Ray T. Chen

CURRICULUM VITAE

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Ray Chen is the Keys and Joan Curry/Cullen Trust Endowed Chair at The University of Texas Austin. Chen is the director of the Nanophotonics and Optical Interconnects Research Lab, at the Microelectronics Research Center. He is the director of the AFOSR MURI-Center for Power-Efficient Silicon Nanophotonics for Optical Computing and Interconnects. From 2008 to 2013 he also led a MURI center for Silicon Nanomembrane involving faculty from Stanford, UIUC, Rutgers, and UT Austin. A myriad of commercially available devices and systems are available in the market from these basic research programs. He received his BS degree in Physics in 1980 from the National Tsing Hua University in Taiwan, his MS degree in physics in 1983, and his PhD degree in Electrical Engineering in 1988, both from the University of California. He joined UT Austin in 1992 to start the optical interconnect research program. From 1988 to 1992 Chen worked as a research scientist, manager, and director of the Department of Engineering at the Physical Optics Corporation in Torrance, California.

Chen served as the CTO, Founder, and Chairman of the Board of Radiant Research, Inc. from 2000 to 2001, where he raised 18 million dollars A-Round funding to commercialize polymer-based photonic devices involving over twenty patents, which were acquired by Finisar in 2002, a publicly traded company in the Silicon Valley (NASDAQ:FNSR). He also serves as the founder and Chairman of the Board of Omega Optics Inc. since its initiation in 2001. Omega Optics has received over twenty million dollars in research funding from private sectors and government agencies. His research work has been awarded over 150 research grants and contracts from such sponsors as Army, Navy, Air Force, DARPA, MDA, NSA, NSF, DOE, EPA, NIST, NIH, NASA, the State of Texas, and private industry. The research topics are focused on four main subjects: (1) Nano-photonic passive and active devices for bio- and EM-wave sensing and interconnect applications, (2) Thin film guided-wave optical interconnection, computing and packaging for 2D and 3D laser beam routing and steering, (3) True time delay (TTD) wide band phased array antenna (PAA), and (4). 3D printed micro-electronics and photonics. Experiences garnered through these programs are pivotal elements for his research and further commercialization.

Chen's group at UT Austin has reported its research findings in more than 970 publications, including over 100 invited papers and 82 patents. He has chaired or been a program-committee member for more than 130 domestic and international conferences organized by IEEE, SPIE OSA, and PSC. He has served as an editor, co-editor or coauthor for over twenty books. Chen has also served as a consultant for various federal agencies and private companies and delivered numerous invited talks to professional societies. Chen is a Fellow of IEEE, OSA, and SPIE. He was the recipient of the 1987 UC Regent's Dissertation Fellowship and the 1999 UT Engineering Foundation Faculty Award, for his contributions in research, teaching and services. He received the honorary citizenship award in 2003 from the Austin city council for his contribution in community service. He was also the recipient of the 2008 IEEE Teaching Award, and the 2010 IEEE HKN Loudest Professor Award. 2013 NASA Certified Technical Achievement Award for contribution on moon surveillance conformable phased array antenna. During his undergraduate years at the National Tsing Hua University he led the 1979 university debate team to the Championship of the Taiwan College-Cup Debate Contest.

Chen has supervised 41 postdocs and graduated 59 PhD students from his research group at UT Austin. Many of them are currently professors in the major research universities in the world.

Department of Electrical and Computer Engineering
CURRICULUM VITAE

Name: Ray T. Chen

Title: Professor, Electrical and Computer Engineering

Date of Appointment: September 1, 1992

Personal:

Date of Birth: October 27, 1958
Place of Birth: Taiwan
Citizenship: USA

Education:

Degree	*Date*	*School*
B.S. Physics	1980	National Tsing Hua University
M.S. Physics	1983	University of California, San Diego
Ph.D. EE	1988	University of California, San Diego and Irvine

Professional Experience:

2014-present	Keys and Joan Curry/Cullen Trust Endowed Chair Professor
2016-2022	Director of Multi-disciplinary University Research Initiative (MURI) Center for Energy-efficient Optical Computing and Interconnects with multi university personnel and budget management
2008-2014	Director of Multi-disciplinary University Research Initiative (MURI) Center for Silicon Nano-membrane with multi university personnel and budget management
2006-2013	Cullen Trust Endowed Professor of Electrical & Computer Engineering The University of Texas at Austin, Austin, TX
2000-2006	Temple Foundation Endowed Professor of Electrical & Computer Engineering, University of Texas, Austin, Austin, TX
2001-Present	Founder and Chief Technical Officer, Omega Optics
2000- 2001	Chairman and Chief Technical Officer, Radiant Research Inc.

Aug. 1996- Dec. 1999	Associate Professor of Electrical & Computer Engineering The University of Texas at Austin, Austin, TX
Sept. 1992 - Aug. 1996	Assistant Professor of Electrical & Computer Engineering The University of Texas at Austin, Austin, TX
July 1989 - July 1992	Director of Department of Electro-optic Engineering Physical Optics Corporation, Torrance, CA
July 1988 - July 1989	Research Scientist, Physical Optics Corporation Torrance, CA
June 1980 - April 1982	Second Lieutenant in charge of maintenance of Gas Engine of M-48 Tank, Taiwan Army, Taiwan

Consulting:

Omega Optics
Novex Corporation
TIR Corporation
DOE
JPL
Teledyne Microelectronic Division
Wright Patterson AFB
National Science Foundation
Department of Energy
ITRI in Taiwan
Lightpath, Inc.
Radiant Research, Inc.
Global Rainbow Technology
Hong Kong Government for Science and Technology

Honors and Awards:

2024 Synopsys Robert S. Hilbert Memorial Optical Design Competition Award (PhD student Shupeng Ning co-supervised with Ray Chen and David Pan)
Shupeng Ning Receives Synopsys Optical Design Competition Award | Texas ECE - Electrical & Computer Engineering at UT Austin (utexas.edu)

UT Austin Graduate School Outstanding Dissertation Award 2024 in Mathematics, Engineering, Physical Sciences, and Biological and Life Sciences PhD thesis "Light-AI Interaction: Bridging Photonics and Artificial Intelligence via Cross-Layer Hardware/Software Co-Design" PhD Candidate JiaQi Gu Jointly supervised by Dave Pan and Ray Chen

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Jiaqi Gu (co-advised by Prof. David Pan) for winning the **UT-ECE Department 2022-2023 Jacome Dissertation Prize**. Jiaqi will join ASU as an Assistant Professor in August 2023.

2022 Synopsys Robert S. Hilbert Memorial Optical Design Competition award
Texas ECE Team Wins Synopsys Optical Design Competition Award | Texas ECE - Electrical & Computer Engineering at UT Austin (utexas.edu)

Professor Ray Chen has been elected as the fellow of the National Academy of Inventors
(1) Post | LinkedIn

Domestic and International News announcements and CBS evening news reporting our research findings:

UT university news announcement:

'Lab-on-a-Chip' Can Tell the Difference Between COVID and the Flu - UT News (utexas.edu)

Reports in Europe:

A Point-of-Care Biosensor for Rapid Detection and Differentiation of COVID-19 Virus (SARS-CoV-2) and Influenza Virus Using Subwavelength Grating Micro-ring Resonator - Abstract - Europe PMC

Science Daily

Optical techniques offer fast, efficient COVID-19 detection: Without rapid point-of-care testing, the pandemic will likely continue to evolve -- ScienceDaily

NIH News Announcement:

A point-of-care biosensor for rapid detection and differentiation of COVID-19 virus (SARS-CoV-2) and influenza virus using subwavelength grating micro-ring resonator - PubMed (nih.gov)

News in America Institute of Physics:

https://aip.scitation.org/doi/10.1063/5.0022211

'Lab-on-a-chip' can tell the difference between COVID and the flu (phys.org)

Won the First Place Gold Medal, Jiaqi Gu, (PhD student co-supervised with Prof. David Pan) at the Association for Computing Machinery Special Interest Group on Design Automation (ACM/SIGDA) Student Research Competition held at the 2020 IEEE/ACM International Conference on Computer Aided Design (ICCAD). His research competition title is "Light in

Artificial Intelligence: Efficient Neuromorphic Computing with Optical Neural Networks." December, 2020

The Best Paper Award at 2020, the 25th ACM/IEEE Asia and South Pacific Design Automation Conference (ASP-DAC 2020) for their paper "Towards Area-Efficient Optical Neural Networks: An FFT-based Architecture." Jiaqi Gu, Zheng Zhao, and Mingjie Liu are advised by Dr. Pan, and Chenghao Feng is advised by Dr. Chen.

Smithsonian Magazine selected 2015 one of the top 10 Senior Design Project that are the highest commercialization potential

Two Best Student Paper awards in Photonics West 2015, and SPIE annual meeting in San Diego 2015

Keys and Joan Curry/Cullen Trust Endowed Chair Professor 2014

Three UT patents licensed to Alfa Sensors for further commercialization, 2014

Top ten most promising Optoelectronics start up ideas in 2013, SPIE Photonics West, San Francisco, CA, Feb 5, 2013

NASA Technical Contribution Award for contributing to the development of scientific and technical innovation, “Fully Printed Flexible 4-Bit 2D (4x4) 16-Element Phased Array Antenna for Lunar Surface Communications LEW-19035-1), 2013

Loudest Research Professor Award from IEEE and HKN Honor Society, April 2010

"2008 IEEE Teaching Award", May 2008

“Ready to Commercialize” UT Annual Conference hosted by UT Office of Technology Commercialization, October 2006

UT Austin Cullen Trust Endowed Professorship, 2006

Elected Fellow of IEEE, Photonics Society, 2004

City of Austin Honorary Citizen Award for local society contributions, 2003

Elected Fellow of Optical Society of America, 2000

Elected Fellow of the International Society of Optical Engineering, 1999

Engineering Foundation Faculty Award for excellent contributions in Teaching, Research, and Service, The College of Engineering of UT Austin, 1999

Elected senior member of IEEE, 1998

Temple Foundation Endowed Faculty Fellow, 1996-2005

"Excellence in Technical Communications" Award from Laser Focus World for the invited paper "Holographic Elements Fanout Laser Beams," Laser Focus World, 32, 221-228 (1996)

University of California Regents Dissertation Fellowship, 1987

Championship of Taiwan College-Cup Debate Contest, 1979

Professional Society Membership:

IEEE-Institute of Electrical and Electronic Engineers (FELLOW)
IEEE/LEOS- Laser and Electro-Optics Society (FELLOW)
OSA- Optical Society of America (FELLOW)
SPIE- International Society of Optical Engineering (FELLOW)
PSC- Photonics Society of Chinese Americans (FELLOW)
NAI- National Academy of Inventors, Inc,

Committee Assignments:

ECE Departmental Committees:

1) ECE - New Faculty Recruiting Committee (1992-93)
2) ECE - Chairman of Library Committee (1993-94)
3) ECE - Course Planning Committee on EM Waves-related Courses (1994-95, 2002-)
4) ECE - Undergraduate Student Advising (1992 –)
5) Chair of Post Tenure Review and Faculty Annual Review Committee 2014
6) Chair of the Endowed Dula Chair search Committee 2015-2017

College of Engineering Committees:

1) EPS Minority Students Mentor (1996-1998, 2004-2005)

University Committees:

1) Member of the Panel Discussion of the 1999 International Students and Scholars for newcomers, arranged by UT's International Office
2) 2006-2008 UT System Faculty Grievance Committee Member
3) Internal Review Committee for UT VP of Research: NSF Major Instrumentation Program (MRI) 2018 submission

National Committees:

1) NIST, Workshop on Optoelectronic Packaging Panel, 1992

2) NIST, Workshop on Material Metrology Issues for Optoelectronic Interconnects and Packaging, Invited University Representative Committee, 1994

3) National Science Foundation, SBIR/Phase II Proposals and Regular 3-year University Program Review Panel, 1994

4) U. S. Army Workshop, Integrated Optics for Military and Commercial Applications Panel, 1994

5) National Science Foundation, NSF URI and REA Proposals Review Panel, 1994, 1996

6) NEC, Optoelectronic Interconnects for High Speed Computer Panel, 1995

7) Invited Round Table Panelist of the Department of Energy for helping determine the research direction of Microelectronics of DOE basic research in the next 10 years (May 2018)

8) Panelist for OSA/ONR Mid-IR Integrated Photonics defining the future direction of Mid-IR nanophotonics (may 2018)

Conference Organization and Participation (Professional and Technical Societies)

1. Chair: IEEE/LEOS Spring Meeting, 1991, Los Angeles, CA
2. Chair: Annual Meeting of the Photonics Society of Chinese Americans, 1991
3. Co-chair: International Conference on Polymer Devices and Physics, 1991 and 1992
4. Program Committee Member: International Conference on Integrated Optical Circuits, 1991, 1992, 1993, 1994
5. Invited Lecturer: Short Course on Optical Interconnects, Annual Meeting, 1992; Symposium on Optical Interconnects and Packaging, 1993; Symposium on Optoelectronic Interconnects, 1994; Microelectronic Manufacturing, 1994 and 1995; Symposium on Optoelectronic Interconnects, 1995
6. Co-chair: International Conference on Photopolymers and Applications in Holography, Optical Data Storage, Optical Sensors, and Interconnects, 1993
7. Chair: International Conference on Optoelectronic Interconnects, 1993, 1994, 1995
8. Moderator and Panel Member: Panel Discussion on Optical Interconnects in OELase, 1993 (Los Angeles) and 1995 (San Jose)

9. Co-chair: IEEE/LEOS Central Texas Monthly Meeting, 1994

10. Co-chair: SPIE/IEEE Symposium on Optical Characterization Technique for High Performance Microelectronic Device manufacturing, 1994, 1995

11. Secretary: Central Texas IEEE/LEOS, 1994-1995

12. Chair: Central Texas IEEE/LEOS, 1995-1998

13. Organizer: National Alliance of Photonics Education for Manufacturing training courses (20 programs) in Microelectronic Manufacturing, 1994-1996

14. Invited Panelist: Panel Discussion, IEEE Computer Society 2nd International Conference on Massively Parallel Processing Using Optical Interconnections, October 1995, San Antonio, Texas
15. Invited Panelist for panel discussion of the 1995 IEEE 2nd International Conference on Massively Parallel Processing Using Optical Interconnections, San Antonio, Texas, October 1995
16. Organization Committee, 1995 Photonics East, Detroit, MI, November 1995

17. Chairman, 1995 SPIE/IEEE Symposium on Optical Characterization Technique for High Performance Device Manufacturing, October 1995, Austin, Texas

18. Member Program Committee: IEEE 3rd International Conference on Massively Parallel Processing Using Optical Interconnections, October 1996, Hawaii

19. Chairman, 1995 SPIE/IEEE Symposium on Optical Characterization Technique for High Performance Microelectronic Device Manufacturing, October 1995, Austin, Texas

20. Member Program Committee: IEEE International Conference on Applications of Photonics Technology, 1996, Montreal, Canada

21. Chair: Photonics China (Optoelectronics Portion), November 1996, Beijing, China

22. Chair: Critical Review Conference on Optoelectronic Interconnects and Packaging, Photonics West, 1996, San Jose, CA

23. Program Committee, 1996 IEEE International Conference on Applications of Photonics Technology, Montreal, Canada, July 1996

24. Chairman for National Alliance of Photonics Education for Manufacturing training courses (20 programs) in Microelectronic Manufacturing Conference, October 1996

25. Chairman, Critical Review Conference on Optoelectronic Interconnects and Packaging, February 1996, Photonics West, San Jose, CA

26. Program Committee of 1996 International Conference on Photopolymer Device Physics,

Chemistry, and Applications III, August 1996, Denver, CO

27. Chairman, 1996 Photonics China (Optoelectronics Portion), Beijing, China, November 1996
28. Program Committee, 1996 IEEE 3rd International Conference on Massively Parallel Processing Using Optical Interconnections, October 1996, Hawaii
29. Chairman, 1996 SPIE/IEEE Symposium on Optical Characterization Technique for High Performance Microelectronic Device Manufacturing, October 1996, Austin, TX
30. Chairman for National Alliance of Photonics Education for Manufacturing training courses (20 programs) in Microelectronic Manufacturing Conference, October 1996
31. Executive Committee of International Symposium on Photonics China '96, helped organize 16 conferences
32. Chairman, SPIE Micromachining & Microfabrication '96 and Microelectronic Manufacturing '96
33. Program Chair of 1997 SPIE International Symposium on Hybrid and Monolithic OEIC Technology, San Jose, 1997 (4 Parallel Conferences)
34. Chairman of the SPIE international Optoelectronic Interconnects and Packaging Conference, San Jose, 1997
35. Chairman of SPIE International Semiconductor Device Packaging Conference, June 1997, Singapore.
36. Chairman of SPIE International Conference on Design and Manufacturing of WDM Devices, Dallas, TX, November 1997
37. Program Committee of IEEE International Conference on Applications of Photonic Technology, Chateau Laurier Hotel, Ottawa, Ontario, Canada, July 1998
38. Chairman of SPIE International Conference on Optoelectronic Interconnects VI, San Jose Convention Center, January 28 to February 1, 1998
39. Program Committee of SPIE International on Photopolymers Device Physics Chemistry and Application IV, Hilton Hotel, Quebec City, Canada, July 1998
40. Program Committee of SPIE International, Conference on In-line Characterization Techniques for Performance and Yield Enhancement in Microelectronic Manufacturing, Santa Clara, CA, September 1998
41. Symposium Co-chair of Photonics China (16 conferences), Beijing, China, September 1998
42. Chairman of the International Conference on Integrated Optoelectronics, Beijing, China, September 1998
43. Program Committee of the Asia Pacific conference on Optical Fiber Communications, Taipei, Taiwan, September 1998

44. Program Chairman of the Program of Photonics West on Monolithic and Hybrid OEICs (6 conferences), San Jose, January 1999

45. Program Committee of the International Conference on Optoelectronic Interconnects and Packaging, San Jose, January 1999

46. Chairman, SPIE Critical Review on Wavelength Division Multiplexers and Demultiplexers, San Jose, January 1999

47. Session Chair of OSA Optical Fiber Communications (OFC) Conference, San Diego, February 1999

48. Committee Member of IEEE/LEOS Summer Topical Meeting on Wavelength Division Multiplexers, San Diego, July 1999

49. Program Committee of IEEE International Conference on Applications of Photonic Technology, Quebec, Canada, July 2000

50. Program Chairman of the Program of Photonics West on Monolithic and Hybrid OEICs (9 conferences), San Jose, January 2000

51. Chair of OEIC Conference in SPIE Photonics West, San Jose, January 2000

52. Chair of WDM and Photonic Switching Devices for Network Applications in SPIE Photonics West, San Jose, January 2000

53. Program Committee of Optoelectronic Interconnects and Packaging Conference in SPIE Photonics West, San Jose, January 2000

