



FACULTY OF COMPUTING HEALTH AND SCIENCE

ELECTRON SCIENCE RESEARCH INSTITUTE LEVEL III RESEARCH INSTITUTE

ANNUAL REPORT 2010

Brief Overview

The past year has been a very challenging and successful in the development of the Electron Science Research Institute (ESRI) owing to the dedication and commitment of ESRI's staff and students to world-class research.

ESRI's R&D infrastructure is expanded to include a state-of-the-art Atomic Force Microscope (AFM) that is being used to characterize nanostructures fabricated by ESRI's nanofabrication facility. Our R&D capabilities in photonics and electronics and world-class competence in Nano-engineered material design and fabrication have enabled the development of several innovations that have commercialisation potential and attracted a new R&D contract with Tropiglas for the development of advanced materials that can be integrated onto transparent window glass panels to convert only the energy from the infrared (IR) part of solar spectrum to electric energy.

In 2010, ESRI filed three provisional patents and published 10 high-impact papers in international journals in micro- and nano-photonics and 23 international conference papers.

In addition, ESRI won \$418k ARC Linkage grant with PDS Pty Ltd for the development of weed sensor prototypes; a \$310k R&D grant with the Department of Attorney General for the development of multi-laser DVD pickup unit; two Nortel grants and an ECU-industry collaboration grant. Furthermore, ESRI submitted an ARC Linkage Project grant application with YTEL Photonics-Korea.

ESRI expanded its international network by appointing an adjunct professor. Also, three postgraduate students and four research staff members visited Korea and China for training and collaboration on Nano/MicroPhotonics and cleanroom operation. ESRI is establishing new collaboration with Prof Mazen Khaled, King Fahd University of Petroleum and Minerals (KFUPM), on nano-porous materials using layer-by-layer technology and nanofilms and coatings for anticorrosion and antibacterial applications.

List of ESRI Members 2010

Title	Name	Qualifications	Role
Prof	Kamal Alameh	PhD, MEngSc, BEngSc	Director
Prof	Yong Tak Lee Gwangju Institute of Science and Technology, S Korea	PhD, MEngSc, BEngSc	Adjunct Professor
Prof	Khalid Al-Begain, Glamorgan Uni, Wales, UK	PhD, MEngSc, BEngSc	Adjunct Professor
Prof	Feijun Song China Daheng Group	PhD	Adjunct Professor
Prof	Clifton Smith	PhD	Adjunct Professor
A/Prof	Volodymyr Lysak	PhD	Adjunct Professor
Dr	Fred Reinholz, Lions Eye Institute	PhD, MEngSc, BEngSc	Adjunct A/Professor
Prof	Peter Hannaford Swinburne Uni, Vic	PhD, MSc, BSc	Adjunct Professor
Prof Dr-Ing	Zhi –Gong Wang, Southeast Uni, Nanjing China	PhD	Adjunct Professor
Dr	Seong-Min Ma Inha University, S Korea	PhD, MSc, BSc	Adjunct Snr Lecturer
Mrs	Linda Arthur		Admin Officer
Mrs	Beverley McKinnon		Admin Assistant
Dr	Mikhail Vasiliev	PhD, MEngSc, BEngSc	Research Fellow
Dr	Sreten Askraba	PhD, BEngSc	Research Fellow
Dr	Narottam Das	PhD, MScEng, BSEng	Research Fellow
Dr	Hoang Nguyen	PhD, MEng, BEng	Research Fellow
Dr	Feng Xiao	MEngSc, BEngSc	Research Fellow
Mr	Budi Juswardy	MEng, BEng	Post Doc/PhD
Mr	Arie Paap	BEngSc (Honours)	Post Doc/PhD
Mr	Ahmed Abdelrahman	MSc, BSc	PhD Student
Mr	Ayman Karar	MSc, BSc	PhD Student
Mr	Ingo Lösch	MEng, BEng	PhD Student
Mr	Haithem Mustafa	MSc, BSc	PhD Student
Mr	Mohammad Nur E Alam	MEng, BEng	PhD Student
Ms	Valentina Tiporlini	MEng, BEng	PhD Student
Mrs	Kavitha Venkatarayanan	MSc, BSc	PhD Student
Mr	David Michel	BSc	MSc Student
Mrs	Nazme Moushoumy	BSc	MSc Student

