
10 years of fostering
research in photonics
Annual Report
08
09
ICIP
CIPI
YEAR ANNIVERSARY

Acknowledgements

CIPI gratefully acknowledges the support of its Host Institution and Premier Affiliates.

Host institution

UNIVERSITÉ LAVAL

2008-2009 Premier Affiliate Members

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BTI Systems
COPL Centre d'optique, photonique et laser
CHRISTIE
CorActive Specialty Optical Fiber Manufacturer
EXFO Expertise Reaching Out
Lilly
FOX-TEK
GroupIV Semiconductor
Honeywell
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CORE Circle of Research Excellence
IGNIS
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KOTURA
MDS Science advancing health
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MONTECO
neoptix Fiber Optic Temperature Sensors
NRC·CNRC
NRC·CNRC Institute for Fuel Cell Innovation
Canadian Photonics Fabrication Centre
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Ontario Centres of Excellence Where Real Happens
OAML
OAML Ontario Association of Medical Laboratories
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Networks of Centres of Excellence

CIPI is part of the Networks of Centres of Excellence Program, an initiative of the Natural Sciences and Engineering Research Council of Canada, the Canadian Institutes of Health Research, the Social Sciences and Humanities Research Council of Canada and Industry Canada.

ICIP
CIPI

Institut canadien pour les **innovations** en **photonique**
Canadian Institute for **Photonic Innovations**

The mission of ICIP/CIPI is to bring university researchers together with public sector and industrial partners in a network with state-of-the-art facilities in order to stimulate innovations in photonics and promote their exploitation to generate wealth and enhance the quality of life for Canadians.

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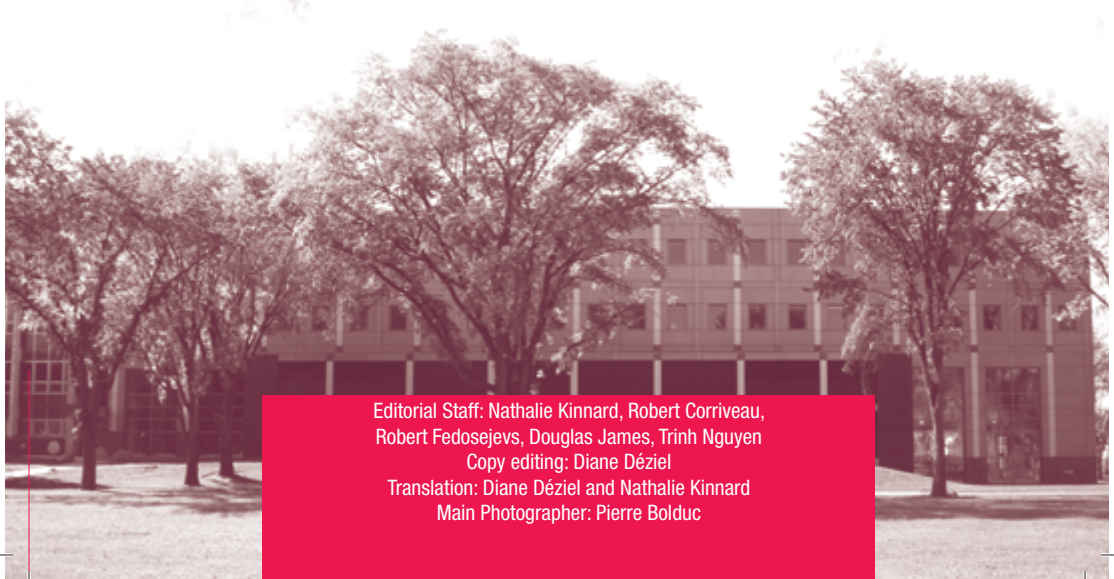

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Message from the Chair of the Board of Directors

As Chair of the Board of Directors of the Canadian Institute for Photonic Innovations, it is my pleasure to present the annual report on our 2008-2009 operations.

CIPI was successful in its final mid-term review, presenting to the Expert Panel a strong image and an excellent value proposition. The independent external review of the impact of CIPI, the views of our International Research Vision Committee, and the hard work and commitment of the team making our presentation were important factors. The Board now is increasingly focused on ensuring CIPI's legacy beyond 2012.

The Technology Exploitation and Networking (TEN) program and the Innovative Photonics Applications (IPA) program continue to attract interesting proposals with the TEN program being oversubscribed at each competition. "Non-photonics" companies increasingly view our Innovative Photonics Applications program (IPA) as an opportunity to capitalize on photonic technologies.

I would like to thank everyone in CIPI for their many contributions to the success of the organization: the President, Scientific Director and Deputy Scientific Director who provide strong leadership, the Thrust Leaders, the Research Program Committee, the International Research Vision Committee, the CIPI staff, the researchers and students, the executive of CIPI-S and my colleagues on the Board and its committees.

Douglas J. James
Chair of the Board of Directors

Message from the President

In its tenth year of existence, CIPI has continued to be very active and to significantly contribute to the growth of the industry through many collaborative projects with university researchers. We have completed 14 research projects, and initiated 4 innovative photonic application projects and 34 colaboration/technology exploitation projects. Two new spinoffs, Incise Photonics and Lenolux, were created and 17 new patents were filed by CIPI researchers. We have financially supported 114 researchers from 19 universities, and contributed to the training of 190 highly qualified personnel including 167 students at master's or doctoral levels. 52% of the new graduates were hired by the industry.

This year, more than 75 affiliates contributed to our projects, accounting for 86% of CIPI investments in research, an increase of 25% from last year. This is a good demonstration of the relevance of our programs.

