# Keith W. Goossen

CURRICULUM VITAE

## EXECUTIVE SUMMARY

Internationally published and invited researcher/entrepreneur/professor with 12 years professional experience in industrial laboratories, successful founder of a company, and 19 years experience as a professor.

- **Researcher**: Authored or co-authored ~**300** refereed journal and conference publications; **8199** total citations, and an h-index of **49** (Google Scholar). I am considered a foremost expert in optoelectronic packaging and integration, micro-electro-mechanical systems, and energy.
- **Entrepreneur**: I am author of 87 issued patents; co-founded *Aralight* to commercialize advanced optoelectronic techniques I have invented, raising $10 million venture capital.
- **Professor**: As Principal Investigator at the University of Delaware (UD), I have raised ~ $10 million in grants in energy efficiency, optoelectronics, fiber sensors, and photovoltaics. I have graduated 6 PhD, and 17 MS students and developed 4 new courses.

## EDUCATION AND TRAINING

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| • University of California at Santa Barbara | Electrical Engineering | BS ‘83 |
| • Princeton University | Electrical Engineering | MA’85 |
| • Princeton University | Electrical Engineering | PhD ’88 |

## PROFESSIONAL EXPERIENCE

2018- **Professor, University of Delaware**

I currently have a group of 2 PhD students working in the fields of optoelectronic packaging and integration, renewable energy and energy systems. While here at the University of Delaware, I have authored 31 journal publications and 49 conference proceedings.

2002-2018 **Associate Professor, University of Delaware**

2000-2002 **Chief Scientist, Aralight, Inc.**

This startup was formed from Lucent to commercialize the integrated two-dimensional vcsel/detector-circuit chip technology that I invented at Bell Labs. Starting with four of us, we raised $10 million and grew our organization to 35 people. I established technical directions, managed intellectual property, and made prototypes of our first product, which performed flawlessly at the 2002 Optical Fiber Communications Conference.

1988-2000 **Member of Technical Staff, AT&T, Bell Labs, AT&T (1988-2006), Lucent Technologies**

I was an “inventor-on-demand” routinely providing new device technology to satisfy system requirements. I view myself as a physical solution maker and problem solver, both theoretical and experimental, not attached to any particular technology, but developing in any platform that meets the requirements, from micromechanics to optics to high-speed electronics.

## NOTABLE RECENT PUBLICATIONS

- Evaluation of 3D printed optofluidic smart glass prototypes (cited 22 times, Google Scholar); Daniel Wolfe, K.W. Goossen, Optics Express vol. 26, p. A85-A98 (2018).
- A signal acquisition system for non-intrusive load monitoring of residential electrical loads based on switching transient voltages (cited 18 times, Google Scholar); Cesar Duarte, Paul Delmar, Kenneth Barner, Keith Goossen, 2015 Clemson University Power Systems Conference (PSC), p. 1-6.
- Fiber Bragg grating sensors toward structural health monitoring in composite materials: Challenges and solutions (cited 503 times, Google Scholar); D Kinet, P Mégret, KW Goossen, L Qiu, D Heider, C Caucheteur, Sensors 14 (4), 7394-7419 (2014).

## RECENT AWARDS AND PROFESSIONAL RECOGNITION

- Editor, Materials Special Issue on Advanced Structural Health Monitoring in Materials, 2020
- Editor, Materials Special Issue on Advanced Materials for Smart and Functional Windows, 2020
- 2015 Department of Energy Industrial Assessment Center Program Excellence in Research Award
- 2013 Best Paper Award, IEEE Optical Interconnects Conference, "Loss analysis for a two wire optical waveguide for chip-to-chip communication"
- 2012 Department of Energy Industrial Assessment Center Program Center of Excellence Award
- Senior Member, IEEE

