyce, G. Qiang, K. Yong, H. H. Tan, C. Jagadish, Z. Xin, G. Yanan, Z. Jin, M. A. Fickenscher, S. Perera, T. B. Hoang, L. M. Smith, H. E. Jackson, J.M. Yarrison-Rice.*, 2008 8th IEEE Conference on Nanotechnology (NANO), pp59-62.
- 17) Photoluminescence Dynamics of GaAs/AlGaAs Core-Shell Nanowires, *HJ Joyce, Y Kim, Q Gao, HH Tan, C Jagadish, MA Fickenscher, S Perera, TB Hoang, HE Jackson, LM Smith, JM Yarrison-Rice, X Zhang, J Zou*, *Bulletin of the American Physical Society 2008 APS March Meeting Volume 53, Number 2*
- 18) Investigation of the Electronic Structure of GaAs/AlGaAs Core Multi-Shell Nanowires, *S Perera, MA Fickenscher, TB Hoang, HE Jackson, LM Smith, JM*

#### PRESENTATIONS/POSTERS/WORKSHOPS

- 1) Poster: Variation of electric potential in a semiconducting hetero-structure placed in an external electric field, 11<sup>th</sup> Academic Sessions-2014, University of Ruhuna, Matara.
- 2) Seminar on Nanotechnology for National development conducted by National Academy of Sciences of Sri Lanka held on 5<sup>th</sup> April 2013 at Sri Lanka Foundation Institute Colombo, Sri Lanka.
- 3) Participated in Advanced Workshop on Thin Film Solar Cells; Their Science, Fabrication and Characterization (19-21 March 2013) at University of Ruhuna, Matara, Sri Lanka.
- 4) Workshop: Participated in Modeling Instruction Workshop (A pedagogical approach to teaching that focuses on model development and testing) conducted by Dr. Eric Brewe. Held in department of physics, University of Cincinnati 05/01/2012.
- 5) Poster: Investigation of Electronic band Structure in wurtzite InP nanowires, 2012 MRS April meeting held in San Francisco, California.
- 6) Investigation of the Electronic Structure of wurtzite InP nanowires Contributed talk American Physical Society (APS) March meeting 2011 held in Dallas, Texas.
- 7) Poster: Investigation of valence band structure in wurtzite InP nanowires using polarized excitation spectroscopy, 2011 Poster forum university of Cincinnati graduate school.
- 8) Variation of wurtzite InP nanowire photoluminescence with diameter, Contributed talk American Physical Society (APS) March meeting 2010 held in Portland, Oregon.
- 9) Poster: Wurtzite InP nanowires – Variation of Photoluminescence with diameter, 2010 Poster forum university of Cincinnati graduate school.
- 10) Poster: Polarization Dynamics of twin-free GaAs/AlGaAs Core-Shell Nanowires for the Ohio Innovation Summit (April 20-23), 2009 held at Dayton Convention Center, Dayton.
- 11) Polarization Dynamics in twin-free GaAs/AlGaAs Core-Shell Nanowires, contributed talk, American Physical Society (APS) March meeting 2009 held in Pittsburgh, Pennsylvania.
- 12) Poster: Photoluminescence dynamics of GaAs/AlGaAs core-shell nanowires Ohio Nanotechnology Summit (April 09-11) 2008.
- 13) Photoluminescence dynamics of GaAs/AlGaAs core-shell nanowires, contributed talk, APS March meeting 2008, New Orleans, Louisiana.

#### EXTRA CURRICULAR ACTIVITES

- 1) Student Counselor - (2013-Up to date)
- 2) RISTCON 2014- Committee member
- 3) Science Faculty Day-2014 -Committee member
- 4) Invention and Innovation Exhibition 2014 -Chair person

## REFERENCES

- **W.G.D. Dharmaratne**  
Professor of Physics,  
Department of Physics University  
of Ruhuna  
Matara.  
**Tel.** 94-71-4500377  
**email:** [dharmad@phy.ruh.ac.lk](mailto:dharmad@phy.ruh.ac.lk)
- **K.K.A.S. Yapa**  
Professor of Physics,  
Department of Physics University  
of Ruhuna  
Matara.  
**email:** [kanthiy@phy.ruh.ac.lk](mailto:kanthiy@phy.ruh.ac.lk)
- **Dr. G.D.K. Mahanama**  
Senior Lecturer in Physics/  
Head/Department of Physics,  
University of Ruhuna  
Matara.  
**email:** [mahanamad@phy.ruh.ac.lk](mailto:mahanamad@phy.ruh.ac.lk)
- **Leigh M. Smith**  
Professor of Physics,  
University of Cincinnati, 424  
Geo-Physics Building, OH- 45221  
**Tel.** 513-556-0457  
**email:** [leigh.smith@uc.edu](mailto:leigh.smith@uc.edu)
- **Howard Jackson**  
Professor of Physics,  
University of Cincinnati, 424  
Geo-Physics Building, OH- 45221  
**Tel.** 513-556-0522  
**email:** [howard.jackson@uc.edu](mailto:howard.jackson@uc.edu)
- **Jan Yarrison-Rice**  
Professor of Physics  
Miami University, Department of  
Physics, Oxford, OH-45056  
**Tel.** 513-529-1862  
**email:** [yarrisjm@muohio.edu](mailto:yarrisjm@muohio.edu)
- **David B Mast**  
Professor of Physics  
University of Cincinnati, 402  
Geology-Physics Building, OH-  
45221  
**Tel.** 513-556-0548  
**email:** [david.mast@uc.edu](mailto:david.mast@uc.edu)