With its funding renewed until 2012, CIPI will continue to be at the forefront of photonic technology development by fostering novel applications of photonics and demonstrating the strategic importance of photonics for the Canadian economy.

Many thanks to the members of the Board, the Scientific Director and his Deputy, the CIPI researchers and the CIPI staff for their highly valued support.

Robert Corriveau
President and C.E.O.

Message from the Scientific Director

The past year has been a time for re-evaluation and redirection of the research program for the final three year phase of CIPI. A call for proposals for the final funding phase led to the development of a focussed research program of 8 targeted research projects in 4 thrust areas; the Frontier Photonics thrust area was expanded to a new area in Applied Photonics. The current and new research programs were highly rated by the Research Vision Committee and in the midterm review assessment.

In 2008-2009, there has been continued progress in developing next generation therapies and diagnostics. The project on two-photon photodynamic therapy for treatment of age related macular degeneracy, a major cause of blindness in the elderly, will continue for the next three years in order to bring the technique to the clinical trial stage. Advances in lasers and more sophisticated scanning techniques have led to real time scanning of tissue using OCT tomography. Also, microfluidic systems have been developed for analysis of cell contents using a combination of advanced diagnostic techniques such as fiber cavity ring down spectroscopy, surface plasmon resonance and surface enhanced Raman spectroscopy.

More advanced fibre laser and sensor systems based on novel materials and microstructured fibres have been developed over the past year which will continue into the new research program. Canada has considerable strength in the fabrication of specialty plastic, microstructured and infrared fibres, which CIPI is helping to exploit. The CIPI Frontier Photonics attosecond science project continues to garner international recognition and members of the research group won prestigious prizes in the past year, a tribute to the leading edge research that CIPI is helping to fund in Canada.

In the Information and Telecommunications sector, CIPI recognized very early on the importance of photonic systems on silicon platforms and is committed to continued support in this area. Many big name players such as Intel are now becoming active in this field where Canada is recognized for some of its leading research. Large scale tests were successfully carried out on dark fibre networks of optical packet switching by groups at Laval and McGill Universities, research which will continue with a focus on localized high capacity data networks.

Message from the Scientific Director

The research program has given Canada a competitive advantage in many areas of application of light, lasers and optical detection. A number of these developments have been featured in the PHOTONS journal published by CIPI, which enjoys a growing lay readership. Many are leading to technology transfer to industry via projects under the TEN program as photonic researchers develop new linkages to commercial and non-academic end users. New opportunities for high impact research are also being stimulated by the Innovative Photonic Applications (IPA) program, which is designed to meet the needs of leading Canadian industries to improve competitiveness and profitability through the application of optical technologies.

The researchers of CIPI are to be commended for their dedication and hard work in meeting the challenging milestones before them. I congratulate them for having made CIPI so successful over the past 10 years. Thanks should also be given to the Thrust leaders, Réal Vallée from Université Laval, Brian Wilson from the University of Toronto and Paul Jessop from McMaster University for their visionary leadership. Likewise, we must acknowledge the contribution of the members of the Research Program Committee and the International Research Vision Committee. Their guidance and insight have been essential in helping the network chart its course into the future. Finally, I would like to express my gratitude to the Deputy Scientific Director, Michel Piché, for his excellent advice and support in ensuring that we have the highest quality research program possible.

Robert Fedosejevs
Scientific Director

Research Program by thrusts

BIOPHOTONICS

BRIAN C. WILSON Thrust Leader, *University of Toronto*

BP1: Lab-on-a-chip for live-cell analysis

Project Leader: Peter Norton, *University of Western Ontario*
David T. Cramb, *University of Calgary* - Stephen Ferguson, *University of Western Ontario* - Cécile Fradin, *McMaster University* - Linda Johnston, *University of Western Ontario*

BP2: Advanced technologies for single cell content analysis

Project Leader: Peter Herman, *University of Toronto*
Christopher J. Backhouse, *University of Alberta* - Robert Fedosejevs, *University of Alberta* - Karan Kaler, *University of Calgary* - Lothar Lilge, *Ontario Cancer Institute* - Hans-Peter Loock, *Queen's University* - Jim McMullin, *University of Alberta* - Michel Meunier, *École Polytechnique de Montréal*

BP3: Two-photon excitation photodynamic therapy (TPE-PDT)

Project Leader: David Cramb, *University of Calgary*
Christine Allen, *University of Toronto* - Miguel Burnier, *McGill University* - Melanie Campbell, *University of Waterloo* - Daniel Houde, *Université de Sherbrooke* - Michael S. Patterson, *McMaster University* - Brian C. Wilson, *University of Toronto*

BP4: Integration of digital micromirror devices with confocal MACROscopy for improved genetic microarray reading and tissue imaging

Project Leader: Brian C. Wilson, *University of Toronto/University Health Network*
Calum MacAulay, *University of British Columbia* - Tze-Wei Yeow, *University of Waterloo*

Research Program by thrusts

BP5: Biophotonic systems using high resolution and diversity imaging

Project Leader: Romain Maciejko, *École Polytechnique de Montréal*
José Azaña, *INRS-EMT* - Michel Bertrand, *École Polytechnique de Montréal* - Lawrence R. Chen, *McGill University* - Raman Kashyap, *École Polytechnique de Montréal* - Michel Piché, *Université Laval*

BP6: Improved femtosecond laser-based approaches for cellular imaging in live tissue

Project Leader: Yves De Koninck, *Université Laval*
See Leang Chin, *Université Laval* - Daniel Côté, *Université Laval* - Paul De Koninck, *Université Laval* - Nathalie McCarthy, *Université Laval* - Michel Piché, *Université Laval* - Paul Wiseman, *McGill University*