## RECENT INVITED TALKS AND PAPERS

- 2023 P2 Webinar on Energy Efficiency in Automotive and Metal Manufacturing.
- 2022 ECU Webinar on Energy Efficiency, "Savings opportunities in compressed air and refrigerated spaces."
- 2020 Manufacturing PACK Expo, "Energy and water savings, and emission reduction, in food/beverage plants."
- 2019 Rochester Institute of Optics Optics Colloquium, "Optofluidic Smart Glass for optically-configurable building envelopes and smart windows."
- 2018 Photonics Media Webinar, "Materials and Methods for Smart Glass, Smart Windows, and Building Shells."
- 2017 Delaware Annual Energy Conference, "Energy policy principles based on human perception to increase energy audit recommendation implementation rates"
- 2017 Department of Natural Resources and Environmental Control (DNREC) Analytical Support Conference, "The nexus of energy and environmental efficiency measures"
- 2014 Optics and Photonics News, "Negawatts: Optics, Photonics, and Energy Savings"
- 2014 Dupont Sustainability Conference, "Energy efficiency principles in supply chains"
- 2012 Greentouch Symposium on Energy Efficiency in Telecommunications, "Energy efficiency in data centers and telecommunications networks"

## PHD DISSERTATIONS SUPERVISED

1. Jonathan Dickason, "Processing and Packaging for Large Format Infrared LED Emitter Arrays for Scene Generation" (2017)
2. Dan Wolfe, "Low Cost Controllable Optofluidic Smart Glass for Energy Efficiency, Thermal Management, and Privacy Applications" (2017); currently Forensic Engineer & Scientist, ARCCA Inc.
3. Cesar Antonio Duarte Gualdron, "Non-intrusive monitoring of electrical loads based on switching transient voltage analysis: Signal acquisition and features extraction" (2013); currently Professor at Industrial University of Santander School of Electrical, Electronic and Telecommunications Engineering.
4. Cory Budischak, "What will be the role of solar hydrogen in our future energy system?" (2012); currently Department Chair, Energy Technologies at Delaware Technical Community College.
5. Liang Qiu, "Free space optical coupling of fiber optic sensors integrated with composite structures" (2011); currently Senior Optical Transceiver Designer at Intel Corporation.
6. Mike Teitelbaum, "Optical data porting to networks embedded in composite materials" (2009); currently Patent Examiner at USPTO.


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## MASTER'S THESES SUPERVISED

1. Chase Lawrence, "Anti-reflection coatings for angled and prismatic surface," (2023)
2. Ian Guzman, "Classification Of High Frequency NILM Switching Transients based on Denoising Convolutional Neural Networks," (2022)
3. Sam Matylewicz, "Effect of white roof on ice rink refrigeration systems" (2021)
4. Andrew Sayanlar, Master's, Super luminescent emitter arrays (2020)
5. Matthew Sayanlar, Master's, Super luminescent emitter arrays (2020)
6. M.A. Sufian, "Investigation of the Christiansen Effect in indium tin oxide bulk material." (2020)
7. Sean Vernon, "Optofluidic smart glass response to differential temperature" (2019); currently Sustainability Manager at Delaware Army National Guard.
8. Xiaozhang Liu, "Optofluidic smart glass with wide angular performance" (2019); currently graduate student University of Washington.
9. Josh Dubey, "Investigation of an energy efficient pump speed control algorithm for controlling sump level" (2018); currently Engineer Exxon.
10. Fan Wang, "Photovoltaic system deployment optimization" (2014); currently graduate student at Philadelphia University.
11. Paul Del Mar, "Motor load detection for voltage transient based non-intrusive load monitoring" (2013); currently Manager - Project Development Engineering - Solar PV at Ameresco.
12. Kristen Pickelsimer, "On the use of scintillating fibers to concentrate solar light" (2011); currently Electronics Engineer, DOD.
13. Xi Long, "Design of a 9 stage 10 bit high speed pipeline analog to digital converter" (2010).
14. Gayathre Krishnan, "Doped and surface coated lithiated metal oxides—Synthesis and electrochemical performance as cathode materials in electrochemical energy storage devices" (2008); currently IT Professional, Wells Fargo.
15. Clara Paola Murcia Salazar, "THz emission from optimized p-doped silicon top devices" (2007); Cell Product Manager at MiaSolé.
16. Jyothi Gubbala, "An Automated process for embedding optical fibers in woven composites" (2005); currently Senior Marketing and Operations Manager, Confidential.
17. Ramsey Akl, "Above bandgap thermo-optic coefficient measurements for direct bandgap materials" (2005)