54. Symposium Chair of Photonics China, September, Beijing, China 2000

55. Chair of SPIE Optoelectronic Integrated Circuits (OEICs) Conference, part of 2000 Photonics China, September, Beijing, China 2000

56. Program Chairman of the Program of Photonics West on Components and Devices for Optical Communication (5 conferences), San Jose, January 25-31, 2002

57. Conference Chair of WDM and Photonic Switching Devices for Network Applications in SPIE Photonics West, San Jose, January 25-31, 2002

58. Symposium Chair of Optoelectronics and Microelectronics (6 parallel conferences), Nanjing, China, November 7-9, 2001

59. Conference Chair of Semiconductor OE Devices and Applications, Nanjing, China, November 7-9, 2001

60. Program Committee of the conference on "Fiber Optics and Optoelectronics for Network Applications" Nanjing, China, November 7-9, 2001

61. Program Committee of the conference on "Fiber Optic Components, Subsystems, and Systems for Telecommunications" Nanjing, China, November 7-9, 2001

62. Program Committee of USA Jian Huan Foundation, (An organization helping missionaries in China)

63. Program Committee for IEEE/LEOS International Conference on Photonics Applications, Quebec Canada 2002

64. Program Chairman of the Program of Photonics West on Monolithic and Hybrid OEICs (9 conferences), San Jose, January 2001

65. Chair of OEIC Conference in SPIE Photonics West, San Jose, January 2001

66. Chair of WDM and Photonic Switching Devices for Network Applications in SPIE Photonics West, San Jose, January 2000

67. Program Committee of Optoelectronic Interconnects and Packaging Conference in SPIE Photonics West, San Jose, January, 2001

68. Symposium Chair of Photonics China, September, Beijing, China, 2000

69. Chair of SPIE Optoelectronic Integrated Circuits (OEICs) Conference, part of 2000 Photonics China, September, Beijing, China, 2000

70. Program Committee of Jian Huan Foundation, (An organization helping missionaries in China)

71. Program Committee for IEEE/LEOS International Conference on Photonics Applications, Quebec Canada, 2002

72. Program Chairman of the Program of Photonics West on Components and Devices for Optical Communication (5 conferences), San Jose, January 25-31, 2003

73. Conference Chair of 2003 WDM and Photonic Switching Devices for Network Applications, San Jose, January 25-31, 2003

74. 2003 Program Committee of USA Jian Huan Foundation, (An organization helping missionaries in China)

75. Program Committee for IEEE/LEOS International Conference on Photonics Applications, Quebec Canada, 2003

76. Conference Chair for IEEE/LEOS Summer Topical Meeting in Optical Interconnections and VLSI Photonics, June, San Diego 2004

77. Program Chair for 2004 Photonics Asia in Beijing on the photonics Integration portion of the Symposium (5 parallel conferences)

78. 2004 Program Committee of USA Jian Huan Foundation, (An organization helping missionaries in China)

79. Conference Chair of 2004 Photonics West Conference on Photonics Packaging and Integration, San Jose, January, 27-30, 2004

80. Session Chair of 2004 SPIE Annual Meeting on Photonic Devices and Algorithms for Computing VI, August, Denver, August, 2nd, 2004

81. Moderator and Chairman of panel discussion on Future market Projection of Optoelectronic Interconnects and VLSI Photonics, San Diego, June 29, 2004

82. Program Committee for 2004 Photonics Asia in Beijing on the photonics Integration portion of the Symposium (5 parallel conferences), November 2004 in Beijing

83. Chair, 2005 SPIE International Meeting: Photonic West in Optoelectronic Packaging, 1/24-28/2005

84. Organizing Committee, IEEE International Workshop on VLSI Design, SuZou, China, 8/28-31/2005

85. Cochair of "Optical interconnects and Packaging" on IEEE 3S Workshop-SOP, SIP, SOC Technologies September 22-23 2005, Georgia Tech---Global Learning Center on 5th Street Atlanta.

86. Chair of "Technology Advancement in Optical Interconnects and Packaging," IEEE 4th International Conference on Optical Communications and Networks Dec. 14-16, 2005, Bangkok, Thailand

87. Chair, 2006 SPIE International Meeting: Photonic West in Optoelectronic Packaging, 1/24-28/2006.

88. Program Committee of 2006 IEEE International Conference on Optical Communications and Networks, ChengDu, China, September 24-27, 2006

89. Program Committee of 2006 OSA Topical meeting on Integrated Photonics Research and Applications (IPRA), April 24-26, 2006 at the Mohegan Sun Hotel in Uncasville, CT.

90. Program Committee 2006 Asia Optical Fiber Communications and Optoeletronic Conference September 16-19, ShangHai Convention Center, 99 XinYi Road, 2006

91. Program Committee of IEEE/LEOS 2006 Annual Meeting program on Optoelectronic Packaging

92. Chair, 2007 SPIE International Meeting: Photonic West in Optoelectronic Packaging, 1/24-28/2007

93. Advisory Committee, The 7th International Symposium on Advanced Organic Photonics Japanese-French Joint Workshop on Photonics and Electronics, June 14-15, Palais des Congrès, Angers in France, 2007

94. Program Committee, 6^{th} International Conference on Optical Communications and Networks ICOCN 2007, 7-9 August 2007, Margala Hotel, Islamabad, Pakistan

95. Program Committee of IEEE/LEOS 2007 Annual Meeting program on Optoelectronic Packaging

96. Chair, 2007 SPIE International Meeting: Photonic West in Optoelectronic Integration and Packaging, 1/24-28/2008

97. Program Committee of IEEE/LEOS 2008 Annual Meeting program on Optoelectronic Packaging, October 9-12, Arlington, Virginia

98. Session Chair, IEEE/OSA Asia Optical Fiber Communication and Optoelectronic Exhibition and Conference, Shanghai, October 30 to November 2, 2008

99. Chair, IEEE Winter Topical Meeting on Nanophotonics, Austria, January 2009

100. Chair, 2009 SPIE International Meeting: Photonic West in Optoelectronic Integration and Packaging, 1/25-29/2009

101. Program Committee for OSA/IEEE Optical Fiber Communications (OFC) Conference, March 2009.

102. Co-Chair of Committee Co-Chair for the meeting on Optoelectronic Devices and Integration for the 2nd International Photonics and Optoelectronics meetings (POEM 2, August 2009, Wuhan, China)

103. Co-Chair of SPIE 2010 PhotonicsWest, conference on Optical Interconnects and Packaging, January 2010 in San Jose

104. Member of IEEE/OSA Optical Fiber Communications (OFC) Conference, March 2009-September 2009

105. Member of Member of Program Committee of IEEE/LEOS 2008 Annual Meeting program on Optoelectronic Packaging, November 2010, Denver, Colorado

106. Chair of SPIE 2010 Photonics West conference on Optical Interconnects and Packaging, January 2010 and 2011 in San Jose, California

107. Committee member of 2011 and 2012 RF and Millimeter-Wave Photonics I, January 21-26, 2011, Moscone Center, San Francisco, California

108. Member of Member Committee of IEEE/LEOS Annual Meeting program on Optoelectronic Packaging, October 9-13, 2011, Arlington, Virginia

109. Session Chair for 2012 Spring Materials Research Society Meeting "M-Optical Interconnects--Materials, Performance, and Applications", San Francisco, 2012

110. Conference Chair of 2012 Photonics West Conference on "Optoelectronics Interconnects XII", San Francisco, CA, 23-25, January, 2012

111. Program Committee of 2012 photonics West Conference on "RF and Millimeter Wave Photonics"

112. Chair for 2013 Optoelectronic Interconnects and Packaging Conference, SPIE Photonics West, Feb, 2-6, 2013

113. Forum Panel Member for 2013 Nano Science and Technology Conference, QingDao, China, Oct. 25-28, 2012

114. Session Chair for 2013 Photonics West Conference on Optoelectronic Integrated Circuit, Session Chair on Si Photonics for Optical Interconnects, February 6, San Francisco, CA, 2013

115. IEEE Photonics Society IEEE Fellow Evaluation Committee, 2013-2015

116. Optical Society of America 2014 Fraunhofer Award/Burley Price Award Committee Chair, 2013

117. Co-Chair for 2014 Optoelectronic Interconnects and Packaging Conference, SPIE Photonics West, San Francisco Feb, 1-5, 2014

118. Invited Panelist for 2014 Invest Austin Symposium, Hosted by Austin City Government and D B Business group, April, 7-9, 2014

119. IEEE Photonics Society Fellow Selection Committee, April 2014

120. Co-Chair for 2015 Optoelectronic Interconnects, SPIE Photonics West, San Francisco Feb, 1-5, 2015

121. Program Committee and session chair for 2015 Optoelectronic Integrated Circuit Conference, SPIE Photonics West, San Francisco, 2015

122. Co-Chair for 2016 Optoelectronic Interconnects, SPIE Photonics West, San Francisco Feb, 8-10, 2016

123. Program Committee and session chair for 2016 Optoelectronic Integrated Circuit Conference, SPIE Photonics West, San Francisco, Feb., 8-10, 2016

124. Co-Chair for 2017 Optoelectronic Interconnects, SPIE Photonics West, San Francisco Feb, 8-10, 2017

125. Program Committee and session chair for 2017 Optoelectronic Integrated Circuit Conference,

SPIE Photonics West, San Francisco, Feb., 2017

126. Co-Chair for 2018 Optoelectronic Interconnects, SPIE Photonics West, San Francisco Feb, 2018
127. Program Committee and session chair for 2018 Optoelectronic Integrated Circuit Conference, SPIE Photonics West, San Francisco, Feb., 2018
128. Session Chair for Carbon Nanomaterials of Nanotechnology Congress and Expo., April 16-18, Dubai, UAE, 2018
129. Co-Chair for 2019 Optoelectronic Interconnects, SPIE Photonics West, San Francisco Feb, 2019
130. Program Committee and session chair for 2019 Optoelectronic Integrated Circuit Conference, SPIE Photonics West, San Francisco, Feb., 2019
131. Co-Chair for 2020 Optoelectronic Interconnects, SPIE Photonics West, San Francisco Feb, 2020
132. Program Committee and session chair for 2020 Optoelectronic Integrated Circuit Conference, SPIE Photonics West, San Francisco, Feb., 2020
133. Co-Chair for 2021 Optoelectronic Interconnects, SPIE Photonics West, San Francisco January, 2021(online symposium due to the COVID-19 pandemic)
134. Program Committee and session chair for 2021 Optoelectronic Integrated Circuit Conference, SPIE Photonics West, San Francisco, January., 2021 (online symposium due to the COVID-19 pandemic)
135. Program Committee and session chair for 2022 Ultra-High-Definition Imaging Systems V, January 26-27, 2022
136. Co-Chair for 2022 Optoelectronic Interconnects, SPIE Photonics West, San Francisco January, 2022
137. Program Committee and session chair for 2022 Optoelectronic Integrated Circuit Conference, SPIE Photonics West, San Francisco, January., 2022
138. Program Committee and session chair for 2023 Ultra-High-Definition Imaging Systems V, January 26-27, 2023
139. Co-Chair for 2023 Optoelectronic Interconnects, SPIE Photonics West, San Francisco January, 2023
140. Program Committee and session chair for 2023 Optoelectronic Integrated Circuit Conference, SPIE Photonics West, San Francisco, January., 2023
141. Program Committee and session chair for 2023 Ultra-High-Definition Imaging Systems V, January 26-27, 2024
142. Co-Chair for 2023 Optoelectronic Interconnects and Packaging, SPIE Photonics West, San Francisco January, 2024
143. Program Committee and session chair for 2023 Optoelectronic Integrated Circuit Conference, SPIE Photonics West, San Francisco, January., 2024

Refereed Journal Articles:

1. Midkiff, Jason, Po-Yu Hsiao, Patrick T. Camp, and Ray T. Chen. “Mid-infrared 2D nonredundant optical phased array of mirror emitters in an InGaAs/InP platform.” arXiv preprint arXiv:2404.08851 (2024).

2. Sourabh Jain, May Hlaing, Kang Chieh Fan, Jason Midkiff, Shupeng Ning, Chenghao Feng, Po Yu Hsiao, Patrick Camp, Ray Chen, “Incubating Advances in Integrated Photonics with Emerging Sensing and Computational Capabilities”, arxiv.org/abs/2403.19850, 2024.

3. Xia, Lipeng, Yuheng Liu, Ray T. Chen, Binbin Weng, and Yi Zou. “Advancements in miniaturized infrared spectroscopic-based volatile organic compound sensors: A systematic review.” Applied Physics Reviews 11, no. 3 (2024).

4. Qi Zhang, Chaofan Gu, Ragini Singh, Sourabh Jain, Ray Chen, Bingyuan Zhang, and Santosh Kumar. “Hump-Shaped Seven-Core Fiber-based WaveFlex Biosensor for Rapid Detection of Glyphosate Pesticides in Real Food Samples”, Optics Express, Vol 32(15), pp. 25789-25804, 2024.

5. Ning, S., Zhu, H., Feng, C., Gu, J., Jiang, Z., Ying, Z., Midkiff, J., Jain, S., Hlaing, M.H., Pan, D.Z. and Chen, R.T. Photonic-Electronic Integrated Circuits for High-Performance Computing and AI Accelerator. IEEE JLT, 2024. DOI:10.1109/JLT.2024.3427716.

6. S. Lin , S. Ning , H. Zhu, T. Zhou, C. L. Morris, S. Clayton, M. J. Cherukara, R. T. Chen, and Zhehui Wang, “Neural network methods for radiation detectors and imaging” Frontiers in Physics, Vol. 12, pp.1-27, 2024. https://doi.org/10.3389/fphy.2024.1334298.

7. J Gu, H Zhu, C Feng, Z Jiang, RT Chen, DZ Pan, “M3ICRO: Machine Learning-Enabled Compact Photonic Tensor Core based on Programmable Multi-Operand Multimode Interference,” APL Mach. Learn. 2, 016106 (2024)

8. Chenghao Feng, Jiaqi Gu, Hanqing Zhu, Shupeng Ning, Rongxing Tang, May Hlaing, Jason Midkiff, Sourabh Jain, David Z. Pan, Ray T. Chen, “Integrated multi-operand optical neurons for scalable and hardware-efficient deep learning,” Nanophotonics 13(12), pp. 2193-2206, 2024.

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“A WDM based scalable on chip silicon integrated optical comparator for high speed and energy efficient digital computing”, Plenary Speaker, IEEE Electronics Packaging Society workshop on Recent Progress of Photonics-Electronics Fusion Technologies Feb. 10, Tokyo, 2022

“Integrated Photonics for Computation, Interconnects and Sensing,” seminar in the University of Delaware, 22nd, April, 2022.

“Integrated photonics for computing, interconnects and sensing” Tutorial Talk (one hour) in 2021 IEEE/Optica CLEO conference, May, Los Angeles, 2021

“Integrated Photonics for Sensing and Optical Computing” Invited Talk at International Workshop on Photonics Polymer for Innovation (IWPPI2018) which will take place in Suwa, Nagano, Japan during Oct.15-18, 2018

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“Silicon Photonics for 2020 and beyond” Plenary Talk at the International Symposium on Nano and Micro Conference at the Ramada Plaza Jeju, Jeju, South Korea, December 17 ~ 20 2018

“Integrated Photonics for Bio and Chemical Sensing”, National Taiwan University, Taipei, Taiwan, 12/21/2018

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“Silicon Nano-Photonics for Computation, Interconnects and Sensing” ECE Department, Cornell University, Ithaca, NY, May 24, 2019

“Mid-Infrared Trace Gas Sensing using Photonic Crystal Waveguides” IEEE Summer Topical Meeting, Fort Lauderdale, Florida, July 8-10, 2019

“Integarted Photonics for 2020 and beyond” Tutorial talk in International Conference on Information Optics and Photonics (CIOP), Xian, 8/6-8/2019

“Mid-IR Integrated Photonics for Communications and sensing” National Sun Yat San University, Kaoshiong, Taiwan, ROC, March 15, 2018

Plenary Speech entitled “Integrated Photonics for Chemical and Bio-sensing,” Nanotechnology Congress and Expo., April 17, Dubai, UAE, 2018

“Mid-IR Integrated Photonics for Communications and sensing “ NASA AMES, Mountain View, California, May 16th, 2018

“Future Projection of Basic Research on Nanophotonics” DOE Round Table Panel for future direction of basic research in Microelectronics, Department of Energy, Germany Town, Washington DC, May 18, 2018

“Applications of Mid-IR Integrated Photonics Devices” OSA Mid IR Integrated Photonics Incubator, Optical Society of America Headquarter, Washington D. C., May 21, 2018

‘Optical Interconnects for 4-degree Kelvin environment” ONR/DOE Workshop on Super Cables, Office of Naval Research, 2017, Washington D. C., 2017

“Integrated Photonics for Interconnects, Cummunications and Sensing” Boise State University, Idaho, September 6, 2017

“Mid-IR On-Chip Waveguide Sensing Devices” Hua Nan University of Technology, Guangzhou, China, Oct. 17, 2017

“Integrated Photonics for Computing and Sensing” Tel-Aviv Univ, Tel-Aviv, Israel, Oct. 23, 2017

“Mid-IR Integrated Photonics for Chemical Sensing” Hebrew University, Jerusalem, Israel, Oct. 26, 2017

“ Integrated Photonics for Communications, Computing and Sensing”, TsingHua University, Beijing, Nov., 15, 2017

“Lab-on-chip sensing platforms,” Beijing University, Beijing, China, Nov. 15, 2017

“Integrated Photonics for Bio-sensing,”, Beijing University of Posts and Telecommunications, Nov. 16, 2017

“Silicon Photonics for sensing and communications,” National TsingHua University, XinChu, Taiwan, ROC, Dec., 14th, 2017

“Lab-on-chip Devices for communication, computing and Sensing,” National Taiwan University, Taipei, Taiwan, ROC, Dec. 22nd, 2017

“Semiconductor-membrane based Integrated Photonic Sensors for Air-and Water-pollution Sensing,” At OSA Incubators Topical Meeting, May, 17, 2017 OSA Head Quarter, Washington DC

“Silicon Nanomembrane Photonic Crystal Waveguide for Ultra Wideband RF Sensing,” Invited Speech in NASA AMES Technology Transfer Outreach Conference, AMES, September 14th, 2016, San Jose, California.

*“*Silicon based On-chip Sub-Wavelength Grating Ring and Racetrack Resonator BioSensors*,” Invited Paper, MRS Fall Meeting,* Manuscript ID MRSF16-2567505*, Boston, November, 2016*

“Ultra Sensitive Hand-held Biochemical and RF sensing devices,” Invited Speech, Defense Innovation Technology Challenge, November 29th, 2017, Austin, Texas.