FRONTIER PHOTONICS

RÉAL VALLÉE Thrust Leader, *Université Laval*

FP1: Attosecond X-ray imaging

Project Leader: Paul Corkum, *University of Ottawa*
André Bandrauk, *Université de Sherbrooke* - Thomas Brabec, *University of Ottawa* - Jean-Claude Kieffer, *INRS – EMT*

FP2: Generation, amplification and manipulation of femtosecond laser pulses

Project Leader: Michel Piché, *Université Laval*
Harold K. Haugen, *McMaster University* - Nathalie McCarthy, *Université Laval* - R. J. Dwayne Miller, *University of Toronto* - Donna Strickland, *University of Waterloo*

FP3: Specialty optical fiber components for biomedical applications

Project Leader: Réal Vallée, *Université Laval*
Xiaoyi Bao, *University of Ottawa* - Tigran Galstian, *Université Laval* - Jérôme Genest, *Université Laval* - Nicolas Godbout, *École Polytechnique de Montréal* - Suzanne Lacroix, *École Polytechnique de Montréal* - Yunlong Sheng, U*niversité Laval* - Maksim Skorobogatiy, *École Polytechnique de Montréal*

FP4: Development of nanostructures for light emitting and detecting devices

Project Leader: Harry E. Ruda, *University of Toronto*
Harold K. Haugen, *McMaster University* - Frank A. Hegmann, *University of Alberta* - Karen L. Kavanagh, *Simon Fraser University* - John C. Polanyi, *University of Toronto* - Kevin Robbie, *Queen's University*

FP5: Nanoprecision materials processing for biophotonic, sensing and telecom applications

Project Leader: Robert Fedosejevs, *University of Alberta*
See Leang Chin, *Université Laval* - Peter Herman, *University of Toronto* - Robin S. Marjoribanks, *University of Toronto* - Ying Y. Tsui, *University of Alberta* - Réal Vallée, *Université Laval*

INFORMATION AND TELECOMMUNICATIONS

PAUL JESSOP Thrust Leader, *McMaster University*

IT2: Packet-switched networks with photonic code-based processing

Project Leader: Sophie La Rochelle, *Université Laval*
Lawrence R. Chen, *McGill University* - Alberto Leon-Garcia, *University of Toronto* - David V. Plant, *McGill University* - Leslie A. Rusch, *Université Laval*

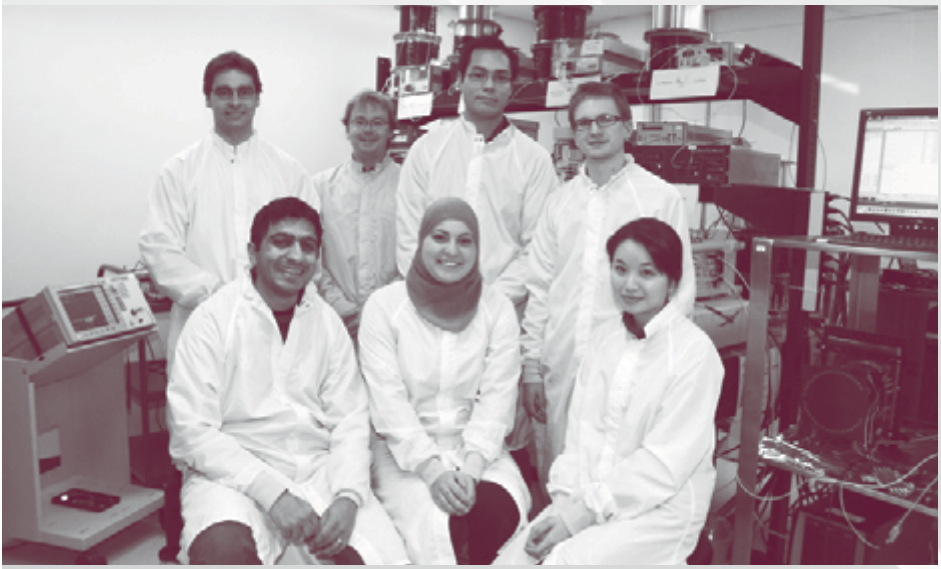
IT3: Scalable absolutely secure optical fibre networks using quantum cryptography

Project Leader: Nicolas Godbout, *École Polytechnique de Montréal*
Brian E. King, *McMaster University* - Raymond Laflamme, *University of Waterloo* - Hoi-Kwong Lo, *University of Toronto* - Amir Majedi, *University of Waterloo* - Aephraim M. Steinberg, *University of Toronto* - Robin Williams, *University of Toronto*

IT4: Silicon-based photonic microsystems

Project Leader: Paul Jessop, *McMaster University*
Robert Gauthier, *Carleton University* - Siegfried Janz, *Carleton University* - Rafael Kleiman, *McMaster University* - Andrew Knights, *McMaster University* - Peter Mascher, *McMaster University* - Tom J. Smy, *Carleton University* - Robert Tait, *Carleton University* - Garry Tarr, *Carleton University* - Dan-Xia Xu, *Carleton University* - David O. Yevick, *University of Waterloo*

Note : Project IT1 Integrated optical transceivers for optical access networks has been terminated in 2007-2008.



Laval and McGill research teams working on optical packet transmission on a 640 km testbed at the COPL laboratories at U. Laval that mimics the RISQ network. Front row: Bhavin Shastri, Yousra Ben M'Sallem, Ming Zeng. Back row: Serge Doucet, Philippe Chrétien, Jeffrey Johnson and Nick Zicha. Collaborating researchers: L. Chen, S. LaRochelle, L. A. Rusch and D. V. Plant. Credits: Sophie LaRochelle

TEN and IPA programs

The TEN program brings together researchers, students and industrial partners to work on a project seeking short term applications, with high commercialization potential.