## CURRENT GRADUATE STUDENTS SUPERVISED

18. Priscila Barbosa, PhD, Optofluidic smart glass with no refractive errors
19. Yash Kabra, PhD, Anti-reflective resonant structures

## COURSES CREATED AND CURRENTLY TEACHING

1. ELEG 437 - Energy Systems: Energy flows are examined in our society including all sources, conversions and conversion efficiencies, and end uses. Both existing and alternative energy sources are presented, especially with regard to total resource availability. Thermodynamics of conversion efficiency is covered, as well as efficiency measures available in end use.
2. ELEG 427 - Terahertz and Millimeter-Wave Light Generation and Detection: Light is treated as an antenna phenomenon at radio wavelengths and a quantum effect near the visible. At terahertz frequencies and millimeter-wavelengths, these distinctions are blurred and both technologies exist. These technologies are described and a unified view of their principles is provided.


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3. ELEG 447 - Optical Properties of Solids: Techniques for the design of optical filters and optoelectronic devices with thin films and the fundamental electromagnetic and solid state physics that determine the optical properties of solids.

## OTHER COURSES RECENTLY TAUGHT

1. ELEG 446 - Nanoelectronic Device Principles: Introduction to the operating principles of nanoscale optical and electronic devices, with emphasis on how nanotechnology and quantum mechanics affect devices with reduced sizes and dimensions. Develops the performance and limitations of devices based on quantum wells, wires, dots, and nanophase materials.
2. ELEG 460 - High Technology Entrepreneurship: Focuses on the critical financial, legal, scientific and engineering issues that must be confronted during the initial planning stages of a start-up enterprise. Students work in teams to develop a business plan for a real world/business product offering.

## Expert Witness Cases

*Cheetah Omni, LLC v. Tellabs, Inc.*, No. 6:11-cv-390 (E.D. Tex.). Expert witness for Tellabs, invalidity support, one expert report, one deposition.

*JDS Uniphase Corporation v. CoAdna Photonics, Inc.*, No. 3:14-cv-*1091* (N.D. Calif.). Expert witness for CoAdna, one declaration.

*Fujitsu Limited v. Tellabs, Inc.,* No. 1:09-cv-04350 (N.D. Ill.). Expert witness for Tellabs, one expert report.

*Finisar, Inc. v. Nistica, Inc.,*No. 4.13-cv-03345 (N.D. Calif.). Expert witness for Nistica, invalidity support and infringement defense, two expert reports, two depositions, numerous declarations, two trials and testimony, won both.

*Oyster Optics LLC v. Cisco, etc.* 2016-cv-01301 (Tex). Expert witness for Oyster, invalidity defense and infringement support, several declarations, three depositions.

*Oyster Optics LLD v. Infinera,* 2:16-cv-01295-JRG. Expert witness for Oyster, two expert reports, infringement and validity, single deposition covering both.

*University of Michigan v. Leica*, 5:19-cv-07470-LHK. Expert witness for U. Michigan, one declaration.

*Capella Photonics, Inc. v. Fujitsu Network Communications, Inc.,* 2:20-CV-0076-JRG. Expert witness for Fujitsu, one expert report.

*II-VI, Inc. v. Soto brothers*, IPR2021-00085. Expert witness for II-VI, three declarations.

*Oyster Optics LLD v. Ciena,* 4:17-CV-05920-JSW. Expert witness for Oyster, two expert reports, infringement and validity, two depositions.

*Oyster Optics LLD v. Cisco,* 2:20-cv-00211-JRG. Expert witness for Oyster, two expert reports, infringement and validity, two depositions.

*Oyster Optics LLD v. Infinera,* 2:19-cv-00257-JRG. Expert witness for Oyster, two expert reports, infringement and validity, two depositions.

*In re Reexamination of: U.S. Patent No. 6,683,858,* Declaration in support of validity.

*SVV v. defendants,* 6:22-cv-511-513-ADA, 6:22-cv-639-641-ADA, No. 6:22-cv-00311-313, Declaration in support of claim construction.