“Silicon Nanophotonic Devices for Interconnects, Computing and Sensing,” Global Congress & Expo on Materials Science & Nanoscience during October 24-26, 2016 at Dubai, UAE

“Integrated Photonic Chip for Wide-band Highly Sensitive EM wave Sensing”, Air Force research lab, Wright Patterson Airforce Base, Dayton, Ohio, April, 30, 2017

“Silicon Nanophotonics for Interconnects, Computing and Sensing Applications“, plenary Talk on EMN Symposium on Nanophotonics, May 4th, 2017**, Dubrovnik, Croatia.**

“EO polymer Attojoule/bit Modulator Array Operating at 4 degree K with 1 Terabits/sec Aggregate Bandwidth” Office of Naval Research, May 17, 2017, Washington DC.

“Silicon Integrated Photonics for Chemical and Biological Sensing,” Army Research Lab, May 16th, 2017, RDRL-SEE-E, 2800 Powder Mill Rd., Adelphi, Maryland

“Silicon integrated Photonics for Interconnects, Computing and Sensing

Applications," Invited Speech on Defense Innovation Submit, May 15th, Washington DC.

"Silicon Chip-based Technologies for Interconnects, Computing and Sensing Applications", Keynote Speech, EMN International Conference on Metamaterials, May, 9th, 2017, Cheng Du China

"Nanophotonic Devices for Power-efficient Computing and Optical Interconnects," Invited Speech in 2017 IEEE Photonics Society Summer Topicals Meeting Series, 10 - 12 July 2017, San Juan, Puerto Rico

"Slow Light Enhanced Silicon Chip Based Chem-Bio Sensors," Invited Speech, OSA Advanced Photonics Symposium, July 25, 2017, New Orleans.

"Silicon CMOS Compatible Highly Multiplexed Early Cancer Detection Chip" third international symposium on next generation electronics," Taoyuan, Taiwan, May 7-10, 2014

"Silicon Nanomembrane-based Nanophotonic Devices for Communications and Biosensing" The Tenth International Nanotechnology Conference on Communication and Cooperation hosted by the National Institute of Standards and Technology (NIST) in Gaithersburg, Md. May 13-15, 2014

"Silicon Photonics for next generation on-chip optical interconnects," 2014 Photonics Asia, Beijing, "Nanophotonics and Micro/Nano Optics (PA113)" as part of Photonics Asia 2014

"Silicon nanomembrane based Devices for Optical Sensing and On-chip Interconnects" OSA Annual Meeting, 19 Oct 2014 - 23 Oct 2014. Tucson, Arizona

"Label-free Highly Sensitive On-chip Early Lung Cancer Detection using Silicon Nanophotonic Devices" Distinguished Lecture Series, Medical School, Wayne State University, Michigan January, 13, 2014.

"Silicon Photonics for On-chip Optical interconnects" 2014 Photonics West Conference on optical interconnects, San Francisco, Feb 4th, 2014

"Ultra sensitive Biosensors using On-chip PCW slow light devices" 2014 Photonics West Conference on optical interconnects, San Francisco, Feb 4th, 2014

"Early Cancer Detection using silicon on chip slow light devices," International Lung Cancer Conference, Rome, Italy, December 5, 2013

"Silicon photonic crystal microarrays for high throughput label-free detection of lung cancer cell line lysates with sensitivity and specificity," Invited Talk SPIE Photonics West, Feb, 5, 2013

Silicon Nanomembranes for Optical Phased Array and Optical True Time Delay Applications, Sensor Directory, Air Force Research Lab, Dayton, Ohio, April 17, 2013

"Biomedical Micro- and Nanotechnology" Invited Seminar in UT Biomedical Engineering Department, April, 5, 2013

"Nanophotonic Label-free Sensors for High Throughput Detection of Cancers and Allergies with High Sensitivity and specificity," Invited Talk, National Institute of Health CAP Meeting, Los Angeles, May 20, 2013

"Silicon On-chip Open Bio-sensors with ultra-high Sensitivity requiring the smallest Sample Volume for Biomedical Diagnostics", Invited talk in Baylor College of Medicine, Houston, TX, May 11, 2013

"Low-Cost, High Throughput, Roll-to-Roll Ink-Jet Manufacturing of Hybrid Electronic Systems on Flexible Substrates" The Department of Navy, US Navy TAP Conference, Hyatt Hotel, Crystal City, Washington DC, June 3, 2013

One day short course on Optical Interconnects for the 1992 SPIE Annual Meeting, San Diego

One day short course on Optical Interconnects for the 1993 symposium on Optical Interconnects and Packaging, Los Angeles

Half-day short course on Introduction of Optical Interconnects for the 1994 symposium on Optoelectronic Interconnects, Los Angeles

One-day short course on Optical Interconnects for the 1994 symposium on Optoelectronic Interconnects, Los Angeles

One-day short course on Optical Interconnects and Packaging for the 1995 symposium on Optical Interconnects, San Jose

Half day short course on Optical interconnects for 1996 Photonics China, Beijing, China, 1996.

One-day short course on Optical Interconnects and Packaging for the 1996 symposium on Optical Interconnects, San Jose

One-day short course on Optical Interconnects and Packaging for the 1997 symposium on Optical Interconnects, San Jose

One-day short course on Optical Interconnects and Packaging for the 1998 symposium on Optical Interconnects, San Jose

Over 300 Invited Lectures in USA, Asia and Europe from 1998 to 2023

PATENTS

Following 82 US patents are approved

- **Vertical Photonic Crystal Waveguide for Gas Detection**

Publication number: 20210278339
Abstract: Methods and apparatuses for gas detection are disclosed, including providing a

device comprising: a light source configured to emit light; an array of vertical photonic crystal waveguides (VPCWs), wherein the VPCWs of the array of VPCWs are configured to slow and guide the light; and a detector array, wherein the detectors of the detector array are configured to measure the intensity of the light passing through each of the VPCWs of the array of VPCWs; wherein the VPCWs of the array of VPCWs slow and guide light having a wavelength within the absorption bands of the one or more gas species to be detected; exposing the apparatus to a gaseous environment such that gas from the environment flows through the array of VPCWs; and reading values from the detectors of the detector array to identify the presence of the one or more gas species. Other embodiments are described and claimed.
Type: Application
Filed: March 8, 2021
Publication date: September 9, 2021
Inventors: Hamed Dalir, Ray T. Chen, Mohammad H. Teimourpour, Jason Midkiff, Ali Rostamian

- **Two-dimensional photonic crystal MicroArray measurement method and apparatus for highly-sensitive label-free multiple analyte sensing, biosensing, and diagnostic assay**

  Patent number: 11097246
  Abstract: Methods and systems for highly-sensitive label-free multiple analyte sensing, biosensing, and diagnostic assay are disclosed. The systems comprise an on-chip integrated two-dimensional photonic crystal sensor chip. The invention provides modulation methods, wavelength modulation and intensity modulation, to monitor the resonance mode shift of the photonic crystal microarray device and further provides methods and systems that enable detection and identification of multiple species to be performed simultaneously with one two-dimensional photonic crystal sensor chip device for high throughput chemical sensing, biosensing, and medical diagnostics. Other embodiments are described and claimed.
  Type: Grant
  Filed: March 6, 2020
  Date of Patent: August 24, 2021
  Assignee: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Yunbo Guo, Ray T Chen

- **Two-Dimensional Photonic Crystal MicroArray Measurement Method and Apparatus for Highly-Sensitive Label-Free Multiple Analyte Sensing, Biosensing, and Diagnostic Assay**

  Publication number: 20200206711
  Abstract: Methods and systems for highly-sensitive label-free multiple analyte sensing, biosensing, and diagnostic assay are disclosed. The systems comprise an on-chip integrated two-dimensional photonic crystal sensor chip. The invention provides modulation methods, wavelength modulation and intensity modulation, to monitor the resonance mode shift of the photonic crystal microarray device and further provides methods and systems that enable detection and identification of multiple species to be performed simultaneously with one two-dimensional photonic crystal sensor chip device for high throughput chemical sensing, biosensing, and medical diagnostics. Other embodiments are described and claimed.
  Type: Application
  Filed: March 6, 2020
  Publication date: July 2, 2020
  Applicant: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Yunbo Guo, Ray T. Chen

- **Optical devices with transverse-coupled-cavity**

  Patent number: 10658815
  Abstract: A light-emitting device is provided. The light-emitting device can include a main cavity formed within an epitaxial structure that is configured to generate light in response to having an electrical current provided thereto. The light-emitting device can also include a plurality of feedback cavities also formed within the epitaxial structure, where each of the plurality of feedback cavities are transversely-coupled with the main cavity to receive light from the main cavity and reflect at least some feedback light back into the main cavity. The light-emitting device may provide enhanced modulation bandwidth or ultra-high speed communication capabilities.
  Type: Grant
  Filed: February 5, 2019
  Date of Patent: May 19, 2020
  Assignee: Avago Technologies International Sales Pte. Limited
  Inventors: Hamed Dalir, Moustafa Farghal Ahmed, Ray T. Chen

- **Two-dimensional photonic crystal microarray measurement method and apparatus for highly-sensitive label-free multiple analyte sensing, biosensing, and diagnostic assay**

  Patent number: 10610846
  Abstract: Methods and systems for highly-sensitive label-free multiple analyte sensing, biosensing, and diagnostic assay are disclosed. The systems comprise an on-chip integrated two-dimensional photonic crystal sensor chip. The invention provides modulation methods, wavelength modulation and intensity modulation, to monitor the resonance mode shift of the photonic crystal microarray device and further provides methods and systems that enable detection and identification of multiple species to be performed simultaneously with one two-dimensional photonic crystal sensor chip device for high throughput chemical sensing, biosensing, and medical diagnostics. Other embodiments are described and claimed.
  Type: Grant
  Filed: June 18, 2014
  Date of Patent: April 7, 2020
  Assignee: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Yunbo Guo, Ray T. Chen

- **Slot waveguide with structural modulation**

  Patent number: 10490906
  Abstract: Apparatuses for communication or sensing are disclosed, the apparatuses comprising a substrate; a bottom cladding disposed on the substrate; a device layer disposed on the bottom cladding, wherein the device layer comprises: two substantially parallel rails extending from an input side to an output side of the device layer and configured to form a slot between the two substantially parallel rails, wherein each of the two substantially parallel rails comprises an inner edge adjacent to the slot and an outer edge opposite the slot; and one or more teeth coupled to each of the two substantially parallel rails; and a top cladding disposed onto the device layer and bottom cladding; wherein the bottom cladding, the device layer, and the top cladding are configured to support at least one optical guided mode. Other embodiments are described and claimed.
  Type: Grant
  Filed: August 22, 2017
  Date of Patent: November 26, 2019

Assignee: Omega Optics, Inc.
Inventors: Xiaochuan Xu, Ray T. Chen

- **Slot Waveguide with Structural Modulation**

  Publication number: 20190067830
  Abstract: Apparatuses for communication or sensing are disclosed, the apparatuses comprising a substrate; a bottom cladding disposed on the substrate; a device layer disposed on the bottom cladding, wherein the device layer comprises: two substantially parallel rails extending from an input side to an output side of the device layer and configured to form a slot between the two substantially parallel rails, wherein each of the two substantially parallel rails comprises an inner edge adjacent to the slot and an outer edge opposite the slot; and one or more teeth coupled to each of the two substantially parallel rails; and a top cladding disposed onto the device layer and bottom cladding; wherein the bottom cladding, the device layer, and the top cladding are configured to support at least one optical guided mode. Other embodiments are described and claimed.
  Type: Application
  Filed: August 22, 2017
  Publication date: February 28, 2019
  Applicant: Omega Optics, Inc.
  Inventors: Xiaochuan Xu, Ray T. Chen

- **Subwavelength photonic crystal waveguide in optical systems**

  Patent number: 10215918
  Abstract: An optical system is disclosed. The optical system comprising: a substrate; and a subwavelength photonic crystal waveguide atop the substrate, wherein the subwavelength photonic crystal waveguide comprises a periodic one or two-dimensional array of two or more interleaved dielectric pillars; wherein the periodicity of the one or two-dimensional array is constant, a combination of two or more periods, or random; wherein the one or two-dimensional array is substantially linear or curved; wherein each of the pillars of the one or two-dimensional array is at least one of a triangular prism, a trapezoidal prism, an elliptic cylinder, a cylinder, a tube, a frustum, a pyramid, a trapezoidal prism, and an asymmetric frustum; and wherein each of the pillars of the one or two-dimensional array comprises a solid, liquid, and/or gas. Other embodiments are described and claimed.
  Type: Grant
  Filed: September 30, 2016
  Date of Patent: February 26, 2019
  Assignee: Omega Optics, Inc.
  Inventors: Xiaochuan Xu, Ray T. Chen

- **Subwavelength Photonic Crystal Waveguide in Optical Systems**

  Publication number: 20170146738
  Abstract: An optical system is disclosed. The optical system comprising: a substrate; and a subwavelength photonic crystal waveguide atop the substrate, wherein the subwavelength photonic crystal waveguide comprises a periodic one or two-dimensional array of two or more interleaved dielectric pillars; wherein the periodicity of the one or two-dimensional array is constant, a combination of two or more periods, or random; wherein the one or two-dimensional array is substantially linear or curved; wherein each of the pillars of the one or two-dimensional

array is at least one of a triangular prism, a trapezoidal prism, an elliptic cylinder, a cylinder, a tube, a frustum, a pyramid, a trapezoidal prism, and an asymmetric frustum; and wherein each of the pillars of the one or two-dimensional array comprises a solid, liquid, and/or gas. Other embodiments are described and claimed.
Type: Application
Filed: September 30, 2016
Publication date: May 25, 2017
Applicant: Omega Optics, Inc.
Inventors: Xiaochuan Xu, Ray T. Chen

- **Method for label-free multiple analyte sensing, biosensing and diagnostic assay**

  Patent number: 9579621
  Abstract: Methods and systems for label-free multiple analyte sensing, biosensing and diagnostic assay chips consisting of an array of photonic crystal microcavities along a single photonic crystal waveguide are disclosed. The invention comprises an on-chip integrated microarray device that enables detection and identification of multiple species to be performed simultaneously using optical techniques leading to a high throughput device for chemical sensing, biosensing and medical diagnostics. Other embodiments are described and claimed.
  Type: Grant
  Filed: November 26, 2013
  Date of Patent: February 28, 2017
  Assignee: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Ray T. Chen

- **Subwavelength photonic crystal waveguide with trapezoidal shaped dielectric pillars in optical systems**

  Patent number: 9563016
  Abstract: A method for reducing loss in a subwavelength photonic crystal waveguide bend is disclosed. The method comprising: forming the subwavelength photonic crystal waveguide bend with a series of trapezoidal shaped dielectric pillars centered about a bend radius; wherein each of the trapezoidal shaped dielectric pillars comprise a top width, a bottom width, and a trapezoid height; wherein the length of the bottom width is greater than the length of the top width; and wherein the bottom width is closer to the center of the bend radius of the subwavelength photonic crystal waveguide bend than the top width. Other embodiments are described and claimed.
  Type: Grant
  Filed: November 24, 2015
  Date of Patent: February 7, 2017
  Assignee: Omega Optics, Inc.
  Inventors: Xiaochuan Xu, Ray T. Chen

- **Method for fabricating and packaging an M×N phased-array antenna**

  Patent number: 9548543
  Abstract: A method for fabricating an M×N, P-bit phased-array antenna on a flexible substrate is disclosed. The method comprising ink jet printing and hardening alignment marks, antenna elements, transmission lines, switches, an RF coupler, and multilayer interconnections onto the flexible substrate. The substrate of the M×N, P-bit phased-array antenna may comprise an

integrated control circuit of printed electronic components such as, photovoltaic cells, batteries, resistors, capacitors, etc. Other embodiments are described and claimed.
Type: Grant
Filed: January 7, 2015
Date of Patent: January 17, 2017
Assignee: Omega Optics, Inc.
Inventors: Harish Subbaraman, Xiaochuan Xu, Yihong Chen, Ray T. Chen

- **Method for fabricating and packaging an M x N phased-array antenna on a flexible substrate utilizing ink-jet printing**

  Publication number: 20160197411
  Abstract: A method for fabricating an M×N, P-bit phased-array antenna on a flexible substrate is disclosed. The method comprising ink jet printing and hardening alignment marks, antenna elements, transmission lines, switches, an RF coupler, and multilayer interconnections onto the flexible substrate. The substrate of the M×N, P-bit phased-array antenna may comprise an integrated control circuit of printed electronic components such as, photovoltaic cells, batteries, resistors, capacitors, etc. Other embodiments are described and claimed.
  Type: Application
  Filed: January 7, 2015
  Publication date: July 7, 2016
  Applicant: Omega Optics, Inc.
  Inventors: Harish Subbaraman, Xiaochuan Xu, Yihong Chen, Ray T. Chen

- **Method of manufacturing polymer optical waveguides and devices thereof**

  Patent number: 9195005
  Abstract: A fully additive method for forming optical waveguides and devices, such as thermo-optic polymer switches and electro-optic polymer modulators, is disclosed. A first polymer material of refractive index N1 is coated onto a suitable substrate to form a first cladding layer. The first cladding is then selectively patterned using a mold to form an impression of the waveguide core into the first cladding layer. Next, a core layer is formed by ink-jet printing onto the imprinted first cladding layer with a core material of refractive index N2 (N2>N1). The core layer is subsequently coated by ink-jet printing with a second polymer material of refractive index N3 (N3<N2) to form a second cladding, resulting in an optical waveguide. An electrode may be ink-jet printed before coating the first cladding material or after coating the second cladding material, or both before and after coating, in order to form active photonic devices.
  Type: Grant
  Filed: October 1, 2013
  Date of Patent: November 24, 2015
  Assignee: Omega Optics, Inc.
  Inventors: Harish Subbaraman, Ray T. Chen

- **Broadband, group index independent, and ultra-low loss coupling into slow light slotted photonic crystal waveguides**

  Patent number: 9170374
  Abstract: The present invention provides a waveguide coupler configured to optically couple a strip waveguide to a first slot photonic crystal waveguide, wherein the slot photonic crystal waveguide has a lattice constant, an air hole diameter, a slot width and a first line defect

waveguide width. The waveguide coupler includes a group reflective index taper having a second slot photonic crystal waveguide disposed between and aligned with the first slot photonic crystal waveguide and the strip waveguide. The second slot photonic crystal waveguide has a length, the lattice constant, the air hole diameter, the slot width, and a second line defect waveguide width that is substantially equal to the first line defect waveguide width adjacent to the first slot photonic crystal waveguide and decreases along the length of the second photonic crystal waveguide.
Type: Grant
Filed: June 13, 2012
Date of Patent: October 27, 2015
Assignee: BOARD OF REGENTS, THE UNIVERSITY OF TEXAS SYSTEM
Inventors: Ray T. Chen, Che-Yun Lin

- **Packaged chip for multiplexing photonic crystal microcavity coupled waveguide and photonic crystal slot waveguide devices for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, specificity, and wide dynamic range**