The IPA program brings together researchers, students, a photonic industrial partner and another "non photonic" partner looking for a short term photonic solution.

According to a recent survey of the completed projects:

- 96% were successful;
- 12% resulted in the development of new products;
- 45% need more development;
- 35% need more research;
- 63% are expected to result in sales for the industrial partner;
- 12% should result in sales of more than $5M.

TEN program – new collaboration grants

Axel Guenther, **U. Toronto,** and **Xceed Molecular**: Optofluidic Chemiluminescent Microarrays for Automated Gene Expression Analysis

Chang-Qing Xu, **McMaster U.,** and **Christie Digital**: Development of RBG Light Engine for Laser Projection

Daniel Côté, **U. Laval,** and **Wegu Devices Inc.**: Live Animal Imaging Active Stabilization Unit

Dwayne Miller, **U. Toronto,** and **MDS** and **OCE**: IR Femtosecond Laser Cell Mining – Mapping the Chemistry of the Single Cell

Gholamreza Chaji, Andrei Sazonov, **U. Waterloo,** and **IGNIS**: Reducing Carbon Footprint of Flat Panel Displays

Jan Dubowski, **U. Sherbrooke,** and **Magnor**: NQ/CSA/CIPI-Quantum Dot Template Biosensor for Rapid Detection and Quantification of Pathogenic Micro-Organisms in Potable Water

John Cartledge, **Queen's U.,** and **BTI Systems**: Signal Processing for Packet Optical Networks

Karin Hinzer, **U. Ottawa,** and **TeraXion** and **CMC**: Integrated Dual-Wavelength Source for Microwave Photonics

TEN and IPA programs

Lawrence Chen, **McGill U.,** and **QPS Photronics**: Demonstration of a Large Channel Count Fibre Bragg Grating Sensor System for Condition Monitoring

Li Quian, **U. Toronto,** and **Fox-Tek** and **OCE**: Prototype Feasibility Study On Using Frequency-Shifted Interferometer for Thermal/Strain Sensing Array Interrogation

Lothar Lilge, **U. Toronto,** and **P&P Optica**: Advanced Spectroscopic Analysis System

Marcus Lawrence, **Concordia U.,** and **Biophage Pharma**: Integrated Deep-Probe Optical Waveguide with Dielectrophoresis

Martin Ferguson-Pell, **U. Alberta,** and **Xsensor Technology Corporation**: Tissue Reflectance-Nir: Noninvasive Assessment of Metabolic Status in Muscle

Martin Rochette, **McGill U.,** and **CorActive**: Nonlinear Devices Based on Nanowires

Michel Meunier, **É. Polytechnique de Montréal,** and **Biophage Pharma**: Photonic Biosensors with Novel Advanced Nanofunctional Materials

Mohammed Zourob, **Concordia U.,** and **Biophage Pharma**: Integrated Deep-Probe Optical Waveguide with Dielectrophoreses

Peter Mascher, **McMaster U.,** and **SiXtron advanced materials inc.**: Silane-Free SiC Deposition for Photovoltaic Applications

Raman Kashyap, **É. Polytechnique de Montréal,** and **Inokuchi & Son**: Ukulele

Reuven Gordon, **U. Victoria,** and **RDDC- Suffield**: Optical Sensing for Defence and Security Applications Using Nanohole Arrays

Rob Lipson, **U. Western Ontario,** and **MDS** and **OCE**: Vacuum Ultraviolet Maldi

Silvia Mittler, **U. Western Ontario,** and **Photon Technology International (PTI)**: Development of Nanoplasmonic-Gold Waveguide-Based (NAuWg) High-Throughput Assay for Plasma Enzymes of Clinical Importance

Thomas Darcie, **U. Victoria,** and **T-Ray Sciences**: Photomixer-driven Reflectance-Coupled Antennas for Terahertz Characterization

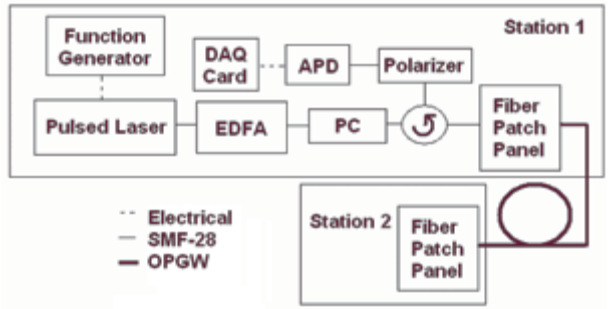
Vamsy Chodavarapu, **McGill U.,** and **Biophage Pharma** and **CMC**: CMOS Integrated Opto-Magnetic Bacterial Biosensor

Vincent Aimez, **U. Sherbrooke,** and **Osemi Canada**: Ultrafast Solar Blind UV Photodetector

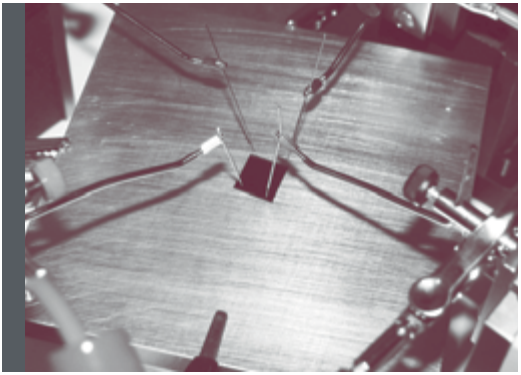
Wojtek Bock, **U. du Québec en Outaouais,** and **Biophage Pharma**: Sensitive and Specific Cyanobacteria Toxins Detection Using Photonic Sensors Based on Lab-on-a-Fiber Concept