## GRANTS (Current Research Support)

1. "Delaware Army National Guard Energy Assessment Program," 9/1/22-8/31/25, $80,000, PI.
2. "Reduction of energy, water, and hazardous material technical assistance for automotive manufacturing and maintenance facilities in the mid-Atlantic region," EPA, 10/1/22-9/30/25; $73,500, PI.
3. "Reduction of energy, water, and hazardous material technical assistance for metal manufacturing facilities in the mid-Atlantic region," EPA, 10/1/22-9/30/25; $192,000, PI.
4. "University of Delaware Industrial Assessment Center," Department of Energy, 9/1/22-8/31/26; $1,200,000, PI.
5. "Delaware Sustainable Energy Utility Program in Energy Efficiency," Energize Delaware, 7/1/23 - 6/30/24; $150,000, PI.

***Total Current Funding: $1,695,500 ($609,417/year)***

***Previous contracts: (prior funding = $7,081,793)***

6. "Delaware Sustainable Energy Utility Program in Energy Efficiency," Energize Delaware, 7/1/22 - 6/30/23; $150,000, PI.
7. "University of Delaware Industrial Assessment Center," Department of Energy, 9/1/19-8/31/22; $510,000, PI.
8. "Reduction of energy, water, and hazardous material technical assistance for automotive manufacturing and maintenance facilities in the mid-Atlantic region," EPA, 10/1/20-9/30/22; $138,800, PI.
9. "Delaware Sustainable Energy Utility Program in Energy Efficiency," Energize Delaware, 7/1/21-6/30/22; $90,000, PI.
10. "Delaware Sustainable Energy Utility Program in Energy Efficiency," Energize Delaware, 7/1/20-6/30/21; $87,000, PI.
11. "Delaware Sustainable Energy Utility Program in Energy Efficiency," 7/1/17-6/30/20; $281,000, PI. (these were 3 grants, each FY).
12. "Delaware Army National Guard Energy Assessment Program," 7/1/17-6/30/20; $92,000, PI.
13. "Narrowed bandwidth SWIR obscurants," 4/1/19-3/31/20; $125,000, PI
14. "Comcast Energy Assessment Program," 10/1/19-1/31/20; $24,000, PI.
15. "Reduction of energy, water, and hazardous material technical assistance for food and beverage manufacturers in the mid-Atlantic region," EPA, 10/1/18-9/30/20; $223,232, PI.
16. "RF-blocking window," 4/1/18-3/31/19; $40,000, co-PI.
17. "Obscurants with SWIR window," 4/1/18-3/31/19; $50,000, PI.
18. "Two-Color Superlattice LED Arrays for Advanced Infrared Projection Systems," subcontract from U. Iowa/Army Research Laboratories, 8/1/13-8/31/17; I am only a consultant on this subcontract with ~ $10,000/year support. I will note that awarding of this contract depending upon successful production of chips in the preceding one-color contract. Production of two-color chips on this contract has been moved to U. Iowa with me consulting.