HIGHER DEGREE BY RESEARCH LOAD

Mr	Budi Juswardy	Post Doc/PhD
Mr	Arie Paap	Post Doc/PhD
Mr	Ahmed Abdelrahman	PhD Student
Mr	Ayman Karar	PhD Student
Mr	Ingo Lösch	PhD Student
Mr	Haithem Mustafa	PhD Student
Mr	Mohammad Nur E Alam	PhD Student
Ms	Valentina Tiporlini	PhD Student
Mrs	Kavitha Venkatarayan	PhD Student
Mr	David Michel	MSc Student
Mrs	Nazme Moushoumy	MSc Student

HIGHER DEGREE BY RESEARCH COMPLETIONS

Budi Juswardy PhD Integrated MicroPhotonic
 Beamformer for Adaptive Nulling in Smart Antennas

ESRI's Research Grants awarded in 2010

		CI	Year	\$'000
ARC Development of Pre-Production Prototype weed control system	ARC/PDS Pty Ltd /	K Alameh S Askraba	10-13	418
Centre of Excellence for Radio Astronomy	CoE with Curtin University	K Alameh	10	36
Transceiver Array for Optical media	Attorney General/ECU	K Alameh	10-11	310
Manufacture & characterisation of Novel Diffusion	Ytel Photonics Inc/ECU Ind Collab	M Vasiliev K Alameh	10	30
Design & Development of High Speed MSM	Nortel Networks	N Das K Alameh	10-11	23
Advanced Fibre-Optics Sensors and Network Architecture for Real-Time Monitoring in Desalination	Nortel Networks	L Nguyen K Alameh	10-11	23
RIBG to purchase Atomic Force Microscope in conjunction with School of Engineering	FCHS/RIBG	K Alameh Z Xie	10	165
RAI 2009 Income rec'd in 2010	ECU	ESRI	10	20
	TOTAL			\$1,025k

ESRI's Collaboration

- Centre for Micro-Photonics, Swinburne University: fabrication and characterisation of Nano-Photonic structures.
- Gwangju Institute of Science and Technology (GIST), Korea: Vertical cavity surface emitting laser array and photodiode fabrication, Nano-engineered magneto-photonic crystal sputtering, and integrated photonic structure fabrication.
- Hanyang University: Development of Magneto-Photonic crystals using femto-second lasers.
- Chonnum University, Korea: Planar lightwave circuits and fibre Bragg gratings
- Mobile Computing, Communications and Networking Research Group, University of Glamorgan – Wales, UK: RF photonics.
- Institute of Optics and Electronics (IOE) – China: Adaptive optics for retina imaging, micro-optic fabrication.
- Condensed Matter Physics Group, KTH Royal Institute of Technology, Sweden: Magneto-Photonic crystal fabrication.
- Department of Physics, Michigan Technological University, USA: Planar Magneto-Photonic fabrication.
- Institute of MicroTechnology (IMT), Russia: NanoPhotonics.
- Southeast University, Nanjing– China: High-speed drivers for optical interconnects.
- PDS Pty Ltd., Weed sensing.
- Korea Optron Corporation: Optical interconnects.
- YTEL-Photonics, Korea: development of optical interconnects, tunable lasers, and integrated optical transceivers
- China Daheng Group, China: Weed sensor prototype development and Near Infrared Breast Scanning (NIBS).
- Korea Research Institute of Standards and Science (KRISS): Magnetocardiography
- Lebanese University: Nanotechnology