  Patent number: 9164026
  Abstract: Systems and methods for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity are disclosed. The invention comprises packaged chips for multiplexing photonic crystal microcavity waveguide and photonic crystal slot waveguide devices. The packaged chips comprise crossing waveguides to prevent leakage of fluids from the microfluidic channels from the trenches or voids around the light guiding waveguides. Other embodiments are described and claimed.
  Type: Grant
  Filed: January 27, 2014
  Date of Patent: October 20, 2015
  Assignee: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Amir Hosseini, Ray T. Chen

- **Integrated photonic crystal structures and their applications**

  Patent number: 9157856
  Abstract: Devices, methods and systems based on integrated photonic crystal structures are disclosed. An integrated photonic crystal structure includes a photonic crystal structure and a defect member disposed adjacent the photonic crystal structure. The defect member includes a photoconductive material. The integrated photonic crystal structure is configured to receive an input light signal such that the input light signal is internally reflected within the photonic crystal structure and the defect member, such that the input light signal is absorbed by the photoconductive material in the defect member, and such that a property of the photoconductive material is changed to thereby output an output signal.
  Type: Grant
  Filed: September 10, 2013
  Date of Patent: October 13, 2015
  Inventors: Yunbo Guo, Harish Subbaraman, Ray T. Chen

- **Method for the chip-integrated spectroscopic identification of solids, liquids, and gases**

  Patent number: 9157850

Abstract: Methods and systems for a label-free on-chip optical absorption spectrometer consisting of a photonic crystal slot waveguide are disclosed. The invention comprises an on-chip integrated optical absorption spectroscopy device that combines the slow light effect in photonic crystal waveguide and optical field enhancement in a slot waveguide and enables detection and identification of multiple analytes to be performed simultaneously using optical absorption techniques leading to a device for chemical and biological sensing, trace detection, and identification via unique analyte absorption spectral signatures. Other embodiments are described and claimed.
Type: Grant
Filed: November 26, 2013
Date of Patent: October 13, 2015
Assignee: Omega Optics, Inc.
Inventors: Swapnajit Chakravarty, Ray T. Chen

- **Subwavelength grating coupler**

  Patent number: 9122820
  Abstract: A method, system or device for configuring an optical coupling device including obtaining characteristics of an optical signal and ambient conditions for storage in memory, utilizing a processor for identifying an optimum effective subwavelength area refractive index and a grating period for the input signal and ambient characteristics stored in memory, and utilizing the processor for identifying a preferred filling factor for a transverse polarization.
  Type: Grant
  Filed: February 24, 2014
  Date of Patent: September 1, 2015
  Assignee: Board of Regents, The University of Texas System
  Inventors: Ray T. Chen, Xiaochuan Xu

- **Method for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity**

  Patent number: 9063135
  Abstract: Systems and methods for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity are disclosed. The invention comprises packaged chips for multiplexing photonic crystal waveguide and photonic crystal slot waveguide devices. Other embodiments are described and claimed.
  Type: Grant
  Filed: January 24, 2014
  Date of Patent: June 23, 2015
  Assignee: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Amir Hosseini, Ray T. Chen

- **Method Of Manufacturing Multilayer Interconnects For Printed Electronic Systems**

  Publication number: 20150104562
  Abstract: A fully additive method for forming multilayer electrical interconnects for printed electronic and/or optoelectronic devices is disclosed. Electrical interconnects are fabricated by directly ink-jet printing a dielectric material with selective interconnection holes, and then ink jet printing conductive patterns and filling the interconnection holes with conductive material to form multilayer interconnects. A method for manufacturing a multilayer printed electronic system

utilizing the invention is also disclosed. Other embodiments are described and claimed.
Type: Application
Filed: October 10, 2013
Publication date: April 16, 2015
Applicant: OMEGA OPTICS, INC.
Inventors: Harish Subbaraman, Ray T. Chen

- **Method Of Manufacturing Polymer Optical Waveguides And Devices Thereof**

  Publication number: 20150093515
  Abstract: A fully additive method for forming optical waveguides and devices, such as thermo-optic polymer switches and electro-optic polymer modulators, is disclosed. A first polymer material of refractive index N1 is coated onto a suitable substrate to form a first cladding layer. The first cladding is then selectively patterned using a mold to form an impression of the waveguide core into the first cladding layer. Next, a core layer is formed by ink-jet printing onto the imprinted first cladding layer with a core material of refractive index N2 (N2>N1). The core layer is subsequently coated by ink jet printing with a second polymer material of refractive index N3 (N3<N2) to form a second cladding, resulting in an optical waveguide. An electrode may be ink jet printed before coating the first cladding material or after coating the second cladding material, or both before and after coating, in order to form active photonic devices.
  Type: Application
  Filed: October 1, 2013
  Publication date: April 2, 2015
  Applicant: Omega Optics, Inc.
  Inventors: Harish Subbaraman, Ray T. Chen

- **Integrated Printed Decorative Antenna And Electronics**

  Publication number: 20150002346
  Abstract: Apparatuses comprising an integrated printed decorative image with a printed antenna structure and/or printed electronic circuits are disclosed. In one embodiment, the apparatus comprises a printed decorative image atop the layer of the printed antenna structure, wherein the printed antenna structure is substantially concealed by the printed decorative image. Other embodiments are described and claimed.
  Type: Application
  Filed: June 17, 2014
  Publication date: January 1, 2015
  Applicant: OMEGA OPTICS, INC.
  Inventors: Harish Subbaraman, Swapnajit Chakravarty, Yunbo Guo, Ray T. Chen

- **Two-Dimensional Photonic Crystal MicroArray Measurement Method and Apparatus for Highly-Sensitive Label-Free Multiple Analyte Sensing, Biosensing, and Diagnostic Assay**

  Publication number: 20140378328
  Abstract: Methods and systems for highly-sensitive label-free multiple analyte sensing, biosensing, and diagnostic assay are disclosed. The systems comprise an on-chip integrated two-dimensional photonic crystal sensor chip. The invention provides modulation methods, wavelength modulation and intensity modulation, to monitor the resonance mode shift of the photonic crystal microarray device and further provides methods and systems that enable detection and identification of multiple species to be performed simultaneously with one two-

dimensional photonic crystal sensor chip device for high throughput chemical sensing, biosensing, and medical diagnostics. Other embodiments are described and claimed.
Type: Application
Filed: June 18, 2014
Publication date: December 25, 2014
Applicant: OMEGA OPTICS, INC.
Inventors: Swapnajit Chakravarty, Yunbo Guo, Ray T. Chen

- **SUBWAVELENGTH GRATING COUPLER**

  Publication number: 20140241661
  Abstract: A method, system or device for configuring an optical coupling device including obtaining characteristics of an optical signal and ambient conditions for storage in memory, utilizing a processor for identifying an optimum effective subwavelength area refractive index and a grating period for the input signal and ambient characteristics stored in memory, and utilizing the processor for identifying a preferred filling factor for a transverse polarization.
  Type: Application
  Filed: February 24, 2014
  Publication date: August 28, 2014
  Applicant: Board of Regents, The University of Texas System
  Inventors: Ray T. Chen, Xiaochuan Xu

- **Broadband, Group Index Independent, and Ultra-Low Loss Coupling into Slow Light Slotted Photonic Crystal Waveguides**

  Publication number: 20140219602
  Abstract: The present invention provides a waveguide coupler configured to optically couple a strip waveguide to a first slot photonic crystal waveguide, wherein the slot photonic crystal waveguide has a lattice constant, an air hole diameter, a slot width and a first line defect waveguide width. The waveguide coupler includes a group reflective index taper having a second slot photonic crystal waveguide disposed between and aligned with the first slot photonic crystal waveguide and the strip waveguide. The second slot photonic crystal waveguide has a length, the lattice constant, the air hole diameter, the slot width, and a second line defect waveguide width that is substantially equal to the first line defect waveguide width adjacent to the first slot photonic crystal waveguide and decreases along the length of the second photonic crystal waveguide.
  Type: Application
  Filed: June 13, 2012
  Publication date: August 7, 2014
  Applicant: BOARD OF REGENTS, THE UNIVERSITY OF TEXAS SYSTEM
  Inventors: Ray T. Chen, Che-Yun Lin

- **Packaged Chip For Multiplexing Photonic Crystal Microcavity Coupled Waveguide And Photonic Crystal Slot Waveguide Devices For Chip-Integrated Label-Free Detection And Absorption Spectroscopy With High Throughput, Sensitivity, Specificity, And Wide Dynamic Range**

  Publication number: 20140140655
  Abstract: Systems and methods for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity are disclosed. The invention

comprises packaged chips for multiplexing photonic crystal microcavity waveguide and photonic crystal slot waveguide devices. The packaged chips comprise crossing waveguides to prevent leakage of fluids from the microfluidic channels from the trenches or voids around the light guiding waveguides. Other embodiments are described and claimed.
Type: Application
Filed: January 27, 2014
Publication date: May 22, 2014
Applicant: Omega Optics, Inc.
Inventors: Swapnajit Chakravarty, Amir Hosseini, Ray T. Chen

- **Method for Chip-Integrated Label-Free Detection and Absorption Spectroscopy with High Throughput, Sensitivity, and Specificity**

  Publication number: 20140141999
  Abstract: Systems and methods for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity are disclosed. The invention comprises packaged chips for multiplexing photonic crystal waveguide and photonic crystal slot waveguide devices. Other embodiments are described and claimed.
  Type: Application
  Filed: January 24, 2014
  Publication date: May 22, 2014
  Applicant: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Amir Hosseini, Ray T. Chen

- **Method for the Chip-Integrated Spectroscopic Identification of Solids, Liquids, and Gases**

  Publication number: 20140084147
  Abstract: Methods and systems for a label-free on-chip optical absorption spectrometer consisting of a photonic crystal slot waveguide are disclosed. The invention comprises an on-chip integrated optical absorption spectroscopy device that combines the slow light effect in photonic crystal waveguide and optical field enhancement in a slot waveguide and enables detection and identification of multiple analytes to be performed simultaneously using optical absorption techniques leading to a device for chemical and biological sensing, trace detection, and identification via unique analyte absorption spectral signatures. Other embodiments are described and claimed.
  Type: Application
  Filed: November 26, 2013
  Publication date: March 27, 2014
  Applicant: OMEGA OPTICS, INC.
  Inventors: Swapnajit Chakravarty, Ray T. Chen

- **Method for Label-Free Multiple Analyte Sensing, Biosensing and Diagnostic Assay**

  Publication number: 20140080740
  Abstract: Methods and systems for label-free multiple analyte sensing, biosensing and diagnostic assay chips consisting of an array of photonic crystal microcavities along a single photonic crystal waveguide are disclosed. The invention comprises an on-chip integrated microarray device that enables detection and identification of multiple species to be performed simultaneously using optical techniques leading to a high throughput device for chemical sensing, biosensing and medical diagnostics. Other embodiments are described and claimed.

Type: Application
Filed: November 26, 2013
Publication date: March 20, 2014
Applicant: OMEGA OPTICS, INC.
Inventors: Swapnajit Chakravarty, Ray T. Chen

- **INTEGRATED PHOTONIC CRYSTAL STRUCTURES AND THEIR APPLICATIONS**

  Publication number: 20140070082
  Abstract: Devices, methods and systems based on integrated photonic crystal structures are disclosed. An integrated photonic crystal structure includes a photonic crystal structure and a defect member disposed adjacent the photonic crystal structure. The defect member includes a photoconductive material. The integrated photonic crystal structure is configured to receive an input light signal such that the input light signal is internally reflected within the photonic crystal structure and the defect member, such that the input light signal is absorbed by the photoconductive material in the defect member, and such that a property of the photoconductive material is changed to thereby output an output signal.
  Type: Application
  Filed: September 10, 2013
  Publication date: March 13, 2014
  Inventors: Yunbo Guo, Harish Subbaraman, Ray T. Chen

- **Packaged chip for multiplexing photonic crystal waveguide and photonic crystal slot waveguide devices for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity**

  Patent number: 8636955
  Abstract: Systems and methods for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity are disclosed. The invention comprises packaged chips for multiplexing photonic crystal waveguide and photonic crystal slot waveguide devices. Other embodiments are described and claimed.
  Type: Grant
  Filed: September 9, 2012
  Date of Patent: January 28, 2014
  Assignee: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Ray T. Chen, Amir Hosseini

- **Photonic crystal microarray layouts for enhanced sensitivity and specificity of label-free multiple analyte sensing, biosensing and diagnostic assay**

  Patent number: 8623284
  Abstract: Methods and systems for label-free multiple analyte sensing, biosensing and diagnostic assay chips consisting of an array of photonic crystal microcavities along a single photonic crystal waveguide are disclosed. The invention comprises an on-chip integrated microarray device that enables detection and identification of multiple species to be performed simultaneously using optical techniques leading to a high throughput device for chemical sensing, biosensing and medical diagnostics. Other embodiments are described and claimed.
  Type: Grant
  Filed: September 9, 2012
  Date of Patent: January 7, 2014

Assignee: Omega Optics, Inc.
Inventors: Swapnajit Chakravarty, Ray T. Chen

- **Fabrication tolerant design for the chip-integrated spectroscopic identification of solids, liquids, and gases**

  Patent number: 8617471
  Abstract: Methods and systems for a label-free on-chip optical absorption spectrometer consisting of a photonic crystal slot waveguide are disclosed. The invention comprises an on-chip integrated optical absorption spectroscopy device that combines the slow light effect in photonic crystal waveguide and optical field enhancement in a slot waveguide and enables detection and identification of multiple analytes to be performed simultaneously using optical absorption techniques leading to a device for chemical and biological sensing, trace detection, and identification via unique analyte absorption spectral signatures. Other embodiments are described and claimed.
  Type: Grant
  Filed: September 9, 2012
  Date of Patent: December 31, 2013
  Assignee: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Ray T. Chen

- **Method for the chip-integrated spectroscopic identification of solids, liquids, and gases**

  Patent number: 8585974
  Abstract: Methods and systems for a label-free on-chip optical absorption spectrometer consisting of a photonic crystal slot waveguide are disclosed. The invention comprises an on-chip integrated optical absorption spectroscopy device that combines the slow light effect in photonic crystal waveguide and optical field enhancement in a slot waveguide and enables detection and identification of multiple analytes to be performed simultaneously using optical absorption techniques leading to a device for chemical and biological sensing, trace detection, and identification via unique analyte absorption spectral signatures. Other embodiments are described and claimed.
  Type: Grant
  Filed: September 9, 2012
  Date of Patent: November 19, 2013
  Assignee: Omega Optics, Inc.
  Inventors: Swapnajit Chakravarty, Ray T. Chen

- **Method for label-free multiple analyte sensing, biosensing and diagnostic assay**

  Patent number: 8580200
  Abstract: Methods and systems for label-free multiple analyte sensing, biosensing and diagnostic assay chips consisting of an array of photonic crystal microcavities along a single photonic crystal waveguide are disclosed. The invention comprises an on-chip integrated microarray device that enables detection and identification of multiple species to be performed simultaneously using optical techniques leading to a high throughput device for chemical sensing, biosensing and medical diagnostics. Other embodiments are described and claimed.
  Type: Grant
  Filed: September 9, 2012
  Date of Patent: November 12, 2013

Assignee: Omega Optics, Inc.
Inventors: Swapnajit Chakravarty, Ray T. Chen

- **Photonic crystal band-shifting device for dynamic control of light transmission**

  Patent number: 8571373
  Abstract: An active device for dynamic control of lightwave transmission properties has at least one photonic crystal waveguide that has anti-reflection photonic crystal waveguides with gradually changed group refractive indices at both input and output side. An alternating voltage or current signal applied to two electrically conductive regions changes the refractive indices of the photonic crystal materials, introducing a certain degree of blue-shift or red-shift of the transmission spectrum of the photonic crystal waveguide. The output lightwave with frequency close to the band-edge of the photonic crystal waveguide is controlled by the input electric signal. Devices having one or more such active photonic crystal waveguides may be utilized as an electro-optic modulator, an optical switch, or a tunable optical filter.
  Type: Grant
  Filed: May 23, 2011
  Date of Patent: October 29, 2013
  Inventors: Xiaolong Wang, Ray T Chen, Harish Subbaraman

- **Method for Label-Free Multiple Analyte Sensing, Biosensing and Diagnostic Assay**

  Publication number: 20130005604
  Abstract: Methods and systems for label-free multiple analyte sensing, biosensing and diagnostic assay chips consisting of an array of photonic crystal microcavities along a single photonic crystal waveguide are disclosed. The invention comprises an on-chip integrated microarray device that enables detection and identification of multiple species to be performed simultaneously using optical techniques leading to a high throughput device for chemical sensing, biosensing and medical diagnostics. Other embodiments are described and claimed.
  Type: Application
  Filed: September 9, 2012
  Publication date: January 3, 2013
  Applicant: OMEGA OPTICS, INC.
  Inventors: Swapnajit Chakravarty, Ray T. Chen

- **Packaged chip for multiplexing photonic crystal waveguide and photonic crystal slot waveguide devices for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity**

  Publication number: 20130005606
  Abstract: Systems and methods for chip-integrated label-free detection and absorption spectroscopy with high throughput, sensitivity, and specificity are disclosed. The invention comprises packaged chips for multiplexing photonic crystal waveguide and photonic crystal slot waveguide devices. Other embodiments are described and claimed.
  Type: Application
  Filed: September 9, 2012
  Publication date: January 3, 2013
  Applicant: OMEGA OPTICS, INC.
  Inventors: Swapnajit Chakravarty, Ray T. Chen, Amir Hosseini

- **Photonic Crystal MicroArray Layouts for Enhanced Sensitivity and Specificity of Label-Free Multiple Analyte Sensing, Biosensing and Diagnostic Assay**

Publication number: 20130005605
Abstract: Methods and systems for label-free multiple analyte sensing, biosensing and diagnostic assay chips consisting of an array of photonic crystal microcavities along a single photonic crystal waveguide are disclosed. The invention comprises an on-chip integrated microarray device that enables detection and identification of multiple species to be performed simultaneously using optical techniques leading to a high throughput device for chemical sensing, biosensing and medical diagnostics. Other embodiments are described and claimed.
Type: Application
Filed: September 9, 2012
Publication date: January 3, 2013
Applicant: OMEGA OPTICS, INC.
Inventors: Swapnajit Chakravarty, Ray T. Chen

- Method for the Chip-Integrated Spectroscopic Identification of Solids, Liquids, and Gases

Publication number: 20120327398
Abstract: Methods and systems for a label-free on-chip optical absorption spectrometer consisting of a photonic crystal slot waveguide are disclosed. The invention comprises an on-chip integrated optical absorption spectroscopy device that combines the slow light effect in photonic crystal waveguide and optical field enhancement in a slot waveguide and enables detection and identification of multiple analytes to be performed simultaneously using optical absorption techniques leading to a device for chemical and biological sensing, trace detection, and identification via unique analyte absorption spectral signatures. Other embodiments are described and claimed.
Type: Application
Filed: September 9, 2012
Publication date: December 27, 2012
Applicant: OMEGA OPTICS, INC.
Inventors: Swapnajit Chakravarty, Ray T. Chen

- Fabrication Tolerant Design for the Chip-Integrated Spectroscopic Identification of Solids, Liquids, and Gases

Publication number: 20120328233
Abstract: Methods and systems for a label-free on-chip optical absorption spectrometer consisting of a photonic crystal slot waveguide are disclosed. The invention comprises an on-chip integrated optical absorption spectroscopy device that combines the slow light effect in photonic crystal waveguide and optical field enhancement in a slot waveguide and enables detection and identification of multiple analytes to be performed simultaneously using optical absorption techniques leading to a device for chemical and biological sensing, trace detection, and identification via unique analyte absorption spectral signatures. Other embodiments are described and claimed.
Type: Application
Filed: September 9, 2012
Publication date: December 27, 2012
Applicant: OMEGA OPTICS, INC.