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19. "Delaware Sustainable Energy Utility Program in Energy Efficiency," 9/1/13-6/30/17; $398,000, Principal Investigator.
20. "University of Delaware Industrial Assessment Center," Department of Energy, 10/1/11 – 9/31/16; $1,000,000, Principal Investigator and Director.
21. "High-Performance MWIR/LWIR Multi-spectral Superlattice LED Arrays for Advanced Infrared Projection Systems," subcontract from U. Iowa/Army Research Laboratories, 1/1/08-2/28/13; $900,000 (Goossen's part), co-Principal Investigator.
22. "Optical interconnects on VLSI," DARPA, 4/1/09-9/30/11, $60,000 (Goossen only), co-Principal Investigator.
23. "50% Efficient Solar Cells, Phase 3," DuPont/DARPA, ~$40,000 (Goossen only), 6/1/09-12/31/11, co-Principal Investigator.
24. "University of Delaware Industrial Assessment Center," Department of Energy, 9/1/06-9/31/11; ~$780,000, Principal Investigator and Director.
25. "Multifunctional Composite Materials and Structures for Lightweight Vehicle Protection," Army Research Laboratory, $460,000 (Goossen only), 2/1/03 – 2/28/12, co-Principal Investigator.
26. "High sensitivity thermal focal plane arrays," Epitaxial Technologies/Missile Defense Agency, $250,000, 2/1/08-1/31/10, Principal Investigator.
27. "Microelectronic Precision Optical Element Fabrication." Defense Advanced Research Projects Agency, $100,000, 8/15/07 – 8/14/08, Principal Investigator.
28. "50% Efficient Solar Cells, Phase 2B," DuPont/DARPA, $422,414 (Goossen only), 7/23/07 – 7/22/08, co-Principal Investigator.
29. "50% Efficient Solar Cells, Phase 1-2A," DuPont/DARPA, $157,539 (Goossen only), 7/23/07 – 7/22/08, co-Principal Investigator.
30. "MEMS-Based Athermal Modulating Retroreflector," Office of Naval Research, $200,000, 2/1/03-7/31/04, Principal Investigator.
31. "Increased Reliability VCSEL Arrays," DARPA, $75,000, 2/1/03-1/31/04, Principal Investigator.
32. "Terahertz Nanodevices for Communication, Imaging Sensing and Ranging," Air Force Office of Scientific Research, $195,837 (Goossen only), 2/1/03-7/31/06, co-Principal Investigator.
33. "Fabrication of a Terahertz Imaging System," DARPA, $100,000 (Goossen only), 10/1/03-1/31/05, co-Principal Investigator.
34. "Millimeter wave Imaging," Office of Naval Research, $75,000 (Goossen only), 2/1/03-1/31/05, co-Principal Investigator.
35. "Role of Photonics in the Battlefield," Army Research Office, $21,971 (Goossen only), 1/31/03-12/31/03, co-Principal Investigator.
36. "Optoelectronics Center," DARPA, $15,000 (Goossen only), 9/1/02-8/31/03.

## ENERGY AUDIT REPORT UPDATE

In 2023, 60 reports were submitted having 588 recommendations.

## JOURNAL PUBLICATIONS

1. Evaluation of 3D printed optofluidic smart glass prototypes; D. Wolfe and K.W. GOOSSEN, *Optics Express*, 26 (2), A85-A98 (2018).
2. 512x512, 100 Hz Mid-Wave Infrared LED Microdisplay System; Garrett A Ejzak, Jonathan Dickason, Joshua A Marks, Kassem Nabha, Rodney T McGee, Nicholas A Waite, Jake T Benedict, Miguel A Hernandez, Sydney R Provence, Dennis T Norton, John P Prineas, Keith W GOOSSEN,


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Fouad E Kiamilev, Thomas F Boggess, *Journal of Display Technology* Vol: 12 Issue: 10 Pages: 1139-1144 Published 2016.