Xiaoyi Bao, **U. Ottawa,** and **NRC-IFCI Institute for Fuel Cell Innovation**: Development of Distributed Temperature Sensor for in-situ Mapping of Temperature Distribution Inside a PEM Fuel Cell

Zetian Mi, **McGill U.,** and **Reflex Photonics**: High Performance 1.55 µm Quantum Dot Lasers for Applications in High Speed Optical Interconnect

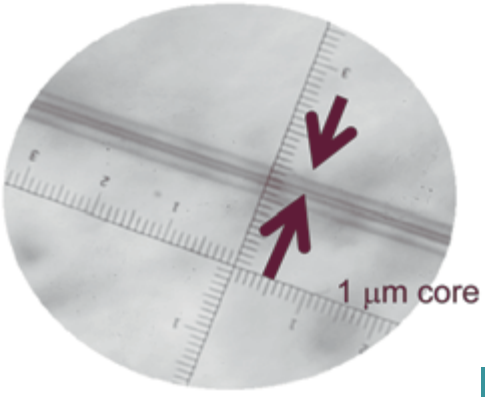


Experimental setup for distributed state of polarization analysis of the optical ground wire (OPGW) Network. Xiaoyi Bao, University of Ottawa, and IREQ-Institut de recherches d'Hydro-Québec investigated the use of fibers imbedded in OPGW network as environment sensors. Results of this concluded project showed that by monitoring the state of polarization of OPGW fiber networks it is possible to provide an on-line low cost dynamic monitoring of the OPGW environment (temperature, wind, ice…). "In addition to better understanding the process involved, we have developed a successful partnership which is still running", said Alain Côté, scientist at IREQ. Credits: Xiaoyi Bao.



Solar cell device being prepared for testing under illumination. Trevor Hall, University of Ottawa, works with Cyrium Technologies and NRC-IMS-CPFC to develop anti-reflection coatings for high efficiency solar cells in concentrated photovoltaic applications. A 35% improvement in efficiency was obtained with the addition of the appropriate coating. The project is completed, but further collaboration with the partners continues through a new project called SUNRISE (Semiconductors Using nanostructures for Record Increases in Solar-cell Efficiency). Credits: Christopher Valdivia, University of Ottawa

Hybrid chalcogenide/polymer taper. The core is a 1 µm chalcogenide taper covered by a polymer coating. Researcher Martin Rochette from McGill University is working with CorActive to implement nonlinear directional couplers (NDC) made of highly nonlinear chalcogenide glass fiber and generate switching in these couplers. Credits: Martin Rochette



TEN and IPA programs

TEN program - technology exploitation

Ralph Dacosta, **U. Toronto,** and **ORCP-OCE-Founders / UHN-MARS-Invitrogen**: A Start-Up Corporation Developing a Hand-Held Digital Optical Imaging Platform for Real-Time Pre-Clinical and Clinical Applications

Hans-Peter Loock, **Queen's U.,** and **Partec** and **ITF Labs, Resendes Studio**: The Photonic Guitar

Calum Macaulay, **UBC,** and **OneLight** and **BCCA**: MEMS Based Hyperspectral Imaging Platform for the Automated Analysis of the Neoplactic Process as the Interaction of Competing Cellular Clonal Populations

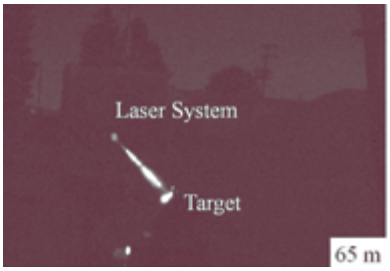
Muthukumaran Packirisamy, **Concordia U.,** and **SciMed Technologies Inc**: Enhanced Hybrid Integration of Photonics and Microfluidics for Bio-detection with Spectrometer-on-Chip

Michel Piché, **U. Laval,** and **Lenolux** and **Neoptix**: Croissance du Silicium par Évaporation Laser

Harry Ruda, **U. Toronto,** and **Monteco**: MOMS Chip for Gas Analysis

Queen's researchers Daniel Paz Soldan, Nick Ballard and Peter Loock (picture) have previously reported on the use of fiber Bragg gratings as pickups for musical instruments (Applied Optics, May 2009). Together with QPS Photronics (Pointe-Claire, QC) a new transducer based on a Fabry-Perot-type fiber cavity is under development for solid body and acoustic guitars. Credits: Greg Black, Queen's University Photographer

Christine Tremblay, École de technologie supérieure, and EXFO Electro-Optical Engineering have been exploring methods for monitoring and troubleshooting point-to-multipoint passive optical networks (PONs). The project, which is completed, has served as a springboard for a subsequent internal EXFO R&D project to develop an optical-layer PON monitoring system. "The project has enabled EXFO to develop a working prototype system for customer feedback much more rapidly", said Gregory W. Schinn, R&D Director, EXFO. The project was also the first step towards the implementation of a FTTx/PON testbed at ÉTS (shown above with Guillaume Mantelet, Master's student, who has worked with EXFO on the project). Credits: Christine Tremblay



Experiment setup and propagation axis picture of the laser filament. See Leang Chin, Université Laval, worked with DRDC-Valcartier to demonstrate the feasibility of remotely detecting chemical agents using filamentation of femtosecond laser pulses in field experiments. The summer field experiments demonstrated remote sensing of trace methane using filament-induced fluorescence in air at 20m. And during winter experiments, researchers were able to measure quantitative alloy concentration at 30 m even under both relatively adverse polar conditions and bright sunlight with strong snow scattering. This project is terminated. Credits: DRDC-Valcartier

