

# Illuminating the Social Nature of Innovation: Toronto Optical Science

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# Why Study Optics?

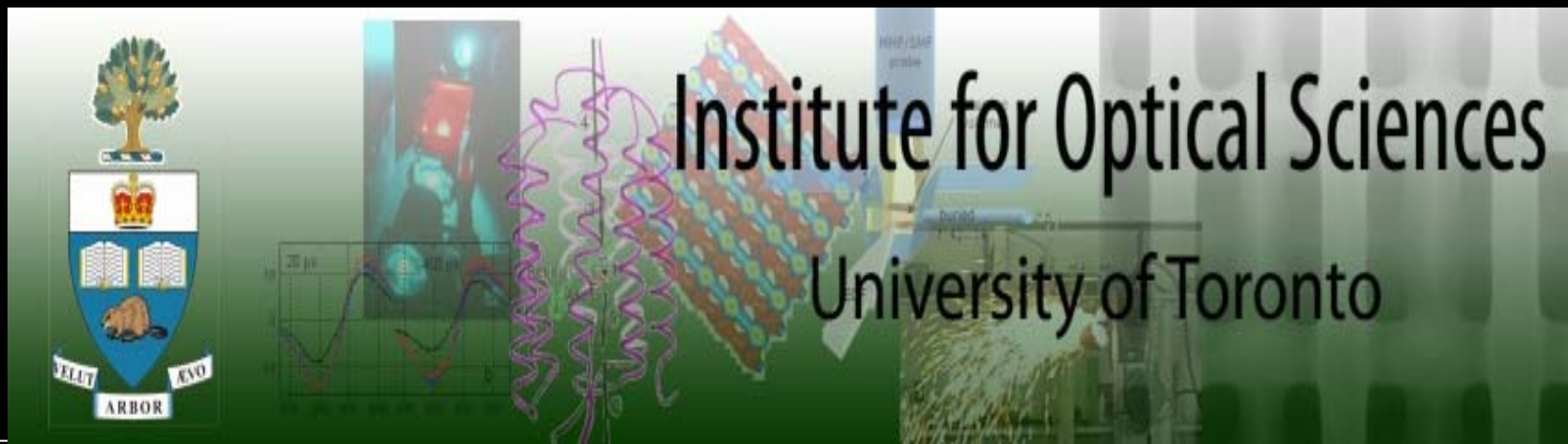
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- **Optics:** Branch of physics studying light
  - **Optical science** - Pure science aspects of the field
  - **Photonics** - bridge to applied or optical engineering
  - **Optoelectronics** - narrowed to electrical interaction
- **Enabling Technology**
  - Used in wide variety of intermediate markets
  - Diverse products
  - Increasingly important
    - Information Technology and Telecommunications
    - Optics in Health Care and the Life Sciences
    - Optical Sensing, Lighting, and Energy
    - Industrial Manufacturing

# Why Study Optics In Toronto?

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- Opened in April 2004
  - Core from Photonics Research Ontario
    - Ontario Center of Excellence (1988)
    - New Faculty



# Connection to ISRN

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- How does a city-region support advances in a field that is not part of a single industry
  - cuts across sectors/industries?
  - Involves public and private organizations?
- How does an emerging scientific field fit in local innovation systems?
  - Evolving Role of University
  - Hybrid Organization form
    - Why form an Institute?
    - How does multidisciplinary work progress?
- What is the role of the city-region in the evolution and growth of this scientific field?

# ONTARIO PHOTONICS TECHNOLOGY INDUSTRY CLUSTER (OPTIC)

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- Prominent Companies
  - ELCan – (subsidiary of Raytheon)
  - Trojan Technologies (1976)
  - Xerox – (Canadian subsidiary)
- Few S & M enterprises
- International Society for Optical Engineering (SPIE) list 30 international clusters
  - <http://www.photonicsclusters.org/cluster-list.dxp>
  - Ottawa, Vancouver, Montreal
- Next Step: Characterizing Toronto Optics

# Canadian Optics Technology Inventor Networks, 1983 – 2002

## The Geography of Inventor Collaborations

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# Space, Scale & Timeframe of the Study

## Geography: CANADA

Census Metropolitan Areas &  
Census Agglomerations

## Technology Sector: OPTICS

US Patent and Trademark Office  
(USPTO) micro-level data –  
Patents Classified as Optics Technology