3. Design of IIR Multi-Notch Filters Based on Polynomially-Represented Squared Frequency Response; Duarte, Cesar; Barner, Kenneth E.; GOOSSEN, Keith, *IEEE Transactions on Signal Processing* Vol: 64 Issue: 10 Pages: 2613-2623 Published 2016.
4. Initial Study on Controllable Roofing System to Tailor Building Solar Loads for Increased HVAC Efficiency; Wolfe, D.M and GOOSSEN, K.W., *Journal of Solar Energy Engineering-Transactions of The ASME* vol. 137 (2015).
5. Experiences with non-intrusive monitoring of distribution transformers based on the on-line frequency response; Gomez-Luna, E (Gomez-Luna, E.); Duarte, C (Duarte, C.) ; Aponte, G (Aponte, G.); Pleite, J (Pleite, J.)[3]; GOOSSEN, KW (Goossen, K. W.), *Ingenieria E Investigacion*, Vol: 35 Issue: 1 Pages: 55-59 (2015).
6. Theoretical study of the effects of strain balancing on the bandgap of dilute nitride InGaSbN/InAs superlattices on GaSb substrates; *Infrared Physics & Technology* Vol: 69 Pages: 211-217 (2015).
7. Negawatts: Optics, Photonics and Energy Savings; GOOSSEN, K., *Optics and Photonics News* 25 (2014).
8. Fiber Bragg Grating Sensors toward Structural Health Monitoring in Composite Materials: Challenges and Solutions; Kinet, Damien; Megret, Patrice; GOOSSEN, Keith W.; et al., *Sensors* 14 (2014).
9. 512 Individually Addressable MWIR LED Arrays Based on Type-II InAs/GaSb Superlattices; Dennis T. Norton, Jonathon T. Olesberg, Rodney T. McGee, Nick Waite, Jonathon Dickason, GOOSSEN, KW, John Lawler, Gerry Sullivan, Amal Ikhlassi, Fouad Kiamelev, Edwin J. Koerperick, Thomas F. Boggess, *IEEE Journal Quantum of Electron* **49** (2013).
10. Loss Analysis for a two-wire optical waveguide for chip-to-chip optical communication; J. Dickason and GOOSSEN, KW, *Optics Express* 21 (2013).
11. Dual-prism coupler for board-level free-space optical interconnects: Design and Simulations; Nair, R. GOOSSEN, KW, and Haney, M., *Optical Engineering* 51 (2012).
12. Lateral spectrum splitting concentrator photovoltaics: direct measurement of component and submodule efficiency; Xiaoting Wang, Nick Waite, Paola Murcia, Keith Emery, Myles Steiner, Fouad Kiamilev, KEITH GOOSSEN, Christiana Honsberg, Allen Barnett, *Progress in Photovoltaics: Research and Applications* 20 (2012).
13. Free-space input and output coupling to an embedded fiber optic strain sensor: dual-ended interrogation via transmission; Qiu, L., Heider, D., O'Brien, D.J., Wetzel, E.D., GOOSSEN, K.W., *Optical Engineering* 50 (2011)
14. Progress in low-power switched optical interconnects; Ashok V. Krishnamoorthy, GOOSSEN, KW, William Jan, Xuezhe Zheng, Ron Ho, Guoliang Li, Richard Rozier, Frankie Liu, Dinesh Patil, Jon Lexau, Herb Schwetman, Dazeng Feng, Mehdi Asghari, Thierry Pinguet, and John E. Cunningham, *IEEE J. Quantum Electronics,* 47 (2011).
15. Cost-effective integration of plastic optical fiber and total internal reflection mirrors in printed circuit boards for parallel optical interconnects; Teitelbaum, M., O'Brien, D.J., Wetzel, E.D., GOOSSEN, K.W., *Optical Engineering* 49, (2010).
16. Non-pigtail Optical Coupling to Embedded Fiber Bragg Grating Sensors; Qiu, L., Heider, D., O'Brien, D.J., Wetzel, E.D., GOOSSEN, K.W., *Optical Engineering* 49, (2010).
17. Effect of Face Separation on Corner Cube Reflectors; Nair, R., Teitelbaum, M., GOOSSEN, K.W., *Optical Engineering* 49 (2010).
18. Printed Circuit Board based Modulated Retroreflector using three Large Area Quantum Well Modulators; Nair, R., Teitelbaum, M., GOOSSEN, K.W., *Optical Engineering* 48, (2009).