Inventors: Swapnajit Chakravarty, Ray T. Chen

- Photonic crystal band-shifiting device for dynamic control of light transmission

Publication number: 20120301075
Abstract: An active device for dynamic control of lightwave transmission properties has at least one photonic crystal waveguide that has anti-reflection photonic crystal waveguides with gradually changed group refractive indices at both input and output side. An alternating voltage or current signal applied to two electrically conductive regions changes the refractive indices of the photonic crystal materials, introducing a certain degree of blue-shift or red-shift of the transmission spectrum of the photonic crystal waveguide. The output lightwave with frequency close to the band-edge of the photonic crystal waveguide is controlled by the input electric signal. Devices having one or more such active photonic crystal waveguides may be utilized as an electro-optic modulator, an optical switch, or a tunable optical filter.
Type: Application
Filed: May 23, 2011
Publication date: November 29, 2012
Applicant: Omega Optics, Inc.
Inventors: Xiaolong Wang, Ray T. Chen, Harish Subbaraman

- Photonic crystal microarray device for label-free multiple analyte sensing, biosensing and diagnostic assay chips

Patent number: 8293177
Abstract: Methods and systems for label-free multiple analyte sensing, biosensing and diagnostic assay chips consisting of an array of photonic crystal microcavities along a single photonic crystal waveguide are disclosed. The invention comprises an on-chip integrated microarray device that enables detection and identification of multiple species to be performed simultaneously using optical techniques leading to a high throughput device for chemical sensing, biosensing and medical diagnostics. Other embodiments are described and claimed.
Type: Grant
Filed: August 3, 2009
Date of Patent: October 23, 2012
Inventors: Swapnajit Chakravarty, Ray T Chen

- Photonic crystal slot waveguide miniature on-chip absorption spectrometer

Patent number: 8282882
Abstract: Methods and systems for label-free on-chip optical absorption spectrometer consisting of a photonic crystal slot waveguide are disclosed. The invention comprises an on-chip integrated optical absorption spectroscopy device that combines the slow light effect in photonic crystal waveguide and optical field enhancement in a slot waveguide and enables detection and identification of multiple analytes to be performed simultaneously using optical absorption techniques leading to a device for chemical and biological sensing, trace detection, and identification via unique analyte absorption spectral signatures. Other embodiments are described and claimed.
Type: Grant
Filed: August 23, 2010
Date of Patent: October 9, 2012
Inventors: Swapnajit Chakravarty, Ray T Chen

- Two-dimensional surface normal slow-light photonic crystal waveguide optical phased array

Patent number: 8200055
Abstract: Methods and devices for optical beam steering are disclosed including coupling a laser light into an apparatus comprising a first substrate; an array of air core photonic crystal waveguides; columnar members etched around each air core waveguide; a pair of metal electrodes around the columnar members; a trench around the pair of metal electrodes surrounding each air core photonic crystal waveguide; a second substrate coupled to the first substrate comprising electrical interconnection lines; and a holographic fanout array comprising a third substrate; a photopolymer film coated on the third substrate; a hologram written in the photopolymer film configured to couple the laser light into the third substrate; and an array of holograms recorded in the photopolymer film configured to couple a portion of the laser light into the waveguides; and passing a current through the electrodes to induce a refractive index change in the first substrate to control the phase of the portion of the laser light that passes throug
Type: Grant
Filed: July 19, 2010
Date of Patent: June 12, 2012
Inventors: Harish Subbaraman, Ray T Chen

- Multimode interference coupler for use with slot photonic crystal waveguides

Patent number: 8189968
Abstract: The present invention provides an optical apparatus having a multimode interference coupler configured to optically couple a strip waveguide to a slot photonic crystal waveguide. The multimode interference coupler has a coupling efficiency to the slot photonic crystal waveguide greater than or equal to 90%, a width that is approximately equal to a defect width of the slot photonic crystal waveguide, a length that is equal to or less than 1.5 ?m, and interfaces with the slot photonic crystal waveguide at an edge of a period that gives a termination parameter of approximately zero. The optical apparatus may also include an insulation gap disposed between the multimode interference coupler and the slot photonic crystal waveguide, wherein the length of the multimode interference coupler is reduced by approximately one half of a width of the insulation gap.
Type: Grant
Filed: August 28, 2009
Date of Patent: May 29, 2012
Assignee: Board of Regents, The University of Texas
Inventors: Xiaonan Chen, Ray T. Chen

- Photonic crystal slot waveguide miniature on-chip absorption spectrometer

Publication number: 20120044489
Abstract: Methods and systems for label-free on-chip optical absorption spectrometer consisting of a photonic crystal slot waveguide are disclosed. The invention comprises an on-chip integrated optical absorption spectroscopy device that combines the slow light effect in photonic crystal waveguide and optical field enhancement in a slot waveguide and enables detection and identification of multiple analytes to be performed simultaneously using optical absorption techniques leading to a device for chemical and biological sensing, trace detection,

and identification via unique analyte absorption spectral signatures. Other embodiments are described and claimed.
Type: Application
Filed: August 23, 2010
Publication date: February 23, 2012
Applicant: OMEGA OPTICS INC.
Inventors: Swapnajit Chakravarty, Ray T. Chen

- Two-dimensional surface normal slow-light photonic crystal waveguide optical phased array

Publication number: 20120013962
Abstract: Methods and devices for optical beam steering are disclosed including coupling a laser light into an apparatus comprising a first substrate; an array of air core photonic crystal waveguides; columnar members etched around each air core waveguide; a pair of metal electrodes around the columnar members; a trench around the pair of metal electrodes surrounding each air core photonic crystal waveguide; a second substrate coupled to the first substrate comprising electrical interconnection lines; and a holographic fanout array comprising a third substrate; a photopolymer film coated on the third substrate; a hologram written in the photopolymer film configured to couple the laser light into the third substrate; and an array of holograms recorded in the photopolymer film configured to couple a portion of the laser light into the waveguides; and passing a current through the electrodes to induce a refractive index change in the first substrate to control the phase of the portion of the laser light that passes throug
Type: Application
Filed: July 19, 2010
Publication date: January 19, 2012
Applicant: Omega Optics, Inc.
Inventors: Harish Subbaraman, Ray T. Chen

- Carbon nanotube field effect transistor for printed flexible/rigid electronics

Publication number: 20110248243
Abstract: Methods and devices for manufacturing carbon nanotube based field effect transistors are disclosed including providing a substrate; printing a gate electrode layer onto the substrate and sintering and/or UV curing; printing a gate isolation layer onto the gate electrode and air drying and/or UV curing; printing one or more carbon nanotube channel layers onto the gate isolation layer, wherein each carbon nanotube channel layer is air dried prior to subsequent printings; and printing a source and drain electrode layer onto the one or more carbon nanotube channel layers and sintering and/or UV curing. Other embodiments are described and claimed.
Type: Application
Filed: November 30, 2009
Publication date: October 13, 2011
Applicant: Omega Optics, Inc.
Inventors: Yihong Chen, Ray T. Chen

- Photonic crystal microarray device for label-free multiple analyte sensing, biosensing and diagnostic assay chips

Publication number: 20110028346

Abstract: Methods and systems for label-free multiple analyte sensing, biosensing and diagnostic assay chips consisting of an array of photonic crystal microcavities along a single photonic crystal waveguide are disclosed. The invention comprises an on-chip integrated microarray device that enables detection and identification of multiple species to be performed simultaneously using optical techniques leading to a high throughput device for chemical sensing, biosensing and medical diagnostics. Other embodiments are described and claimed.
Type: Application
Filed: August 3, 2009
Publication date: February 3, 2011
Applicant: Omega Optics, Inc.
Inventors: Swapnajit Chakravarty, Ray T. Chen

- Photonic crystal band-shifting device for dynamic control of light transmission

Publication number: 20100310208
Abstract: An active device for dynamic control of lightwave transmission properties has at least one photonic crystal waveguide that has anti-reflection photonic crystal waveguides with gradually changed group refractive indices at both input and output side. An alternating voltage or current signal applied to two electrically conductive regions changes the refractive indices of the photonic crystal materials, introducing a certain degree of blue-shift or red-shift of the transmission spectrum of the photonic crystal waveguide. The output lightwave with frequency close to the band-edge of the photonic crystal waveguide is controlled by the input electric signal. Devices having one or more such active photonic crystal waveguides may be utilized as an electro-optic modulator, an optical switch, or a tunable optical filter.
Type: Application
Filed: June 8, 2009
Publication date: December 9, 2010
Applicant: Omega Optics, Inc.
Inventors: Xiaolong Wang, Ray T. Chen

- MULTIMODE INTERFERENCE COUPLER FOR USE WITH SLOT PHOTONIC CRYSTAL WAVEGUIDES

Publication number: 20100226608
Abstract: The present invention provides an optical apparatus having a multimode interference coupler configured to optically couple a strip waveguide to a slot photonic crystal waveguide. The multimode interference coupler has a coupling efficiency to the slot photonic crystal waveguide greater than or equal to 90%, a width that is approximately equal to a defect width of the slot photonic crystal waveguide, a length that is equal to or less than 1.5 ?m, and interfaces with the slot photonic crystal waveguide at an edge of a period that gives a termination parameter of approximately zero. The optical apparatus may also include an insulation gap disposed between the multimode interference coupler and the slot photonic crystal waveguide, wherein the length of the multimode interference coupler is reduced by approximately one half of a width of the insulation gap.
Type: Application
Filed: August 28, 2009
Publication date: September 9, 2010
Applicant: Board of Regents, The University of Texas System
Inventors: Xiaonan Chen, Ray T. Chen

- System, method and apparatus for improved electrical-to-optical transmitters disposed within printed circuit boards

Patent number: 7529448
Abstract: The present invention provides a system, method and apparatus for improved electrical-to-optical transmitters (100) disposed within printed circuit boards (104). The heat sink (110, 200) is a thermal conductive material disposed within a cavity (102) of the printed circuit board (104) and is thermally coupled to a bottom surface (112) of the electrical-to-optical transmitter (100). A portion of the thermal conductive material extends approximately to an outer surface (120, 122 or 124) of a layer (114, 116 or 118) of the printed circuit board (104). The printed circuit board may comprise a planarized signal communications system or an optoelectronic signal communications system. In addition, the present invention provides a method for fabricating the heat sink wherein the electrical-to-optical transmitter disposed within a cavity of the printed circuit board is fabricated. New methods for flexible waveguides and micro-mirror couplers are also provided.
Type: Grant
Filed: September 21, 2006
Date of Patent: May 5, 2009
Assignee: Board of Regents, The University of Texas System
Inventors: Ray T. Chen, Chulchae Choi

- System, method and apparatus for improved electrical-to-optical transmitters disposed within printed circuit boards

Patent number: 7457491
Abstract: The present invention provides a system, method and apparatus for improved electrical-to-optical transmitters (100) disposed within printed circuit boards (104). The heat sink (110, 200) is a thermal conductive material disposed within a cavity (102) of the printed circuit board (104) and is thermally coupled to a bottom surface (112) of the electrical-to-optical transmitter (100). A portion of the thermal conductive material extends approximately to an outer surface (120, 122 or 124) of a layer (114, 116 or 118) of the printed circuit board (104). The printed circuit board may comprise a planarized signal communications system or an optoelectronic signal communications system. In addition, the present invention provides a method for fabricating the heat sink wherein the electrical-to-optical transmitter disposed within a cavity of the printed circuit board is fabricated. New methods for flexible waveguides and micro-mirror couplers are also provided.
Type: Grant
Filed: September 21, 2006
Date of Patent: November 25, 2008
Assignee: Board of Regents, The University of Texas System
Inventors: Ray T. Chen, Chulchae Chol

- SYSTEM, METHOD AND APPARATUS FOR IMPROVED ELECTRICAL-TO-OPTICAL TRANSMITTERS DISPOSED WITHIN PRINTED CIRCUIT BOARDS

Publication number: 20080273830
Abstract: The present invention provides a system, method and apparatus for improved electrical-to-optical transmitters (100) disposed within printed circuit boards (104). The heat sink (110, 200) is a thermal conductive material disposed within a cavity (102) of the printed circuit board (104) and is thermally coupled to a bottom surface (112) of the electrical-to-optical

transmitter (100). A portion of the thermal conductive material extends approximately to an outer surface (120, 122 or 124) of a layer (114, 116 or 118) of the printed circuit board (104). The printed circuit board may comprise a planarized signal communications system or an optoelectronic signal communications system. In addition, the present invention provides a method for fabricating the heat sink wherein the electrical-to-optical transmitter disposed within a cavity of the printed circuit board is fabricated. New methods for flexible waveguides and micro-mirror couplers are also provided.
Type: Application
Filed: September 21, 2006
Publication date: November 6, 2008
Applicant: Board of Regents, The University of Texas System
Inventors: Ray T. Chen, Chulchae Choi

- System, method and apparatus for improved electrical-to-optical transmitters disposed within printed circuit boards

Patent number: 7444041
Abstract: The present invention provides a system, method and apparatus for improved electrical-to-optical transmitters (100) disposed within printed circuit boards (104). The heat sink (110, 200) is a thermal conductive material disposed within a cavity (102) of the printed circuit board (104) and is thermally coupled to a bottom surface (112) of the electrical-to-optical transmitter (100). A portion of the thermal conductive material extends approximately to an outer surface (120, 122 or 124) of a layer (114, 116 or 118) of the printed circuit board (104). The printed circuit board may comprise a planarized signal communications system or an optoelectronic signal communications system. In addition, the present invention provides a method for fabricating the heat sink wherein the electrical-to-optical transmitter disposed within a cavity of the printed circuit board is fabricated. New methods for flexible waveguides and micro-mirror couplers are also provided.
Type: Grant
Filed: September 21, 2006
Date of Patent: October 28, 2008
Assignee: Board of Regents, The University of Texas System
Inventors: Ray T. Chen, Chulchae Choi

- Apparatus and method for switching, modulation and dynamic control of light transmission using photonic crystals

Patent number: 7421179
Abstract: An active device for dynamic control of the transmission properties has at least one photonic crystal waveguide that has an electrically insulating layer formed within or near the waveguide core and two lateral conductive regions divided by the insulating layer. An alternating voltage signal induces phase and amplitude changes of electromagnetic wave propagating inside the device. Electromagnetic wave signals propagating through two such active photonic crystal waveguide devices may be mixed to produce at least one output signal through interference. Devices having one or more such active photonic crystal waveguides may be utilized as a tunable optical delay line, a tunable optical filter, a switch, or a modulator. A preferred embodiment comprises a photonic crystal waveguide made of a silicon slab with a periodic array of apertures or oxide columns therein, wherein an silicon oxide layer disposed in the waveguide core separates a p-doped region from an n-doped region.

Type: Grant
Filed: September 29, 2006
Date of Patent: September 2, 2008
Inventors: Wei Jiang, Ray T. Chen

- System, method and apparatus for improved electrical-to-optical transmitters disposed within printed circuit boards

Patent number: 7112885
Abstract: The present invention provides a system, method and apparatus for improved electrical-to-optical transmitters (100) disposed within printed circuit boards (104). The heat sink (110, 200) is a thermal conductive material disposed within a cavity (102) of the printed circuit board (104) and is thermally coupled to a bottom surface (112) of the electrical-to-optical transmitter (100). A portion of the thermal conductive material extends approximately to an outer surface (120, 122 or 124) of a layer (114, 116 or 118) of the printed circuit board (104). The printed circuit board may comprise a planarized signal communications system or an optoelectronic signal communications system. In addition, the present invention provides a method for fabricating the heat sink wherein the electrical-to-optical transmitter disposed within a cavity of the printed circuit board is fabricated. New methods for flexible waveguides and micro-mirror couplers are also provided.
Type: Grant
Filed: July 7, 2004
Date of Patent: September 26, 2006
Assignee: Board of Regents, The University of Texas System
Inventors: Ray T. Chen, Chulchae Chol

- Miniaturized reconfigurable DWDM add/drop system for optical communication system

Patent number: 7103244
Abstract: A DWDM add/drop system for use in optical communication system is disclosed. Using semiconductor fabrication techniques, a plurality of waveguide arrays and signal carriers are substantially symmetrically arranged about an optical axis of the system. Electrode heaters are provided proximate junctions created at the intersections of selected waveguides. Using the heaters, portions of optical signals may be redirected to other waveguides. In addition, the heaters may be used to attenuate or otherwise modify signals in the waveguides. The waveguide arrays are arranged such that a plurality of signal processing operations may be performed substantially simultaneously. In a preferred embodiment, the switches and waveguide arrays are coupled with a light focusing device and a dispersion apparatus to form a switched, combined multiplexer/demultiplexer having signal attenuation and modification capabilities.
Type: Grant
Filed: March 14, 2002
Date of Patent: September 5, 2006
Assignee: Finisar Corporation
Inventors: Ray T. Chen, William W. Morey

- Systems and devices for dynamic processing of optical signals

Patent number: 7024085

Abstract: Optical systems are disclosed which include one or more components such as an optical multiplexer, an optical demultiplexer, and, an optical amplifier. An optical device is included in the optical system and is configured to communicate with the optical component(s). The optical device includes a substrate proximate to which is disposed a first waveguide array. A second waveguide array is also provided that is disposed proximate the substrate so that a portion of the second waveguide array intersects a portion of the first waveguide array at a predetermined angle, so that a junction is formed. An index of refraction associated with the junction can be varied so that desirable effects can be implemented concerning optical signals transmitted through the waveguides.
Type: Grant
Filed: June 3, 2004
Date of Patent: April 4, 2006
Assignee: Finisar Corporation
Inventors: Terry L. Markwardt, Leif G. Fredin, Ray T. Chen, Ram Sivaraman

- Combined multiplexer and demultiplexer for optical communication systems

Patent number: 7006727
Abstract: A combined multiplexer/demultiplexer for use in optical communication systems is disclosed. The combined multiplexer/demultiplexer includes a plurality of waveguide arrays and a plurality of signal carriers, each disposed substantially symmetrically about an optical axis of the device. In operation, a signal carrier emits a multiple wavelength optical signal that is received and directed to a dispersion apparatus by a light focusing device. The dispersion apparatus diffracts the optical signal into selected spectral components and reflects the spectral components back to the waveguide arrays through the light focusing device. The signal processing, such as multiplexing and demultiplexing, performed by each waveguide array depends on their configuration. The waveguide arrays may be configured to substantially simultaneously multiplex and/or demultiplex the spectral components.
Type: Grant
Filed: March 14, 2002
Date of Patent: February 28, 2006
Assignee: Fluisar Corporation
Inventors: William W. Morey, Ray T. Chen