## Data & Timeframe:

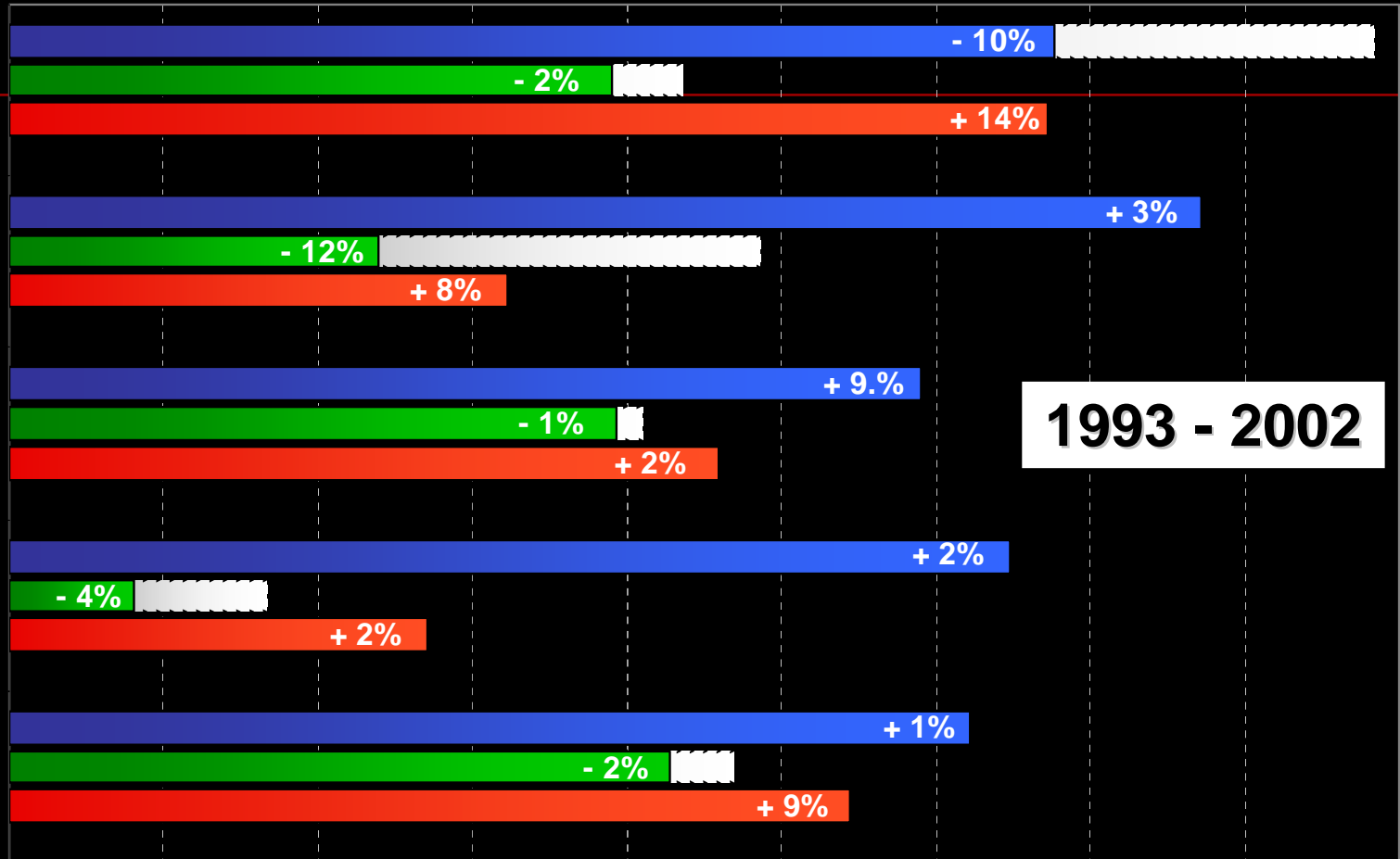
All USPTO optics patents granted from 1983 to 2002,  
which contain at least one inventor residing in Canada

NORTH  
AMERICA



# Spaces & Scales of Collaborations

[Spatial Distribution of Collaborations for Multi-Inventor Patents]



1993 - 2002

LOCAL NATIONAL GLOBAL



# Characterizing Toronto Optics II

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- Look at Optical Society Members
  - 121 Companies
  - Pull USPTO patents
  - What IPCs are most highly represented?
- New Industry Definition!
  - IPC G01B 9/02: PHYSICS; MEASURING
  - IPC G02B 6/26: PHYSICS; OPTICS; OPTICAL ELEMENTS, SYSTEMS, OR APPARATUS
  - IPC H01S 3/08: ELECTRICITY; BASIC ELECTRIC ELEMENTS; DEVICES USING STIMULATED EMISSION
  - IPC H01S 3/10: BASIC ELECTRIC ELEMENTS; DEVICES USING STIMULATED EMISSION
- Different Representation
  - NO Xerox
  - Some Smaller Companies
    - Femtonics Corporation
    - Oz Optics Ltd.
    - EXFO Photonic Solutions Inc. EXFO Photonic Solutions Inc.

# Why Form an Institute?

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- Focal point for expertise
  - Copying of Rochester Model
  - Driven by Faculty Member
    - Industry Orientation
    - Keep Graduate Students in Canada
- Greater Collaboration
  - Different Models
  - Not happening yet!
- Dynamic tensions

# Role of the City-Industry on the Emerging Field

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- Why in Toronto?
  - Immigrants seeking opportunity
  - Big company research versus small
    - Fixed cost the same
    - Problem differences
  - Licensing versus start-ups
- Globally connected
  - Balance between academic prestige and commercial activity
  - New expertise
- Different from Other Optics Clusters

# Next Steps

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- Continue Interviews
  - 12 Done
  - 13 to Do
    - Prolific Inventors
    - Companies
- Quantitative Analysis
  - ISI citations in sub-fields
- Synthesis

# Comments and Suggestions Appreciated

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- Next study
  - Tissue Engineering
  - Neuroscience
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- Thank You