ESRI Visits

Organisation	Visit to	Date	Nature of Visit
Gwangju Institute of Science & Technology (GIST)	S Korea	19 April – 28 May 10 13 Jun – 2 Sept 10	PhD student A Karar visited for training and collaboration on NanoPhotonics PhD student A Abdelrahman visited for training and collaboration on quantum signal processing
Korea Research Institute of Standards and Science (KRISS)	S Korea	13 June-2 Sept 10	PhD student V Tiporlini visited KRISS for training and collaboration on magnetocardiography
Gwangju Institute of Science and Technology	S Korea	Oct-10	Advancing ARC project on High Speed Bidirectional Optical Interconnects, Prof K Alameh had discussions with KOC-OPTRON on the development of board-to-board optical interconnects
Gwangju Institute of Science and Technology	S Korea	Nov-10	Dr L Nguyen collaborating with GIST on development of optical fibre sensors
7th International Symposium on High Capacity Optical Networks & Enabling Technologies	Egypt	Dec-10	Prof K Alameh presented 10 papers at the HONET conference.
China Daheng & Minzu Uni	China	Dec10	Prof K Alameh visited Beijing for discussions on the formation of a joint International R & D Centre in Beijing
NANO 2010	India	Dec-10	Prof K Alameh presented two papers at the NANO 2010 conference in India, both papers have been invited for publication in the IUPAC Journal
3rd International Workshop on Water Desalination	S Korea	Nov-10	Prof K Alameh and Dr L Nguyen presented paper at the International workshop on Water Desalination
China Daheng Group KRISS	China S Korea	Aug -10	Prof Alameh: Collaboration on the development of weed sensor prototype and DVD multilaser head. Also, visit KRISS-Korea and assisted PhD student V Tiporlini on foetal sound monitoring project while she was working at KRISS.
China Daheng Group	China	Aug-10	Dr Sreten Askraha accompanied Prof Alameh on meetings with developers at China Daheng regarding the weed sensor prototype development and testing.
Shanghai University, Southeast University and China Daheng Group	China	June-10	Prof Alameh working with China Daheng Group on improvements to the Near Infrared Breast Scanner. Meetings on establishment of International Research and Development Centre.
Shanghai Jiao Tong University	China	June-10	Dr F Xiao visited for collaboration on optical telecommunications

Southeast University	China	June-10	Dr F Xiao visited for collaboration on high speed optical interconnects
Korean Optron Corp	S Korea	Apr-10	Prof Alameh visited in relation to the ARC project
Gwangju Institute of Science & Technology	S Korea	Apr-10	Prof Alameh visited GIST working in the cleanroom and training PhD student A Karar.
Gwangju Institute of Science & Technology	S Korea	Jan-10	Prof Alameh - collaborating on NIBS, Optical Interconnects and ARC linkage project discussions
National Trips			
Melbourne University	Melbourne	July-10	Prof Alameh working with Melbourne University on FTTP CRC bid and meeting with new investors regarding possible funding for Optical Interconnects project
Arabic Heritage League	Sydney	April-10	Prof Alameh was presented with the Gibran International Award.
CSIRO	Sydney	Mar-10	Prof Alameh met with CSIRO and CEO of CRC re improving the FTTP CRC bid by including the CSIRO
DOIR	Melbourne	Feb-10	Prof Alameh attended information session on 13 th CRC program selection round
<u>Visitors</u>			
Prof V Kotov	Russia	24 Jul-22 Aug 10	From the Institute of Radio Engineering and Electronics, Russian Academy of science, Moscow visited for collaboration on Magneto-optics.
Dr Fouad Karouta	ANFF/ANU		Collaboration on nanophotonics and assistance with ESRI's cleanroom design