- Add/drop module using two full-ball lenses

Patent number: 7006728
Abstract: An optical device has a housing for receiving a plurality of optical fibers adapted to carry optical signals. A filter is disposed within the housing for transmitting specific optical signals having a predetermined wavelength range. A first ball lens is coupled to the housing and is positioned relative to the filter and the optical fibers to selectively collimate and focus the optical signals. A second ball lens is coupled to the housing and is also positioned relative to the filter and optical fibers to selectively collimate and focus the optical signals. Both ball lenses are optically coupled to the filter.
Type: Grant
Filed: June 23, 2003
Date of Patent: February 28, 2006
Assignee: Finisar Corporation
Inventors: Wei Jiang, Yingzhi Sun, Ray T. Chen

- Systems and devices for dynamic processing of optical signals

Publication number: 20040218855
Abstract: Optical systems are disclosed which include one or more components such as an optical multiplexer, an optical demultiplexer, and, an optical amplifier. An optical device is included in the optical system and is configured to communicate with the optical component(s). The optical device includes a substrate proximate to which is disposed a first waveguide array. A second waveguide array is also provided that is disposed proximate the substrate so that a portion of the second waveguide array intersects a portion of the first waveguide array at a predetermined angle, so that a junction is formed. An index of refraction associated with the junction can be varied so that desirable effects can be implemented concerning optical signals transmitted through the waveguides.
Type: Application
Filed: June 3, 2004
Publication date: November 4, 2004
Inventors: Terry L. Markwardt, Leif G. Fredin, Ray T. Chen, Ram Sivaraman

- Dynamic variable optical attenuator and variable optical tap

Patent number: 6778736
Abstract: An optical device with at least one junction formed by an intersection of at least two waveguides may be used to tap, and/or attenuate an optical signal. The waveguides may be formed from various materials such as polymers and other combinations of monomers. Internal reflection produced at each junction between the waveguides in response to heating from a thin film electrode will direct a portion of an optical signal from one of the waveguides to another waveguide. Internal reflection at each junction may be used to selectively tap and/or attenuate power level of an optical signal.
Type: Grant
Filed: March 14, 2002
Date of Patent: August 17, 2004
Assignee: Finisar Corporation
Inventors: Terry L. Markwardt, Leif G. Fredin, Ray T. Chen, Ram Sivaraman

- Diffractive optics assembly in an optical signal multiplexer/demultiplexer

Publication number: 20040136071
Abstract: A diffractive optics system for wavelength division multiplexing and demultiplexing optical signals. The present system can be employed in multiplexers, demultiplexers, spectrum analyzers, and the like. In one embodiment, the diffractive optics system includes a waveguide array, a lens assembly, first and second diffractive optical elements ("DOEs"), and a reflector. In a demultiplexing operation, a multiplexed optical signal is input into the system via an input waveguide in the waveguide array. The signal is focused by the lens assembly, then transmitted through the first and second DOEs, where diffraction of the signal and separation of its constituent wavelength-distinct channels occurs. The channels are then reflected by the reflector back through the first and second DOEs, after which each channel is directed by the lens assembly to one of a plurality of output waveguides located in the waveguide array. A conversely similar process is followed for producing a multiplexed optical signal.
Type: Application
Filed: October 22, 2003
Publication date: July 15, 2004

Inventors: William W. Morey, Xuegong Deng, Ray T. Chen

- N×N optical switching device based on thermal optic induced internal reflection effect

Patent number: 6510260
Abstract: An optical switch which uses internal reflection at a junction formed by two waveguides is discussed. The waveguides may be formed from various materials such as polymers and other combinations of monomers. Substantially total internal reflection may be produced at the junction between the two waveguides in response to heating from a thin film electrode.
Type: Grant
Filed: November 1, 2001
Date of Patent: January 21, 2003
Assignee: Finisar Corporation, Inc.
Inventors: Ray T. Chen, Ram Sivaraman

- Optical waveguide coupler for interconnection of electro-optical devices

Patent number: 6483967
Abstract: The present invention is a three-dimensional tapered waveguide coupler capable of interconnecting electro-optical devices with differing optical mode profiles. The ends of the waveguide are configured to match the optical mode profiles of the electro-optical devices that the waveguide interconnects. The waveguide adiabatically transmits the fundamental mode of the photo-optic signal from the electro-optical device at the waveguide's input end to a different electro-optical device at the waveguide's output end. A single coupler can be configured with one or more waveguides, each waveguide having different optical mode profiles at either end and different optical transmission characteristics.
Type: Grant
Filed: June 27, 2001
Date of Patent: November 19, 2002
Assignee: Finisar Corporation
Inventors: Suning Tang, Ray T. Chen

- Compression-molded three-dimensional tapered universal waveguide couplers

Patent number: 6470117
Abstract: The present invention is a three-dimensional tapered waveguide coupler capable of interconnecting electro-optical devices with differing optical mode profiles. The ends of the waveguide are configured to match the optical mode profiles of the electro-optical devices that the waveguide interconnects. The waveguide adiabatically transmits the fundamental mode of the photo-optic signal from the electro-optical device at the waveguide's input end to a different electro-optical device at the waveguide's output end. A single coupler can be configured with one or more waveguides, each waveguide having different optical mode profiles at either end and different optical transmission characteristics.
Type: Grant
Filed: December 4, 1998
Date of Patent: October 22, 2002
Assignee: Radiant Photonics, Inc.
Inventors: Suning Tang, Ray T. Chen

- Miniaturized reconfigurable DWDM add/drop system for optical communication system

Publication number: 20020131692
Abstract: A DWDM add/drop system for use in optical communication system is disclosed. Using semiconductor fabrication techniques, a plurality of waveguide arrays and signal carriers are substantially symmetrically arranged about an optical axis of the system. Electrode heaters are provided proximate junctions created at the intersections of selected waveguides. Using the heaters, portions of optical signals may be redirected to other waveguides. In addition, the heaters may be used to attenuate or otherwise modify signals in the waveguides. The waveguide arrays are arranged such that a plurality of signal processing operations may be performed substantially simultaneously. In a preferred embodiment, the switches and waveguide arrays are coupled with a light focusing device and a dispersion apparatus to form a switched, combined multiplexer/demultiplexer having signal attenuation and modification capabilities.
Type: Application
Filed: March 14, 2002
Publication date: September 19, 2002
Inventors: Ray T. Chen, William W. Morey

- Combined multiplexer and demultiplexer for optical communication systems

Publication number: 20020131702
Abstract: A combined multiplexer/demultiplexer for use in optical communication systems is disclosed. The combined multiplexer/demultiplexer includes a plurality of waveguide arrays and a plurality of signal carriers, each disposed substantially symmetrically about an optical axis of the device. In operation, a signal carrier emits a multiple wavelength optical signal that is received and directed to a dispersion apparatus by a light focusing device. The dispersion apparatus diffracts the optical signal into selected spectral components and reflects the spectral components back to the waveguide arrays through the light focusing device. The signal processing, such sas multiplexing and demultiplexing, performed by each waveguide array depends on their configuration. The waveguide arrays may be configured to substantially simultaneously multiplex and/or demultiplex the spectral components.
Type: Application
Filed: March 14, 2002
Publication date: September 19, 2002
Inventors: William W. Morey, Ray T. Chen

- Dynamic variable optical attenuator and variable optical tap

Publication number: 20020131712
Abstract: An optical device with at least one junction formed by an intersection of at least two waveguides may be used to tap, and/or attenuate an optical signal. The waveguides may be formed from various materials such as polymers and other combinations of monomers. Internal reflection produced at each junction between the waveguides in response to heating from a thin film electrode will direct a portion of an optical signal from one of the waveguides to another waveguide. Internal reflection at each junction may be used to selectively tap and/or attenuate power level of an optical signal.
Type: Application
Filed: March 14, 2002
Publication date: September 19, 2002

Inventors: Terry L. Markwardt, Leif G. Fredin, Ray T. Chen, Ram Sivaraman

- NxN optical switching device based on thermal optic induced internal reflection effect

Publication number: 20020085794
Abstract: An optical switch which uses internal reflection at a junction formed by two waveguides is discussed. The waveguides may be formed from various materials such as polymers and other combinations of monomers. Substantially total internal reflection may be produced at the junction between the two waveguides in response to heating from a thin film electrode.
Type: Application
Filed: November 1, 2001
Publication date: July 4, 2002
Applicant: Radiant Photonics, Inc.
Inventors: Ray T Chen, Ram Sivaraman

- Optical waveguide coupler for interconnection of electro-optical devices

Publication number: 20020012501
Abstract: The present invention is a three-dimensional tapered waveguide coupler capable of interconnecting electro-optical devices with differing optical mode profiles. The ends of the waveguide are configured to match the optical mode profiles of the electro-optical devices that the waveguide interconnects. The waveguide adiabatically transmits the fundamental mode of the photo-optic signal from the electro-optical device at the waveguide's input end to a different electro-optical device at the waveguide's output end. A single coupler can be configured with one or more waveguides, each waveguide having different optical mode profiles at either end and different optical transmission characteristics.
Type: Application
Filed: June 27, 2001
Publication date: January 31, 2002
Applicant: Radiant Photonics, Inc.
Inventors: Suning Tang, Ray T. Chen

- Beam splitting ball lens, method for its manufacture, and apparatus for its packaging

Patent number: 6332051
Abstract: Accordingly, a beam-splitting ball lens is provided. The beam-splitting ball lens has: a ball lens; and a beam-splitter filter disposed within the ball lens. The ball lens preferably has first and second portions wherein the beam-splitter filter is disposed at a junction between the first and second portions. The beam-splitting ball lens can further have a mid-plane optical element disposed at the junction such as, a wavelength selective filter, a polarization component, an amplitude modulation mask, a phase modulation mask, a hologram and/or a grating. Also provided is a method for fabricating the beam-splitting ball lens of the present invention. The method includes the steps of: providing the ball lens; and disposing the beam-splitter filter within the ball lens. Preferably the disposing step includes: dividing the ball lens into first and second portions; and disposing the beam-splitter filter at the junction between the first and second portions.
Type: Grant

Filed: September 18, 2000
Date of Patent: December 18, 2001
Assignee: NEC Research Institute, Inc.
Inventors: Jun Ai, Jan Popelek, Yao Li, Ray T. Chen

- Compression-molded three-dimensional tapered universal waveguide couplers

Patent number: 6324321
Abstract: The present invention is a three-dimensional tapered waveguide coupler capable of interconnecting electro-optical devices with differing optical mode profiles. The ends of the waveguide are configured to match the optical mode profiles of the electro-optical devices that the waveguide interconnects. The waveguide adiabatically transmits the fundamental mode of the photo-optic signal from the electro-optical device at the waveguide's input end to a different electro-optical device at the waveguide's output end. A single coupler can be configured with one or more waveguides, each waveguide having different optical mode profiles at either end and different optical transmission characteristics.
Type: Grant
Filed: December 4, 1998
Date of Patent: November 27, 2001
Assignee: Radiant Photonics, Inc.
Inventors: Suning Tang, Ray T. Chen

- Beam splitting ball lens method for its manufacture and apparatus for its packaging

Patent number: 6285508
Abstract: Accordingly, a beam-splitting ball lens is provided. The beam-splitting ball lens has: a ball lens; and a beam-splitter filter disposed within the ball lens. The ball lens preferably has first and second portions wherein the beam-splitter filter is disposed at a junction between the first and second portions. The beam-splitting ball lens can further have a mid-plane optical element disposed at the junction such as, a wavelength selective filter, a polarization component, an amplitude modulation mask, a phase modulation mask, a hologram and/or a grating. Also provided is a method for fabricating the beam-splitting ball lens of the present invention. The method includes the steps of: providing the ball lens; and disposing the beam-splitter filter within the ball lens. Preferably the disposing step includes: dividing the ball lens into first and second portions; and disposing the beam-splitter filter at the junction between the first and second portions.
Type: Grant
Filed: June 30, 1999
Date of Patent: September 4, 2001
Assignees: Radiant Research Inc., NEC Research Institute, Inc.
Inventors: Jun Ai, Jan Popelek, Yao Li, Ray T. Chen

- System and method for wavelength division multiplexing and demultiplexing

Patent number: 6282337
Abstract: A system and method for wavelength division multiplexing and demultiplexing are disclosed. The disclosed system may include a fiber optic element operable to transmit a multiplexed light signal. The system may also include a light focusing device, and the fiber optic element may be oriented to project light through the light focusing device. An additional element

may be a diffraction grating having a diffraction order greater than one. The diffraction grating may be positioned in a Littrow configuration with respect to the light focusing device and may have a groove spacing equal to or larger than three times the wavelength of light used in the system.
Type: Grant
Filed: September 24, 1999
Date of Patent: August 28, 2001
Assignee: Radiant Photonics, Inc.
Inventors: James W. Horwitz, Ray T. Chen

- Holographic optical devices for transmission of optical signals

Patent number: 6269203
Abstract: The present invention relates to the transmission of optical signals, and more particularly to wavelength division multiplexers and demultiplexers for optical signals. A wavelength division multiplexer device for use in an optical transmission system comprises a light input, one or more lenses, a substrate, one or more holographic optical elements, and two or more light outputs. The light input, the substrate, and the one or more lenses direct a light beam through the device. The one or more holographic optical elements act as transmission diffraction gratings and spatially separate the input light beam into dispersed light beams. Each light output receives one of the dispersed light beams. Multiple holographic optical elements may be stacked upon one another or separated by a substrate. Additionally, the substrate may comprise edges or parts that are beveled. Finally, the elements of the present invention may be rigidly coupled to each other, without intervening air space.
Type: Grant
Filed: May 21, 1999
Date of Patent: July 31, 2001
Assignee: Radiant Photonics
Inventors: Brian M. Davies, Ray T. Chen, Jian Liu

- Packaging enhanced board level opto-electronic interconnects

Patent number: 6243509
Abstract: A planarized signal communications system (110) embedded within a printed circuit board (102) is disclosed, comprising first (118) and second (120) index buffer layers within the printed circuit board, a polymer waveguide (116) disposed below the first and above the second index buffer layers, an electrical-to-optical transmitter (122) disposed within the first index buffer layer in direct adjoinment with the polymer waveguide, a reflective element (126) disposed within the polymer waveguide in direct alignment with the electrical-to-optical transmitter and adapted to reflect optical energy from the electrical-to-optical transmitter along the polymer waveguide, an optical-to-electrical receiver (124) disposed within the first index buffer layer and in direct adjoinment with the polymer waveguide, a reflective element (126) disposed within the polymer waveguide in direct alignment with the optical-to-electrical receiver and adapted to reflect optical energy from within the polymer waveguide to the optical-to-e
Type: Grant
Filed: August 24, 2000
Date of Patent: June 5, 2001
Assignee: Board of Regents - The University of Texas System
Inventor: Ray T. Chen

- Integrated bi-directional dual axial gradient refractive index/diffraction grating wavelength division multiplexer

Patent number: 6137933
Abstract: A wavelength division multiplexer/demultiplexer is provided that integrates axial gradient refractive index elements with a diffraction grating to provide efficient coupling from a plurality of input optical sources (each delivering a single wavelength to the device) which are multiplexed to a single polychromatic beam for output to a single output optical source.
Type: Grant
Filed: February 25, 1999
Date of Patent: October 24, 2000
Assignee: LightChip, Inc.
Inventors: Boyd V. Hunter, Robert K. Wade, Joseph R. Dempewolf, Ray T. Chen

- Integrated bi-directional dual axial gradient refractive index/diffraction grating wavelength division multiplexer

Patent number: 5999672
Abstract: A wavelength division multiplexer/demultiplexer is provided that integrates axial gradient refractive index elements with a diffraction grating to provide efficient coupling from a plurality of input optical sources (each delivering a single wavelength to the device) which are multiplexed to a single polychromatic beam for output to a single output optical source.
Type: Grant
Filed: December 13, 1997
Date of Patent: December 7, 1999
Assignee: Light Chip, Inc.
Inventors: Boyd V. Hunter, Robert K. Wade, Joseph R. Dempewolf, Ray T. Chen

Contract Awards in UT Austin

1) "Center for Optoelectronic Science and Technologies (COST)," (with Joe Campbell, Dennis Deppe, Russ Dupuis), ARPA, $210,000 (my Portion), 1/1/94-2/28/98.

2) "National Alliance for Photonics Education in Manufacturing," ARPA/NSF/TRP, $184,000, 1/1/94-12/31/96.

3) "Polymer Optical Backplane Bus Array for Backplane Optical Interconnects," CRAY, Inc., $140,000, 1/1/93-12/31/95.

4) "Polymer Optical Backplane Bus Array for Backplane Optical Interconnects," URI, $15,000, 6/1/93-7/31/93.

5) "Polymer-based Photonic Integrated Circuits," Novex Corp., $10,000, 6/1/93-7/31/96.

6) "Microprism-based Inter-MCM Optical Interconnects," Physical Optics Corporation and Army Research Office, $60,000, 12/1/93-2/28/95.

7) "Polymer-based Optical Bus Array for Inter-Multi-Chip Module Interconnects," Physical Optics

Corporation and AFOSR, $40,000, 9/1/92-8/31/93.

8) "High Density Waveguide Interconnects," Radiant Research, Inc., $300,000, 10/1/95-9/30/98.

9) "Texas Alliance of Photonics Education for Manufacturing," State of Texas, $92,000, 9/1/94-12/31/95.

10) "Polymer-based Integrated Photonic Devices for Highly Parallel Optical Interconnects," AFOSR and BMDO, $250,000, 6/1/94-5/31/97.

11) "High-speed EO Polymer-based Modulator," AFOSR, $95,000, 6/1/95-5/31/98.

12) Intel Equipment Grant, Intel, $122,000, 1/1/95.

13) MCC Equipment Grant, MCC, $20,000, 7/1/95.

14) GE Equipment Grant, GE, $50,000, 7/1/95.

15) Honeywell Equipment Grant, Honeywell, $50,000, 7/1/95.

16) "Photonics Education for Manufacturing", $12,000, 6/1/95 to 5/31/97, International Society of Optical Engineering

17) "Optical-controlled True-time-delay Phased Array Antennae", $320,000, 10/1/95 to 9/30/98, Office of Naval Research

18) "CMOS Process-compatible Optical Vias for Three-dimensional Optical Interconnects," $229,500, 1/1/96-12/31/97. The ATP Program of the State of Texas.