19. High Detectivity Dilute Nitride Strained Layer Superlattice Detectors for LWIR and VLWIR Applications; Leye, A., Hier, H., Fathimulla, A., Lecates, M., Kolodzey, J., GOOSSEN, K.W., Coppinger, M., Bhurgava, N., *Infrared Physics and Technology* 52, p. 310-316 (2009).
20. Very High Efficiency Solar Cell Modules; Barnett, Kirkpatrick, Honsberg, Moore, Wanlass, Emery, Schwartz, Carlson, Bowden, Aiken, Gray, Kurtz, Kazmerski, Steiner, Gray, Davenport, Beulow, Takacs, Shatz, Bortz, Jani, GOOOSSEN, K.W., Kiamilev, Doolittle, Ferguson, Unger, Schmidt, Christensen, Salzman, *Progress in Photovoltaics, Research and Applications,* v 17, April 2009, p. 75-83.
21. Mirrored line-of-sight input nodes for embedded optical waveguides; Teitelbaum, Michael E. (Dept. of Electr. & Comput. Eng., Univ. of Delaware); Yarlagadda, Shridhar; O'Brien, Daniel J.; Wetzel, Eric D.; GOOSSEN, KEITH W. Source: *Optical Engineering*, v 47, November 2008, p. 1-8.
22. Normal incidence free space optical data porting to embedded communication links; Teitelbaum, Michael E. (Dept. of Electr. & Comput. Eng., Univ. of Delaware); Yarlagadda, Shridhar; O'Brien, Daniel J.; Wetzel, Eric D.; GOOSSEN, KEITH W. Source: *IEEE Transactions on Components and Packaging Technologies*, v 31, March 2008, p. 32-38.
23. Fabrication and yield of large-area quantum-well modulators; GOOSSEN, K.W. (Dept. of Electr. & Comput. Eng., Univ. of Delaware) Prather, D. Source: *IEEE Photonics Technology Letters,* v 19, November 2007, p. 21-24.
24. Microelectromechanical etalon modulator designs with wide angular tolerance for free-space optical links; GOOSSEN, K.W. (Dept. of Electr. & Comput. Eng., Univ. of Delaware) Source: *IEEE Photonics Technology Letters*, v 18, n 8, April 2006, p 959-61
25. 1 × 12 VCSEL array with optical monitoring via flip-chip bonding; GOOSSEN, K.W. (Dept. of Electr. & Comput. Eng., Univ. of Delaware); Cunningham, J.E.; Krishnamoorthy, A.V. Source: *IEEE Photonics Technology Letters*, v 18, n 11, June 2006, p 1219-21
26. Optically absorbing metallization; GOOSSEN, K.W. (Dept. of Electr. & Comput. Eng., Univ. of Delaware) Source: *Journal of Electronic Materials*, v 34, n 9, Sept. 2005, p L34-6
27. Free-space optical link by microelectromechanical system array and corner cube reflector; Changping Luo (Dept. of Electr. & Comput. Eng., Univ. of Delaware); GOOSSEN, K.W. Source: *IEEE Photonics Technology Letters*, v 17, n 6, June 2005, p 1316-18
28. Terahertz emission from electrically pumped gallium doped silicon devices; Lv, P.-C. (Dept. of Electr. & Comput. Eng., Univ. of Delaware); Troeger, R.T.; Kim, S.; Ray, S.K.; GOOSSEN, K.W.; Kolodzey, J.; Yassievich, I.N.; Odnoblyudov, M.A.; Kagan, M.S. Source: *Applied Physics Letters*, v 85, n 17, 25 Oct. 2004, p 3660-2
29. Optical microelectromechanical system array for free-space retrocommunication; Changping Luo (Dept. of Electr. & Comput. Eng., Univ. of Delaware); GOOSSEN, K.W. Source: *IEEE Photonics Technology Letters*, v 16, n 9, Sept. 2004, p 2045-7
30. A 36-channel parallel optical interconnect module based on optoelectronics-on-VLSI technology; Cook, C. (AraLight Inc., NJ, USA); Cunningham, J.E.; Hargrove, A.; Ger, G.G.; GOOSSEN, K.W.; Jan, W.Y.; Kim, H.H.; Krause, R.; Manges, M.; Morrissey, M.; Perinpanayagam, M.; Persaud, A.; Shevchuk, G.J.; Sinyansky, V.; Krishnamoorthy, A.V. Source: *IEEE Journal of Selected Topics in Quantum Electronics*, v 9, n 2, March-April 2003, p 387-99
31. Interference-based micromechanical spectral equalizers; Ford, J.E. (Dept. of Electr. & Comput. Eng., Univ. of California, La Jolla, CA, USA); GOOSSEN, K.W.; Walker, J.A.; Neilson, D.T.; Tennant, D.M.; Seo Yeon Park; Sulhoff, J.W. Source: *IEEE Journal of Selected Topics in Quantum Electronics*, v 10, n 3, May-June 2004, p 579-87
32. A tunable dispersion compensating MEMS all-pass filter; Madsen, C.K. (Lucent Technol. Bell Labs, Murray Hill, NJ, USA); Walker, J.A.; Ford, J.E.; GOOSSEN, K.W.; Nielsen, T.N.; Lenz, G. Source: *IEEE Photonics Technology Letters*, v 12, n 6, June 2000, p 651-3