Community Engagement Activities and Linkages

- Prof Alameh: Lead Editor, Special Issue on Reconfigurable Photonics, Journal of Advances in Optical Technologies, Hindawi Publishers, 2010-2011.
- Prof Alameh: Advisory Committee member, International Conference on Nanomaterial and Nanotechnology (NANO 2010), Tamil Nadu, India, 13-16 December 2010.
- Prof Alameh: International Advisory Board member, 5th International Symposium on Macro- and Supramolecular Architectures and Materials (MAM-10): New Science and Technologies for the Improvement of Human Living Standards, Jamaica, West Indies, 16-21 August 2010.
- Prof Alameh: Program Committee, 2nd International Symposium on Peer Reviewing: ISPR 2010, Orlando, Florida, USA, June 29th - July 2nd, 2010.
- Dr F Xiao: Reviewer for Optics letters, IEEE Journal of lightwave technology, IEEE photonic technology letter, Journal of optical society of American A, Applied optics, Optics and Quantum Electronics, and a book from Bentham Science Publishers.
- Dr. L Nguyen: Reviewer for IEEE Photonics Technology Letters, Optics Letters and Journal of Modern Optics
- Dr Sreten Askraba: Reviewer for Optics Express.
- The ESRI team is working closely with the team at GIST and China Daheng Group on several projects including the Optical Interconnects spin-out company, the development of 3-wavelength light sources for the near infrared breast scanner (NIBS), the development of Opto-VLSI processors for tunable lasers.
- Training: Three PhD students visited S Korea for collaboration and training
- Linkages with WA industries: PDS, Tropiglas, on product development and characterisation.
- CRC: Working on partnerships to put forward a bid.
- Linkages with overseas industries: KOC-optron, China Daheng Group, and YTEL-Photonics, on prototype development and characterisation.

Future Plans and Directions

- ESRI is expanding its Micro-NanoPhotonics applications into research areas of national and global priority such as Green Energy (solar cells), National Broadband Networking (opto-electronic system on a chip for Fibre-To-The-Home), Bio-technology (near infrared breast scanning and thin films), Environmental Sensing and Monitoring (water sensors, weed sensors), and Security and Defence (laser arrays and laser pickup). This will increase ESRI's high-impact publications and IP generation and create opportunities for new collaboration with world-class institutions and organisations.
- ESRI submitted an ARC Linkage project application with YTEL Photonics-Korea based on a joint IP. If successful, this project will enable the development of a multiport tunable laser prototype.
- ESRI will submit an ARC Linkage project application with Tropiglas and two ECR Discovery project applications.
- ESRI attracted a new R&D contract with Tropiglas. This will be followed with a Commercialisation Australia grant and an ARC Linkage grant application.

- ESRI is sourcing equipment for the cleanroom in the new CET building.
- ESRI is developing a business plan for a new Centre of Excellence for Advanced Nano-Photonics (CAN), which will be submitted once a new round of CoE is announced.
- ESRI is working with ORI to prototype ECU/GIST's Optical Interconnects and to establish ECU's first Spin-out company.

PATENTS 2010

1. Alameh, K. and Vasiliev, M., "METHOD AND APPARATUS FOR CHARACTERISING A FILM ON A SUBSTRATE", Australian Provisional Patent Application No. 2010900639, 2010.
2. Alameh, K. and Nguyen, L., "An Optical Sensor for Measuring a Property of a Fluid", Provisional, 2010.
3. Alameh, K., "A device for transmission of data between the device and an optical data storage medium", Provisional, 2010.

Publications 2010

Journals

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2. Mustafa, H.; Xiao, F. Alameh, K., "Adaptive optical splitter employing an Opto-VLSI processor and a 4-f imaging system", Journal Lightwave Technology, vol. 28, pp.2761 – 2765, 2010.
3. A. Abdelrahman, M. Vasiliev, K. Alameh, et al., "Asymmetrical two-dimensional magnetic lattices for ultracold atoms", Phys. Rev. A 82, 012320 (2010).
4. Kavitha Venkatarayanan, Sreten Askraba, Kamal Alameh, and Clifton L. Smith, "Photonic-based multi-wavelength sensor for object identification", Optics Express, Vol. 18, Issue 4, pp. 3774-3783 (2010).
5. Feng Xiao and Kamal Alameh, "Adaptive multi/demultiplexers for optical signals with arbitrary wavelength spacing", Optics Express, Vol. 18, Issue 12, pp. 12277-12282 (2010).
6. Mohammad Nur-E- Alam, Mikhail Vasiliev and Kamal Alameh, "Nano-structured magnetic photonic crystals for magneto-optic polarization controllers at the communication-band wavelengths", Online, Optics and Quantum Electronics Letters, Feb. 2010.
7. Sooraj Ravindran, Kamal Alameh and Yong Tak Lee, "Design and analysis of electroabsorptive quantum well based double ring resonators for wavelength switching applications", Online, Optics and Quantum Electronics Letters, Feb. 2010.
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CONFERENCE PAPERS 2010