IPA program

Steven Dodge, **Simon Fraser U.,** and **Honeywell** and **Domtar**: Development of a Time Domain Terahertz Sensor for Application in Paper processing

Geoffrey Ozin, **U. Toronto,** and **Opalux** and an end-user: Photonic Crystals as Next Generation State-of-Charge Indicators

Tito Scaiano, **U. Ottawa,** and **Sigma-Aldrich** and **Intel**: Sub-Wavelength Lithography

Gholamreza Ghali and Andrei Sazonov, **U. Waterloo,** and **Ignis** and an end-user: Development of an OLED High Resolution Small Area Display for Mobile Devices

Awards, recognitions and nominations

Alexandre April and Karl-Alexandre Jahjah were selected Grands Lauréats Le Soleil/ Radio-Canada

Alexandre April, Karl-Alexandre Jahjah and Marc-André Lapointe were selected Lauréat Forces Avenir 2008

José Azaña, J. D. Schwartz and David Plant received the 2009 IEEE Microwave Prize for their work on temporal imaging

Christopher J. Backhouse, D. Elliot and Jim McMullin were awarded the Engineers Canada 2009 National Award for an Engineering project or Achievement for developing a low-cost USB powered diagnostic chip.

André D. Bandrauk
Nominated as consultant with DESY in Hamburg, Germany
Nominated Honorary Doctorate at the F.U. Berlin, Germany
2009 SIAM Fellow

Melanie Campbell
Nominee for the Killam Research Award, U. of Waterloo

Paul Corkum and André D. Bandrauk received the NSERC JC.Polanyi Award 2008

Paul Corkum
2009 NSERC Gerhard-Herzberg Award in science and engineering

David Cramb
Fellow of the Canadian Chemical Institute of Canada
2008 Award for outstanding achievement in supervision, Faculty of Grad studies, University of Calgary

Jason Grenier
Best Student Paper Award at the LASE 2009 SPIE Photonics West Conference

Hans-Peter Loock
2009 McBryde Medal by the Canadian Society for Chemistry

Karl-Alexandre Jahjah
Quebec Lieutenant-Governor's Medal

Darren Kraemer
2008 NSERC Innovation Challenge Award

Paul Corkum receives the 2009 NSERC G. Herzberg Award from Prime Minister Stephen Harper and NSERC President Suzanne Fortier. Credits: NSERC

Raymond Laflamme
Fellow of the Royal Society of Canada

François Lagugné-Labarthet
CRC Tier 2 Chair in Nanomaterials and Photonics and CFI infrastructure grant

Dwayne Miller
Appointed to the Science Advisory Review Board at the LCLS Stanford, USA
Japanese Physical Science Society Fellowship

David Plant
Fellow of the Engineering Institute of Canada
James McGill Professorship
Bell Canada/NSERC Industrial Research Chair in Ultra-High Bit Rate Optical Transport and Access Networks

Aephraim M. Steinberg
Fellow of the American Physical Society
Fellow of the Optical Society of America

Brian Wilson
Professor-at-Large at the Institute for Advanced Studies, University of Western Australia

Darren Kraemer receives the first CIPI Young Photonic Innovator Award from Sylvain Charbonneau, Director, Applications Technologies, NRC–IMS, CPFC. Credits: Pierre Bolduc

Highly qualified personnel

Group of CIPI-S students at CIPI AGM in Quebec, May 2009. Credits: Pierre Bolduc

Distribution of graduate students working on CIPI network research projects

			Number of students	Theses completed
PhDs	Male	Canadian*	55	11
		International	24	3
	Female	Canadian*	14	1
		International	7	0
	TOTAL		100	15

			Number of students	Theses completed
Masters	Male	Canadian*	38	13
		International	12	6
	Female	Canadian*	16	2
		International	1	1
	TOTAL		67	22

* Includes permanent residents

CIPI student network (CIPI-S) activities for 2008-2009

Events organized by CIPI-S

Computing tools workshops:

- Software: CATIA and MATLAB, at Concordia University in Montreal
- Software: LabVIEW, at University of Calgary

Students participating at CATIA workshop at Concordia University. Credits: Arvind Chandrasekaran

Biophotonics seminar series

- Day long seminar series which covered a wide range of topics currently being studied in the field of biophotonics
- Speakers included: Dr. Brian Wilson (UHN), Dr. Gang Zheng (UHN), Dr. Dwayne Miller (U. Toronto), Dr. David Cramb (U. Calgary) and Dr. Kimberly Samkoe (Dartmouth College)
- A total of approximately 40 students attended the seminar series

CIPI-S president Trinh Nguyen presenting CIPI at the Biophotonics seminar series. Credits: Arvind Chandrasekaran

Highly qualified personnel

CIPI-S AGM

- Entrepreneurship theme: Dr. Marc Soucy from InnovMetric Software Inc. was kind enough to share his experience on starting his own business
- Student poster competition: winners were Véronique Zambon (U. Laval), Ryan Bolen (U. Ottawa) and Alexandre April (U. Laval)

Events sponsored by CIPI-S

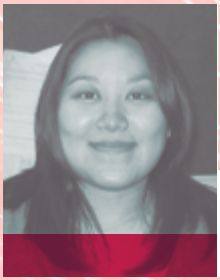
CIPI-S reserves funds every year to help sponsor events organized by other graduate students in the photonics field. During 2008-2009, CIPI-S sponsored 2 events:

- Photonics ToolkiT in Quebec City at U. Laval
- Canadian Graduate Summer School of Biophotonics in Toronto at Ryerson University

CIPI-S's Geneviève Taurand presenting CIPI-S at Photonics ToolkiT in Quebec City. Credits: Photonics ToolkiT

Skating party in Peter Herman's, U. Toronto, back yard. (5th from the left) Credits: Peter Herman's group

CIPI-S Executive



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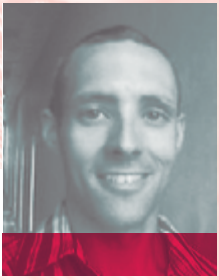
University of Calgary



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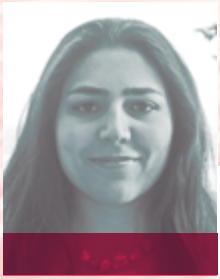
Melanie Burger
Treasurer
McGill University

Arvind Chandrasekaran
Scientific Activities
Coordinator
Concordia University



Nazanin Mobrhan-Shafiee
Web Site Coordinator
Simon Fraser University

Geneviève Taurand
Industry and Government
Relations Coordinator
Université Laval

Mamta Khurana
Communications Coordinator
University of Toronto

Knowledge exchange

Workshops, seminars and **conferences**

- OCE Discovery 2008, CIPI booth, **Toronto,**
  May 2008
- Frontiers in Neurophotonics Summer School 2008, CIPI sponsorship, **Quebec,**
  May 18-24, 2008
- Photonics North 2008, CIPI Booth, **Montreal,**
  June 2-4, 2008
- LPM 2008-Laser Precision Micro-Fabrication, organized by CIPI, **Quebec,**
  June 17-19, 2008
- 1st International Symposium on Laser Ultrasonics, CIPI sponsorship, **Montreal,**
  July 16-18, 2008
- OPTO 2008 Conference, CIPI organized the Canadian participation, **Paris, France,**
  September 27-October 8, 2008
- MatLab Catia Workshop, organized by CIPI-S, **Montreal,**
  November 28, 2008
- Laser Control and Monitoring in New Materials, Biomedecine, Environment, Security and Defense, organized by NATO Advanced Study Institute, CIPI sponsorship, **Ottawa,**
  November 24 to December 5, 2008
- Photonic Solutions for Detection and Identification of Nanoparticles in Air and Liquids, organized by CIPI, **Montreal,**
  January 21, 2009
- Photonics West 2009, CIPI Booth, **San Jose, CA, USA,**
  January 26-29, 2009
- Photonics ToolkiT, CIPI sponsorship, **Quebec,**
  March 5-8, 2009
- CLAN-Canadian Laser Application Network Workshop, organized by CIPI, **Toronto,**
  March 11-12, 2009
- Graduate Summer School on Optical Coherence Tomography and Bioimaging, organized by CIPI-S, **Calgary**

Students exchanges

Researcher	University	Project Title	Student
JESSOP, Paul	McMaster	Fabrication of Silicon Nanophotonic Devices	Dylan Logan, McMaster, to University of Glasgow, UK
MORANDOTTI, Roberto	INRS	Affordable All-Fibre Source of Entangled Photons	David Duchesne, INRS, to Hebrew University of Jerusalem, Israël
SKOROBOGATIY, Maksim	École Polytechnique de Montréal	Fabrication of the Photonic Crystal Fiber-Based	Alireza Hassani, EPM, to University of Bath, UK

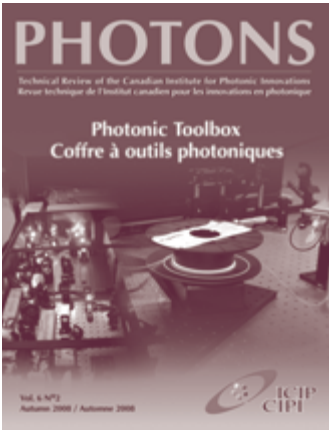
CIPI helped organize the Canadian Laser Application Network (CLAN), a new initiative led by Peter Herman (University of Toronto) to forge industry-academic cooperation in laser material processing and laser characterization activities in Canada. Credits: Pierre Bolduc

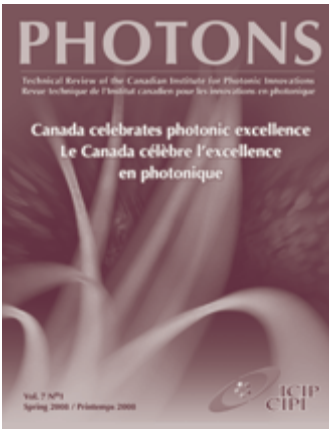
Group of students visiting COPL labs during the Photonics ToolkiT at Université Laval, Quebec. Credits: Photonics ToolkiT

Knowledge Exchange

Publications

Articles published in refereed publications:	178
Other published refereed contributions:	98
Published non-refereed contributions:	46
Specialized publications:	74
Total publications:	**396**





Cover illustrations of PHOTONS magazine published by CIPI

Other transfer outputs

Patent applications filed:	17
Patents issued:	2
Licenses granted to industry:	2
Companies created:	2
Collaboration / technology transfer projects:	38