19) "Polymer-based Photonic Device Packaging", $190,000.00, 10/1/95-9/31/98, 3M

20) "Si CMOS Process Compatible Optical Interconnects", $245,900.00, 1/1/96-8/31/98, ATP,/TD&T Texas

21) "Polymer-based Unidirectional Multimode EO Switching Device" $300,000.00, 8/31/97-7/31/2000, AFOSR

22) "Collinearly multiplexed Optical True Time delay lines", $320,000.00, 7/1/97-6/31/2000, NAVY/ONR

23) "Surface-normal Optoelectronic Packaging", $18,000.00, 6/1/97-5/31/2000, Lightpath

24) "Guided-wave optical interconnects" (Part of the Darpa's center for Optoelectronic Interconnects), $345,000.00, 6/31/98 to 5/30/2001, DARPA through Univ. of New Mexico.

25) "High power lasers for high efficiency hologram formation", $142,000.00, 7/1/95 to

6/31/96, ONR

26) “50 GHz High Bandwidth Network Analyzer “, $150,000.00, 3/15/98 to 12/31/99, AFOSR

27) Dean's Office Equipment Matching Fund for AFOSR Grant, $34,000.00, 3/15/98 to 12/31/99

28) “Polymer-based Linear Waveguide Modulator”, $200,000.00, 6/1/98 to 7/31/2000, Radiant Research

29) “Optoelectronic Packaging for Parallel optical Interconnects”, $150,000.00, NCC, July 1998 to June 2000.

30) “Packaging for WDM optical Interconnects”, $200,000.00 Lightpath. July 1998 to June 2000.

31) "Bandwidth Enhanced Fully Embedded Optoelectronically Interconnected Processor-to-Memory Links", $298,000, Texas TD&T program 1999-2000

32) “Bidirectional Optical Backplane for High speed space-borne sensing applications “, $180,000.00, In Negotiation, 1998.

33) “VCSEL Array and Si CMOS Compatible receiver array,” $50,000.00, Equipment Grant from OIDA (An NSF and DARPA sponsored association)

34) “High-performance Packaging Equipment for Interconnects Packaging”, $201,820, AFOSR, February 1999 to May 2000

35) “Board Level Guided-wave Optical Interconnects,” Dell Computer Company, 5/31/99 to 5/31/99, $42,500.00.

36) “Dispersion Enhanced Wavelength Division Multiplexer,” Army Strategic and Space Defence Command (SMDC), May 1998 to June 2000, $200,000.00

37) “Guided-wave Phased Array Antenna using True-time-delay Optical Lines,” Air Force Research Lab, August 1999, to July 2001, $175,000.00.

38) “Electrooptic Polymer-based Waveguide Prism for Laser beam Scanning”, Air Force Research Lab, 6/1/00 to 5/31/02, $200,000.00.

39) “Multifunctional Polymeric Material for Photonic Switching, Modulation and Amplification,” procurement title, became “Active Multi-functional Polymeric Material with Modulation, Switching, and Amplification Features,” Office of Naval Research, December 1998 to December 2000, $200,000.00.

40) “Packaging Equipment Grant” UT College of Engineering, $20,000.00, 1999.

41) “Bandwidth Enhanced Fully Embedded Optoelectronically Interconnected Processor-to-Memory Links,” 2001 TD&T State of Texas 298,000

42) “Proposed Photonic Array Antenna Based on Optical True-time Delay Lines,” Air Force, June 1999 to January 2001, $175,000.

43) “OSP Number 199901720…” DOD-Air Force DURIP Equipment Grant, 4/1/00 to 3/31/01, $300,000.

44) Dean's Office Equipment Matching Fund for DOD-Air Force Grant, 4/1/00 to 3/31/01, $40,000.00.

45) “EO Polymer-based System Demonstration for Phased Array Antenna Applications’, 6/1/00 to 5/31/02, $170,000.

46) “Excimer Laser for fine Structure formation” DURIP 4/1/2001 to 5/31/2002, AFOSR, 240,000

47) “Phased Array Demonstration Project using Optical TTD”, 4/1/2001 to 3/31/2002, AFOSR, 200,000

48) “DURIP grant for X-band Phased Array Antenna Equipment”, 240,000, AFOSR/MDA 6/1/2002, 5/31/2003

49) X-Band Phased Array Antenna System Demonstration, 500,000, AFOSR, 9/1/2002-8/31/2004

50) Board Level Optical Interconnects using polymer based fully embedded structure, 6/30/2004 to 12/31/2005 128,000.00, Office of Naval Research

51) Silicon Based Photonic Crystal Waveguide Modulator, AFOSR STTR Program Phase I, 9/1/2004 to 5/31/2005, 40,000.00

52) True Time Delay Formation for Phased Array Antenna, US Navy, 80,000, 6/1/2004 to 8/31/2005.

53) Optical Modulator using Nanophotonic Crystal Waveguide on silicon, STTR Phase I Subcontract, AFOSR, 40,000.00 9/1/2004-5/31/2005

54) Nano-Imprint Machine formed Nanostructure on Polymer Thin Film, Molecular Imprints, Inc. 25,000.00 1/1/2005-

55) Sematech AMRC Research Center, Texas State Government and SEMATECH, 100,000/year for five years, 9/1/2004-8/31/2009

56) “Manufacturable, Multi-dimensional high capacity optoelectronic interconnects,” DARPA Opto Center, 345,000, January 8, 1998 to Sep 31, 2005.

57) “Nano-Photonic Crystal Waveguides for Optical True Time Delay for X-Band Phased Array Antenna, DARPA MTO, 250,000, 9/16/2005 to 9/15/2007

58) “Silicon Nano-photonic Crystal Waveguide based Modulator,” AFOSR/STTR, 300,000, 9/15/2005 to 9/14/2007

59) “Demonstration of Holographic Optical Elements for Highly Parallel Optical Backplane Bus for Processor to Memory Interconnects,” National Security Agency, 280,000, 8/1/2005 to 5/31/2006

60) “Polymer Thermal Optical Switch Array for Optical True Time Delay based Phased Array Antenna,” Navy SPAWAR, 8/1/2005 to 2/28/2006

61) “Fully Embedded Guided Wave Optical Interconnects for Inter- and Intra-board Level interconnection,” National Science Foundation, 100,000.00 12/1/2005 to 12/31/2006

62) “Superprism based Optical Switch using Polymer Nanostructures,” Air Force Research Lab, 300,000.00, 4/1/2006 to 9/31/2008

63) “Advance Processing and Prototyping Consortium (AP2C)”, DARPA, $100,000.00/Year 2006-

64) Equipment Grant on Antenna Test Range Absorbing Cones, Alereon, Inc., $5,600, 2007

65) Non-restricted Research Grant, $540,000, 2007-

66) “Monolithic and Hybrid Silicon Laser”, National Science Foundation, $50,000, (STTR) 8/1/2007 to 7/31/2008.

67) "Polymer Photonic Crystal Waveguide Modulator on Silicon Pillars", AFOSR, $40,000, 8/15/2007 to 4/30/2008

68) "Highly Dispersive Low Loss Photonic Crystal Fibers For Ultra Short Pulse Compression" Navy Air System Command, $40,000, STTR 8/1/2007 to 02/28/2008

69) "Board Level Optical Interconnects using Guided wave Optical Buses" National Science Foundation, $200,000, 9/1/2007 to 8/31/2009.

70) "Fast Tunable Laser Operating at 1.55 micron", OIDA and DARPA, $50,000, 8/1/2007 to 7/31/2008.

71) "Low Power On-Chip Silicon based Optical Interconnects" 2008 Texas Advanced

Research Program by Texas Higher Education Coordination Board, $75,000, 6/1/2008-5/31/2010

72) "Three Dimensionally Interconnected Silicon Nanomembranes for Optical Phased Array (OPA) and Optical TrueTime Delay (TTD) Applications", 2008 MULTIDISCIPLINARY UNIVERSITY RESEARCH INITIATIVE (MURI), $4,750,000.00, 6/1/2008-5/31/2011

73) "High Speed EO-Polymer activated Silicon Slot Photonic Crystal Waveguide Modulator," AFOSR, $200,000, 9/1/2008-8/31/2010

74) "CNT Printing Technology for Phased Array Antenna and Switch Networks," NASA, $100,000, 5/1/2009 to 4/31/2010

75) "EO Polymer based Linearized Domain Inverted Waveguide Modulator" DARPA, $200,000,

76) "Semiconductor nano-particle-based Thin Film Printable Devices for High speed FET," AFOSR, $40,000 STTR, 9/1/2009 to 8/31/2010.

77) "Nanophotonics and Optical interconnects," V. T. Venture and Technology, $200,000 9/1/2009 to 8/31/2013

78) "Silicon based nanophotonic devices for Water Pollution Sensing", National Science Foundation, $40,000 1/1/2010 to 12/31/2010

79) "Silicon Nanophotonic Devices for Air Pollution sensing', Environment Protection Agency (EPA) March 3/15/2010 to December/31/2010, $70,000

80) "Silicon Nanomembrane based nano-cavity for multiple cancer cell detection", NIH, 10/1/2010 to 9/30/2011, $50,000

81) "Printable Silicon Nanomembranes for Solar-Powered, Bi-directional Phased-Array Antenna Communication System on Flexible Substrates," AFOSR, 11-15-2012 to 11-14, 2012, $300,000

82) "Monolithic tunable diode laser absorption Spectrometer," Army, 12-1-2010 to 5-31-2011, $23,330

83) "Low-cost, High Rate, Roll-to-Roll Manufacturing of Organic Solar Cell Powered High Frequency Flexible Communication System," Navy, 6-28-2010 to 4-30-2011, $40,000

84) "High-speed Polymer-Based Linear Modulator," DARPA, 05-11-2009 to 5-10-2011, $200,000

85) "Large Area Fully Printed PAA Incorporating Nano-field Effect Transistors for Lunar and Planetary Exploration," NASA, 1-23-2009 to 1-22-2011, $100,000

86) “High Speed Nano-photonic Modulator based on Electro-optic Polymer Refilled Silicon Photonic Crystal Slot Waveguide,” 11-15-2008 to 11-14-2010, $200,000

87) “Electromagnetic Attack Sensor,” Army, 8-1-2011 to 7-31-2013, $300,000

88) “Metalic Template Replication for High Speed Electro-Optic Polymer Photonic Devices,” DOD, 3-1-2011 to 11-30-2011, $33,000

89) “Flexible Silicon Nanomembrane-Based Photonic Components Utilizing Strain-Induced Electro-Optic Effect with Slow Light Enhanced Configuration through Thin Film Photonic.” Airforce, 7-1-2011 to 3-31-2012, $40,000

90) “Ultra-sensitive Nanophotonic Water Pollution Sensor,” EPA, 3-5-2010 to 9-4-2010, $23,330

91) “Roll-to-Roll Printing of Integrated Photonic Devices on Flexible Substrates via a Combination of Nanoimprinting and Ink-jet Printing,” AFOSR, 3-1-2012 to 11-30-2012, $15,000

92) “High Performance Electric-Field Sensor Based on Enhanced Electro-Optic Polymer Refilled Slot Photonic Crystal Waveguides,” AFOSR, 5-1-2012 to 2-8-2013, $30,000

93) “Low-Cost, High Rate, Roll-to-Roll Manufacturing of Organic Solar Cell Powered High Frequency Flexible Communication System,” Navy, 9-19-2011 to 3-18-2013, $70,000

94) “Photonic Crystal Slot Wave Guide Absorption spectrometer for the Detection of Multiple VOCs in Water,” NSF, 10-15-2011 to 9-30-2013, $150,000

95) “Monolithic Photonic Crystal On-Chip Spectrometer for Laser Absorption Spectroscopy,” Army, 7-25-2012 to 11-03-2014, $215,000

96) “Photonic Crystal Microarray Nanoplatform for High Throughput Highly Sensitive and Specific Detection of Lung and Breast Cancer,” NIH, 9-28-2012 to 9-27-2014, $310,000

97) “High Density Optical Interconnects”, DARPA, 01/14/2014-07/13/2014, $50,000

98) “Low-Cost-High Throughput Roll-to-Roll Printing of Photonic Devices on Devices on Flexible Substrates via a Combination of Nanoimprinting and Ink-Jet Printing” AFOSR, 01/15/2014-01/14/2016, $200,000

99) “Nanomaterial-based Ink-Jet Printing Science and Technology for High Power Conformable X-band Phased Array Antenna” Missile Defense Agency, 08/04/2014-08/03/2017, $600,000

100) “High Throughput Label-Free Point of Care Therapeutic Drug Monitoring Device” US Army, 03/10/2014-02/09/2015, $49,995

101) “Ultra-compact High Performance Electric-Field Sensor Based on EO Polymer Refilled Slot Photonic Crystal Waveguides”, Air Force, 02/21/2014-08/19/2016, $300,000

102) “Photonic Crystal High Throughput Microarray for High Sensitivity Multiplexed Heavy Metal Detection in Water”, Department of Energy, 02/17/2015-11/16/2015, $27,070

103) “Ultra Low Power Consumption Oxide Infiltrated Subwavelength Waveguide based All-Optical Switch for Tera bit-s Optical Time Division Multiplexing” Department of Energy, 02/17/2015-11/16/2015, $45,000

104) “Mid-Infrared Surface Normal QCLs for wide angle beam steering” Navy, 05/15/2015-05/14/2016, $24,160

105) “Fully Printed Flexible 4-bit 2D (4x4) 16-Element Graphene-based Phased Array Antenna System” NASA 05/01/2015-04/30/2017, $140,000

106) “Cilary Micropillar Enriched Exosomal MicroRNA for Cancer Diagnosis by Multiplexed Photonic Crystal Sensor” NIH, 09/22/2015-06/21/2016, $20,000

107) “Ultra Low Power Consumption Graphene Oxide Infiltrated Subwavelength Waveguide Based All-Optical Switch for Terabits per Second Optical Time Division Multiplexing” DOE, 04/11/2016-04/10/2018, $299,622

108) “Integrated Alumina Photonic Waveguide Based Middle Ultraviolet spectroscopy for Picogram/microliter level nuclei acid quantitation” NIH, 05/05/2016-01/31/2017, $58,470

109) “Fiber Pigtailed On-Chip Mid-infrared Difference Frequency Generation” NIST, 08/01/2016-01/31/2017, $27,000

110) “Fully Integrated On-Chip True Time Delay Phase Array Antenna Feed” Airforce, 09/15/2016-06/14/2017, $50,000

110) “High Speed AttoJoule/Bit Passive and Active Nanophotonic Devices for Computing and Optical Interconnects” AFOSR, 12/01/2016-11/30/2023, $6,500,000

111) “Monolithic integrated photonic sensors in the molecular fingerprint region” NSF, 06/01/2017-05/31/2020, $360,000

112) “Slow Light Based On-Chip High Resolution Fourier Transform Spectrometer for Geostationary Imaging of Atmospheric Greenhouse Gases” NASA, 06/09/2017-12/08/2017, $30,000

113) “Monolithic Chip-Integrated Absorption Spectrometer from 3-5 microns” NASA, 06/09/2017-12/08/2017, $35,000

114) “Monolithic Slow Light Enhanced Chip-Integrated Absorption Spectrometer from 3-15 microns” ARMY, 08/08/2017-02/07/2018, $63,000

115) “Slow Light Steered Electro-optic Transmission Scanner with Wafer Scale Aperture” NAVY, 06/06/2017-01/05/2018, $42,723

116) “Toward Ultra-Dense Integrated Plasmonic Circuits” AFOSR, 09/14/2017-06/13/2018, $40,000

117) “Fiber Pigtailed On-Chip Mid-infrared Difference Frequency Generation in Silicon” NIST, 09/01/2017-08/31/2019, $144,000

118) “Wearable Breath Sensors with Chip Integrated Mid-Infrared Slow Light Enhanced Absorbance Spectroscopy on Conformal Flexible Substrates” NIH, 09/15/2017-02/28/2018, $25,000

119) “Flash Drive Integrated Label Free Silicon Nano-Photonic Bio-Assays for Space Station Bio-Diagnostics” NASA, 07/27/2018-08/26/2019, $25,000

120) “Monolithically Integrated TCC-VCSELs with Surface-Normal 20 Slow-Light PC Waveguide Arrays” NASA, 07/27/2018-01/25/2019, $15,000

121) “Monolithic Mid-Infrared Non-Mechanical Two Dimensional Beam” NAVY, 10/01/2018-04/09/2019, $21,000

122) “Monolithic Slow Light Enhance Chip-Integrated Absorption Spectrometer From 3-15 Microns” ARMY, 09/28/2018-04/30/2021, $329,212

123) “Toward Ultra-Dense Integrated Plasmonic Circuits” Airforce, 01/25/2019-01/24/2021, $164,424

124) “High Resolution, Large Spectral Range On-Chip Mid-Infrared Fourier Transform Spectroscopy” NSF, 09/01/2019-08/31/2023, $360,000

125) “Compressed Sensing Fourier Transform Spectroscopy based on Integrated Plasmonic Circuitry on VCSEL platform” AFOSR, 08/02/2019-11/01/2019, $10,000

126) “Fully Automated Optical Evaluation System for Biochemical-sensing, Communication and Computing” AFOSR DURIP, 06/01/2020-05/31/2021, $125,666

127) “Portable On-Chip Fully Automatic COVID 19 Virus detection with high sensitivity” University of Texas, Electrical and Computer Engineering Seed Grant, 06/01/2020-08/31/2020, $9,054

128) “High-frequency and Low-power (enabling-self-powering) Continuous Monitoring of

Tissue-level Biochemistries" AFWERX, 06/01/2020-08/31/2021, $150,000

129) "Mid-Infrared LIDAR for Small Spacecraft" AFRL, 05/19/2022-04/20/2024, $315,850

130) "Highly Efficient Atmospheric Gases Detections Using Integrated Vertical Crystal Waveguide Arrays" NASA, 07/25/2022-08/25/2023, $45,000

131) "MidIR Tunable Quantum Cascaded Lasers" AFOSR DURIP, 07/15/2023-07/14/2024, $154,745

132) "Towards Next-Generation Electronic-Photonic Devices and Systems for Intelligent Sensing: Photonics for AI and AI for Photonics" Airforce, 07/14/2023-07/14/2026, $975,000

133) "Mid-IR UAV-Based Sensing Platform with Deep Learning to Identify and Quantify Gaseous Emission in Gas Flares" Department of Energy, 2023, 07/10/2023-07/09/2024, $75,000

134) "Ultra-Sensitive Detection of Groundwater Contaminants Using Surface Enhanced Raman Scattering (SERS) Sensor with Pinpointed Plasmonic-Active Nanotubes" Department of Energy, 2023, 07/10/2023-07/09/2024, $60,000.

135) "Short Wavelength Division Multiplexed Optical Backplane for Avionics" NAVY, 2024, 07/31/2024 to 01/30/2025, $46,200.

Contract Award for 2000-2001 in Industry

Raised 18,000,000.00 (eighteen million dollars) Round A VC money from Intel Venture, KLM and others for Radiant Research DWDM and polymer waveguide switching devices development and commercialization.