11. M. Vasiliev, Nur-E-Alam, V.A. Kotov and K. Alameh, "High-Performance Thin-Film Garnet Materials for MagnetoOptic and Nanophotonic Applications", COMMAD, Canberra, 2010.
12. Alameh, K., Nguyen, L.V., Nguyen, H.N., Xiao, f., and Vasiliev, M., "Fiber-optic sensor network for real-time water-quality and temperature monitoring", In proceedings, 3rd International Workshop on water Desalination, Jeju-Korea, 2010.
13. Khurram, Naeem, Nguyen, Linh Viet, Alameh, Kamal, Chung, Youngjoo, "Cladding Modes Analysis of Photonics Crystal Fiber for Refractive Index Sensors Using Finite Element Method", In proceedings, Conference on Lasers and Electro-Optics (CLEO) and Quantum Electronics and Laser Science Conference (QELS), San Jose, CA, USA, 2010.
14. Mikhail Vasiliev, Mohammad Nur-E-Alam, Viacheslav Kotov and Kamal Alameh, "The Properties of Nanocomposite (BiDy)₃(FeGa)₅O₁₂:Bi₂O₃ Magneto-optic Garnet Films for Applications in Nanophotonics, Ultrafast Switching and Integrated Optoelectronics", In proceedings 7th International Symposium on High Capacity Optical Networks & Enabling Technologies (HONET-2010), Cairo, Egypt, December 19-21, 2010.
15. Kavitha Venkatarayan^{1*}, Sreten Askra¹, Kamal E. Alameh¹ and Clifton L. Smith, "Multi-Wavelength Laser Scanning Architecture for Object Discrimination", In proceedings 7th International Symposium on High Capacity Optical Networks & Enabling Technologies (HONET-2010), Cairo, Egypt, December 19-21, 2010.
16. Mohammad Nur-E-Alam, Mikhail Vasiliev, Viacheslav Kotov and Kamal Alameh, "High-quality RF-sputtered Magneto-optic Garnet Films of Bi_{1.8}Lu_{1.2}Fe_{3.6}Al_{1.4}O₁₂ with Low Coercivity for Applications in Integrated Optics Imaging and Sensing Devices", In proceedings 7th International Symposium on High Capacity Optical Networks & Enabling Technologies (HONET-2010), Cairo, Egypt, December 19-21, 2010.
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- Performance Optical Networks”, In proceedings, 9th International Conference on Optical Internet (COIN) 2010, TuB2-2, Jeju-Korea.
25. Kotov, V.A., Burkov, V.I., Vasiliev, M., Alameh, K., Balabanov, D.E., Sharov, V.G., Kaledov, V.V., “RF sputtered ultrathin iron garnet films on glass substrates: Transitional layers,” In proceedings, International Conference on Crystal Materials (ICCM’2010), Kharkov, Ukraine, pp. 177, 2010.
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 32. Vasiliev, M., Alameh, K., Balabanov, D. E., Burkov, V. I., Koledov, V. V., Kotov, V. A., Shavrov, V. G., Zvezdin, A. K., “Technological challenges of 1-Dimensional magnetic photonic crystals”, In proceedings, META’10 2nd International Conf. on Metamaterials, Photonic Crystals and Plasmonics, Cairo, 2010.
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Next Five Year Review due in 2013