International research collaborations

North America

- R. S. Marjoribanks, U. of Toronto, and S. Camacho-Lopez of Centro de Investigacion Certifica y de Educacion Superior de Ensenada, Baja California, Mexico
- H. Ruda, U. of Toronto, and M. Johnson, U. Kentucky and G. Salamo, U. Arkansas, USA
- R. Fedosejevs, U. of Alberta, and A. MacKinnon of Lawrence Livermore National Laboratory, USA
- R. Fedosejevs, U. of Alberta, and T. Ogitsu, E. Schwegler, Y. Ping and A. Ng of Lawrence Livermore National Laboratory, USA
- M. Campbell, U. Waterloo, and C. Vogel of U. of Montana, USA
- M. Campbell, U. Waterloo, and A. Roorda of U. of California, Berkeley, USA
- D. Cramb, U. of Calgary, and M. von Zastrow, U. of California, San-Francisco, USA
- M. Piché, U. Laval, and B. Bouma, Harvard/MIT Medical School, USA

Europe

- M. Piché, U. Laval, and H. K. Avetissian of Terevan State University, Armenia
- D. Cramb, U. of Calgary, and D. Massicotte, Université de Strasbourg, France
- F. Lagugné-Labarthet, U. Western Ontario, and N. Marquestaut, Université de Bordeaux, France
- P. De Koninck, Y. De Koninck and D. Côté, U. Laval, and D. Choquet, V. Dousset and M. Letry, U. de Bordeaux, France
- J. Genest, U. Laval, and le Laboratoire de Physique moléculaire, U. de Paris-Sud, France
- P. Herman, U. of Toronto, and R. Stoian, Université Jean Monnet, France
- H. Ruda, U. of Toronto, and J. Gierak and P. Arguel from CNRS, France
- M. Piché, U. Laval, and R. Grunwald and U. Griebner from Max-Born Institute, Berlin, Germany
- T. Brabec, U. Ottawa, and researchers at University of Rostock, Germany
- P. Herman, U. of Toronto, and A. Rosenfeld, MBI, Berlin, Germany
- P. Herman, U. of Toronto, and G. Marowsky, Laser Laboratorium, Goettingen, Germany
- P. Herman, U. of Toronto, and Prof. Poprawe and D. Gottman of Fraunhofer ILT, Aachen, Germany
- D. Miller, U. of Toronto, and A. Leitenstorter of U. of Konstanz, Germany
- P. Masher, McMaster U., and V. Donzella, Scuola Superior Sant'Anna, San Cataldo, Pisa, Italy
- L. A. Rusch, U. Laval. and Prof. Bononi, Universita di Parma, Italy
- P. Herman, U. of Toronto, and P. Marques INESC Porto, Portugal

International research collaborations

- R. Fedosejevs, U. of Alberta, and V. Bychenkov, Lebedev Institute, Moscou, Russia
- H. Ruda, U. of Toronto, and R. Mireta and F. Calleja-Mitja, Universidad Autonoma de Madrid, Spain
- P. Herman, U. of Toronto, and D. Jaque, GIEL, Universidad Autonoma de Madrid, Spain
- L. R. Chen, McGill U., and P. Monoz and J. Capmany, the iTEAM, Universidad Politecnica de Valencia, Spain
- S. Larochelle, U. Laval, and R. Villar Mateo, Universidad Politecnica de Valencia, Spain
- R. Vallée, U.Laval, and J. Fernandez-Rosa, Cambridge U., UK
- D. Cramb, U. of Calgary, and H. Eterson from Oxford University, UK
- H. Ruda, U. of Toronto, and W. Hofer, Surface Science Centre, Liverpool University, UK
- P. Jessop, McMaster U., and G. Reed at Surrey University, UK
- A. P. Knights, McMaster U., and M. Halsall, Manchester University, UK
- P. Jessop and A. P. Knights, McMaster U., and R. De la Rue, University of Glasgow, UK
- M. Skorobogatiy, École Polytechnique de Montréal, and the University of Bath, UK

Asia

- R. Morandotti, INRS, and Hebrew University, Israel
- S. L. Chin, U. Laval, and K. Yamanouchi, University of Tokyo, Japan
- Y. Y. Tsui, U. of Alberta, and Prof. Cho from Injie University in Korea, South Korea

Australia

- A. M. Steinberg, U. of Toronto, and A. White, University of Queensland, Australia
- A. P. Knights, McMaster U., and S. Ruffell, Australian National University, Australia

Financial overview

April 1, 2008 – March 31, 2009

REVENUE

Balance beginning of the year	Cash	941 834 $
NCE Grant for the year	Cash	4 243 000 $
Network Affiliate contributions	Cash	883 556 $
Network Affiliate contributions	In-kind	2 558 845 $
Total funds available year 2008-2009		**8 627 235 $**

RESEARCH INVESTMENTS

Medium Term Research Program	Cash	2 145 970$
Short Term Programs TEN and IPA	Cash	1 924 879$
Networking activities	Cash	394 051$
All Research Programs	In-kind	2 380 795$

GOVERNANCE AND ADMINISTRATION EXPENSES

Administrative Salaries	Cash	355 750$
Administrative Centre equipment, materials, supplies and other expenditures	Cash	82 012$
Expenses incurred by comittees	Cash	49 907$
Administrative Salaries and Committee support	In-kind	178 050$
TOTAL		**7 511 414$**
BALANCE		1 115 821$
Year end commitments		-1 069 379$
Net balance for next year's Research Program		46 442$

The above figures and financial overview were prepared in accordance with accounting practices of Canada. The Administrative Centre and scientific research budgets were audited in accordance with the standards issued by the Canadian Institute of Chartered Accountants and were also submitted for verification to the Networks of Centres of Excellence in the 2008-2009 Statistical Report.

University partners

Network participants between April 1, 2008 and March 31, 2009

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EXFO Electro-Optical Engineering
Fox-Tek
Group IV Semiconductor
Honeywell
iCore
IGNIS
Intel
Kotura
MDS
Micralyne
Monteco
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NRC-IMI
NRC-IMS
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OAML
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