<u>Contract Awards before Joining UT from 1988 to 1992</u>

More than 20 contracts with total contract awards in excess of 5 million dollars were granted to Dr. Chen's Research work. The major ones are summarized below:

1. Multiple mode optical switching array for fiber optic networks
CONTRACT NO.: F33657-89-C-2208, WPAFB
An electro-optic architecture (EOA) suitable for large fiber sensor arrays was first determined. A thorough theoretical investigation was conducted to evaluate the optimal electro-optic grating design that would be suitable for the NASP fiber sensor arrays. Index modulation, interaction length, switching speed and device capacitance were theoretically determined. The feasibility of constructing an electro-optic reconfigurable switching device compatible with multi-mode fibers was successfully demonstrated.

2. Polymer gelatin waveguide modulator
CONTRACT NO.: ISI-8961123, NSF
The ultimate goal of this project was to build an optical waveguide and an electrooptic modulator on any substrate. To accomplish this, a new polymeric material was introduced to solve the complicated problems associated with conventional thin film microstructural waveguide fabrication.

3. Polarization-Sensitive Electro-optic Waveguide Modulator on Indium Tin Oxide Film
CONTRACT NO.: ISI-9061016, NSF
A new device structure is introduced In_2O_3/InxSn1-xOy (ITO) heterostructure thin film. This will decrease the power consumption needed to obtain full intensity modulation. This design is adaptable to any substrate, has a high multiplexing capability, and will potentially yield a new line of both electro-optic and all-optic devices. The ITO waveguides are high polarization sensitive films that allow propagation of only TM modes. Such polarization selectivity eliminates the need to use an external polarizer for coherent optical communication.

4. Optical Manipulation and Distribution of Microwave Signals
CONTRACT NO.: DAAL02-91-C-0034, ARMY HDL
Multiple optical paths containing heterodyned optical signals are constructed to form an optical delay line suitable for phased array antennas. Microprisms, a microprism array, and multiplexed waveguide holograms will be integrated for this application.

5. VLSI optical interconnects based on multiplex Bragg planar holography
CONTRACT NO.: DAAHO1-89-C-0822, DARPA
This project demonstrated a multi-mode planar hologram technology that serves as an optical interconnect system for VLSI devices in inter-chip and inter-processor applications.

6. Polymer gelatin microstructure waveguides in conjunction with HOE for electronics and VLSI optical interconnects
CONTRACT NO.: DASG60-90-C-0018, SDIO/ARMY SDC
In this program, a new polymer graded-index waveguide was investigated for optoelectronic device and system levels. The polymer can form guiding layers on any smooth surface including conductors, semiconductors and insulators. Local sensitization of the polymer waveguide allows integration of single and multiplexed holograms in the selected area. A 15-channel, single-mode Wavelength Division Multiplexer (WDM) has been built.

7. Nonlinear transformation using halftones
CONTRACT NO.: N60921-90-C-0259, NAVAL SWC
In this contract, POC designed a complete optical system for real-time nonlinear transformation. This all-optical processor will be applicable to a variety of systems which require high speed/optical image processing.

8. An optically activated modulator on GaAs-GaAlAs compound semiconductor channel waveguide
This research took advantage of the properties of Group III-V semiconductor materials to create an optically activated modulator, which had a very small interaction length and low power

consumption.

9. Polymer Gelatin Waveguide Modulator
CONTRACT NO.: ISI-8961123, NSF
The ultimate goal of this project was to build an optical waveguide and an electrooptic modulator on any substrate. To accomplish this, a new polymeric material which can solve the complicated problems associated with conventional thin film microstructural waveguide fabrication is being introduced.

10. Polymer gelatin microstructure waveguides in conjunction with HOE for electronics on VLSI optical interconnects
CONTRACT NO.: DASG60-90-C-0018, SDIO/ARMY SDC
In this program, a new polymer graded-index waveguide was investigated for optoelectronic device and system levels. The polymer can form guiding layers on any smooth surface including conductors, semiconductors and insulators. Local sensitization of the polymer waveguide allows integration of single and multiplexed holograms in the selected area. A 50-channel, single-mode Wavelength Division Multiplexer (WDM) will be built.

11. Low threshold all-optical crossbar switch on GaAs-GaAlAs channel waveguide array
CONTRACT NO.: TBA, SDIO/AFOSR
A low threshold 10x10 all-optical crossbar switch is under investigation. Unlike conventional all-optical devices, where high power laser is needed to generate the required optical-optical interaction, the OAM based on GaAs channel waveguide and waveguide array needs only a ~ mW laser (for example, 670 nm laser diode) to activate the modulation. As a result, system compactness and its resulting cost effectiveness are expected. Switching speed as fast as subpicosecond is feasible by H^+ion implantation. In this program, a fully packaged 10x10 all-optical crossbar switching device, including laser diode array, GRIN lens array, activation window and 10x10 GaAs channel waveguide array will be demonstrated.

12. Holographic micron/submicron lithography
CONTRACT NO.: F33615-92-C-3801, WPAFB
A new holographic tool using total internal reflection hologram for large field size and high resolution lithography is developed. Unlike the conventional lithography machine where an array of imaging lenses are needed, the concept developed in this program does not require any lenses for the image formation. It is a 1X machine with system cost at least one order of magnitude less than the existing machines.

13. Polymer-based optical data bus for system-wide communication
CONTRACT NO.: DE FG03-91ER81255, DOE
A polymer-based optical backplane bus is developed in this program with a significant performance upgrade. These include a demonstrated bandwidth of 60 GHz, graded index tuning for the formation of guiding layer, ultra wide optical coupling bandwidth (250nm) and board to board interconnects using the polymer optical data bus.

14. A wideband optical fiber sensor system for electromagnetic field measurement
CONTRACT NO.: N00019-92-C-0068, NAVY ASC

A guided wave electromagnetic sensor using liquid crystal cell and YIG/GGG thin film is proposed. In this program, the extra large linear electrooptic coefficient of liquid crystal was employed to provide a sensitive measurement of the electric field. The magnetic field is measured through the determination of the Faraday rotation of the YIG/GGG film. A compact module will be delivered by the end of this program.

15. Holo-crystal dynamic scanner for space communications
CONTRACT NO.: DASG60-89-C-0034, SDIO
The feasibility of an electrooptic method of rapid (<1 msec), two-dimensional (2D), random-access beam steering over a 40o field of view was demonstrated by the achievement of linear scanning via voltage control of the refractive index of a liquid-crystal waveguide coupled with a wide-angle BRAGG hologram. The possibility of using an acoustic BRAGG cell for this application is also addressed. More than 500 satellites can communicate with each other.

16. Submicron lithography using guided wave holography
CONTRACT NO.: ISI-9160329, NSF
A waveguide hologram is employed to provide an extra large field size lithography. The recording and reconstruction geometry automatically compensate the optical power distribution of the exposure area. Two coupling gratings were utilized for this purpose serving as the input and output coupler, respectively. The coupling efficiency can be as high as 90%. The preliminary theoretical results concluded that the resolution of the image is two times of the optical wavelength of the laser beam which gives us the 1/4 micron imaging resolution with 500 nm light source.

17. Active optical backplane for high performance three dimensional optoelectronic computing
CONTRACT NO.: F08630-92-C-0045, SDIO/WRIGHT LAB
An active optical backplane (AOP) architecture and the building blocks needed to fulfill such anarchitecture are developed in this program. The packaging issue associated with such architecture is much simpler than passive optical backplane where the laser diode and photodetector arrays are located at the card boards. In the AOP, the conventional interface of the electronic computer still exists. The active optical components such as laser diode array and photodetector array are located at the backplane.

18. Architecture for survivable system processing
CONTRACT NO.: D180-32850-3, BOEING/RADC
Rapid advances in processor performance are currently overtaking processing system architectures. This means that system developers/manufacturers have to redesign their systems to use the latest high performance signal/data processing machines. In this program, the optical elements suitable for this application will be thoroughly investigated. Optical interconnection has been widely agreed as an alternative to provide a much better system performance due to its high bandwidth and insertion loss. A demonstration model will be developed in this program.

19. Dispersion free traveling wave plasmon/polymer waveguide modulator
CONTRACT NO.: DASG60-92-C-0062, SDIO/ARMY SDC
In this program, a new guided wave electrooptic modulator is developed based on the surface

plasma effect. The interaction length of the device is equivalent to that of multi quantum well while the cost of such a device is at least two order of magnitude less than the existing devices. The optical wave is transferred to the surface plasma wave when the resonant condition is matched. An external E field is added to modulate the resonant condition and thus the optical through intensity.

20. Micro laser array using rare earth ion-doped polymer waveguide resonators
CONTRACT NO.: DASG-92-C-0071, SDIO/ARMY SDC
In this program, a polymer-based waveguide laser is developed. Previous results have demonstrated an array of guided wave device using the same host material, i.e., photolime gel. The major task of this project is to utilize the same host material to develop an optical source. An optical amplifier was developed in this program using Nd^{+++}-doped polymer. An amplification of 8.5dB was observed at the optical wavelength of 1059 nm.

<u>Evidence of Teaching Effectiveness</u>

1) EE325 Electromagnetic Engineering, Fall 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022

2) EE325 Electromagnetic Engineering, Spring 2013, 2014

3) EE383P Optoelectronic Interconnects, Spring 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2002, 2003, 2004, 2012, 2014, 2016. 2018, 2020

4) EE383P Optical Communications, Spring 2003, 2005, 2006, 2007, 2008, 2013, 2015, 2016, 2017, 2019, 2021

5) EE347 Modern Optics, Spring 2018, 2020, 2022

6) EE383V Modern Optics, Spring 2018, 2020, 2022

7) Supervise Senior Honor Design Teams (EE464D) each year with several awards, 2010-2022

8) ECE 379K Optical Communications, Spring 2023

9) ECE 383P 8-Optical Communications, Spring 2023

10) ECE 325 Electromagnetic Engineering, Fall 2022, 2023

11) ECE 347 Modern Optics, Spring 2024

12) ECE 383V Modern Optics, Spring 2024

Ph.D. Supervision Completed

1) Suning Tang, Summer 1994, Electrical and Computer Engineering, UT Austin
2) Chunhe Zhao, Fall 1997, Electrical and Computer Engineering, UT Austin
3) Charles Zhou, Fall 1998, Electrical and Computer Engineering, UT Austin
4) Jian Liu, Spring 1999, Electrical and Computer Engineering, UT Austin
5) Zhenhai Fu, Summer 2000, Electrical and Computer Engineering, UT Austin
6) John Taboada, Spring 2000, Electrical and Computer Engineering, UT Austin
7) Gicherl Kim, Fall 2000, Electrical and Computer Engineering, UT Austin
8) Jinha Kim, Spring 2003, Electrical and Computer Engineering, UT Austin
9) XueJun Lu, Summer 2001, Electrical and Computer Engineering, UT Austin
10) Xuegong Deng, Summer 2001, Electrical and Computer Engineering, UT Austin
11) Chachae Choi, Fall 2003, Electrical and Computer Engineering, UT Austin
12) Lei Lin, Spring 2004, Electrical and Computer Engineering, UT Austin
13) YuJie Liu, Spring 2004, Electrical and Computer Engineering, UT Austin
14) Chiou Hung Jang, Fall 2002, Electrical and Computer Engineering, UT Austin
15) Jie Qiao, Summer 2001, Electrical and Computer Engineering, UT Austin
16) Dechang An, Fall 2001, Electrical and Computer Engineering, UT Austin
17) LingHui Wu, Spring 2002, Electrical and Computer Engineering, UT Austin
18) Jizuo Zou, Spring 2004, Electrical and Computer Engineering, UT Austin
19) Xuliang Han, Fall 2003, Electrical and Computer Engineering, UT Austin
20) QingJun Zhou, Fall 2004, Electrical and Computer Engineering, UT Austin
21) Yihong Maggie Chen, Summer 2002, Electrical and Computer Engineering, UT Austin
22) Zhong Shi, Fall 2004, Electrical and Computer Engineering, UT Austin
23) Wei Jiang, Spring 2005, Electrical and Computer Engineering, UT Austin
24) YongQiang Jiang, Spring 2006, Electrical and Computer Engineering, UT Austin
25) Brie Howley, Spring 2006, Electrical and Computer Engineering, UT Austin
26) Jinho Choi, Summer 2006, Material Science and Engineering, UT Austin
27) Lanlan Gu, Summer 2007, Electrical and Computer Engineering, UT Austin
28) Xiaolong Wang, Fall 2006, Electrical and Computer Engineering, UT Austin
29) Li Wang, Fall 2007, Electrical and Computer Engineering, UT Austin
30) Hai Bi, Spring 2007, Electrical and Computer Engineering, UT Austin
31) Scott Tu, Summer 2008, Electrical and Computer Engineering
32) Xiaonan Chen, Summer 2008, Electrical and Computer Engineering
33) Harish Subbaraman, Summer 2009, Electrical and Computer Engineering
34) Daniel Pham, Fall 2010, Electrical and Computer Engineering
35) XinYuan Dou, Fall 2010, Electrical and Computer Engineering
36) Beom Suk Lee, Spring 2011, Electrical and Computer Engineering
37) Amir Hosseini, Summer 2011, Electrical and Computer Engineering
38) Che-Yun Lin, Fall 2012, Electrical and Computer Engineering
39) David Kwong, Spring 2013, Electrical and Computer Engineering
40) Xiaohui Lin, Summer 2013, Electrical and Computer Engineering
41) Wei-Cheng Lai, Summer 2013, Electrical and Computer Engineering
42) Xiaochuan Xu, Summer 2013, Electrical and Computer Engineering
43) Yang Zhang, Summer 2013, Electrical and Computer Engineering
44) John L Covey, Fall 2014, Electrical and Computer Engineering

45) Yi Zou, Fall 2014, Electrical and Computer Engineering
46) Xingyu Zhang, Spring 2015, Electrical and Computer Engineering
47) Hi Yan, Summer 2017, Electrical and Computer Engineering
48) Zheng Wang, Fall 2017, Material Science and Engineering
49) Zeyu Pan, Spring 2018, Electrical and Computer Engineering
50) Chi-Jui Chung, Summer 2018, Electrical and Computer Engineering
51) Peter Grubb, Spring 2019, Electrical and Computer Engineering
52) Zhoufeng Ying, Spring 2020, Electrical and Computer Engineering
53) Zheng Zhao, Summer 2020, Electrical and Computer Engineering
54) Elham Heidari, Spring 2021, Electrical and Computer Engineering
55) Ali Rostamian, Summer 2022, Electrical and Computer Engineering
56) Kyoung Min Yoo, Summer 2022, Electrical and Computer Engineering
57) JiaQi Gu, Spring, 2023, Electrical and Computer Engineering
58) Chenghao Feng, Spring 2023, Electrical and Computer Engineering
59) Jason Midkiff, Fall 2023, Electrical and Computer Engineering

M.S. Supervision Completed

1) David Gerold, May, 1994, Electrical and Computer Engineering, UT Austin (Thesis)
2) Chun-he Zhao, May, 1995, Electrical and Computer Engineering, UT Austin (Thesis)
3) Maggie M. Li, August, 1995, Electrical and Computer Engineering, UT Austin (Thesis)
4) Linghui Wu, May, 1998, Electrical and Computer Engineering, UT Austin (Thesis)
5) Guo-hua Cao, May, 1998, Electrical and Computer Engineering, UT Austin (Thesis)
6) John Taboada, December, 1997, Electrical and Computer Engineering, UT Austin (Thesis)
7) Huajun Tang, May, 1997, Electrical and Computer Engineering, UT Austin (Thesis)
8) Feimin Li, May, 1997, Electrical and Computer Engineering, UT Austin (Thesis)
9) Zhenhai Fu, May, 1998, Electrical and Computer Engineering, UT Austin (Thesis)
10) Lin Sun, June, 2000, Electrical and Computer Engineering, UT Austin (Thesis)
11) Xuliang Han, 2001, Electrical and Computer Engineering, UT Austin (Thesis)
12) YongQiang Jiang, 2003, Electrical and Computer Engineering, UT Austin (Thesis)
13) Xiaonan Chen, 1st degree date: Summer 2006(Thesis)
14) Mohandas, Prakash, 1st degree date: Fall 2006(Thesis)
15) Agnihotri, Anustubh, 1st degree date: Spring 2007(Thesis)
16) Chen, Jiaqi, 1st degree date: Spring 2007(Thesis)
17) David Kwong, 1st degree date: Spring, 2010 (Thesis)
18) Patrick Camp, Spring, 2024
19) PoYu Hsiao, Spring, 2024

Postdoctoral/Visiting Scholar Researchers in Nanophotonics and Sensors

1) Daniel Shi
2) Richard Li
3) DeGui Sun
4) HongFa Luan
5) Bing Li
6) Feng Zhao

7) Yuhua Li
8) Xuping Zhang
9) Jian-Yi Yang
10) Ying-Zhi Sun
11) Bipin Bihari
12) QingJun Zhou
13) Wei Jiang
14) Sasa Zhang
15) Wei Dong Zhou
16) Wei Dong Shao
17) YaZhao Liu
18) Yang Zhang
19) Yi Zou
20) Xiangning Chen
21) Lijun Huang
22) Nen-Wen Pu
23) Tao Liu
24) Guilan Feng
25) Wentao Li
26) Yongqiang Hei
27) Xiangjie Zhao
28) Gencheng Wang
29) Ching-Wen Chang
30) Dan Zhang
31) Wenlong Xia
32) Ping Tan
33) Chao Wang
34) Gongwen Gan
35) Jianying Zhou
36) Haixia Mei
37) Kang Chieh Fan
38) Ping Tzan Huang
39) Yen-Wen Lu
40) Sourabh Jain
41) Vivian Chang

Recent Texas, US and International News of Our Research

There are news interviews and CBS Evening News reports for our research activities:

1. Report on our Weather-free 4.6 micron laser based Lidar Chip:

   https://thedailytexan.com/2020/11/20/texas-ut-austin-research-lidar-communication-chip-transparent-waves-bad-weather-longer-distances-air-force

2. Report on our COVID-19 on various media:

Texas Local News Paper Daily Texans:

https://thedailytexan.com/2021/09/24/dt-9-24-21/#4

UT university news announcement:

https://news.utexas.edu/2021/09/09/portable-lab-on-a-chip-diagnostic-platform-can-rapidly-test-dozens-of-people-for-covid-19/

Science Daily

Optical techniques offer fast, efficient COVID-19 detection: Without rapid point-of-care testing, the pandemic will likely continue to evolve -- ScienceDaily

News in America Institute of Physics:

https://aip.scitation.org/doi/10.1063/5.0022211

CBS Evening News TV interview which can be viewed at:

https://cbsaustin.com/news/local/lab-on-a-chip-portable-diagnostic-platform-can-rapidly-test-dozens-for-covid-19

2023 Summer CBS News:

https://cbsaustin.com/news/local/lab-on-a-chip-portable-diagnostic-platform-can-rapidly-test-dozens-for-covid-19