33. 16×16 VCSEL array flip-chip bonded to CMOS VLSI circuit; Krishnamoorthy, A.V. (Lucent Technol. Bell Labs, Holmdel, NJ, USA); GOOSSEN, K.W.; Chirovsky, L.M.F.; Rozier, R.G.; Chandramani, P.; Hui, S.P.; Lopata, J.; Walker, J.A.; D'Asaro, L.A. Source: *IEEE Photonics Technology Letters*, v 12, n 8, Aug. 2000, p 1073-5
34. Micromechanical gain slope compensator for spectrally linear optical power equalization; GOOSSEN, K.W. (Lucent Technol. Bell Labs, Holmdel, NJ, USA); Walker, J.A.; Neilson, D.T.; Ford, J.E.; Knox, W.H. Source: *IEEE Photonics Technology Letters*, v 12, n 7, July 2000, p 831-3
35. Triggered receivers for optoelectronics VLSI; Krishnamoorthy, A.V. (Lucent Technol., AT&T Bell Labs, Holmdel, NJ, USA); Rozier, R.G.; Woodward, T.K.; Chandramani, P.; GOOSSEN, K.W.; Tseng, B.J.; Walker, J.A.; Jan, W.Y.; Cunningham, J.E. Source: *Electronics Letters*, v 36, n 3, 3 Feb. 2000, p 249-50
36. Optoelectronic/VLSI; GOOSSEN, K.W. (Bell Labs, Lucent Technol., Holmdel, NJ, USA) Source: *IEEE Transactions on Advanced Packaging*, v 22, n 4, Nov. 1999, p 561-7
37. On the design of coplanar bond wires as transmission lines; GOOSSEN, K.W. (Bell Labs, Lucent Technol., Holmdel, NJ, USA) Source: *IEEE Microwave and Guided Wave Letters*, v 9, n 12, Dec. 1999, p 511-13
38. Electroabsorption in extremely shallow quantum wells: Comparison between theory and experiment; Chen, X. (Dept. of Phys., Univ. of Manchester Inst. of Sci. & Technol., UK); Earnshaw, M.P.; GOOSSEN, K.W.; Batty, W.; Allsopp, D.W.E.; Grey, R. Source: *Journal of Applied Physics*, v 85, n 10, 15 May 1999, p 7231-8
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7. Energy and water savings, and emission reduction, in food/beverage plants, Invited Talk, Manufacturing PACK Expo (2020).
8. Optofluidic Smart Glass for optically-configurable building envelopes and smart windows, Invited talk, Optics Colloquium at the Rochester Institute of Optics (2019).
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- 5,914,804: “Double-cavity Micromechanical Optical Modulator with Plural Multilayer Mirrors”.
- 5,918,794: “Solder Bonding of Dense Arrays of Microminiature Contact Pads”.
- 5,923,951: “Method of Making a Flip-Chip Bonded GaAs-based Optoelectronic Device”.
- 5,940,723: “Heteroepitaxial Growth of III-V Materials”.
- 5,943,155: “MARS Optical Modulators”.
- 5,943,158: “Micromechanical, Anti-reflection, Switched Optical Modulator Array and Method”.
- 5,949,561: “Wavelength Demultiplexing Multiple Quantum Well Photodetector”.
- 5,949,571: “MARS Optical Modulators”.
- 5,962,846: “Redundant Linear Detection Arrays”.
- 5,975,408: “Solder Bonding of Electrical Components”.
- 5,977,571: “Low-loss Connecting Arrangement for Photodiodes”.

- 5,996,221: “Method for Thermocompression Bonding Structures”.
- 6,002,513: “Optical Modulator Providing Independent Control of Attenuation and Spectral Tilt”.
- 6,005,262: “Flip-chip Bonded VCSEL CMOS Circuit with Silicon Monitor Detector”.
- 6,034,431: “Electronic integrated circuit with optical inputs and outputs.”
- 6,048,751: “Process for manufacture of composite semiconductor devices.”
- 6,159,760: “Method of fabricating oxide-aperature vertical cavity surface emitting lasers.”
- 6,169,833: “CMOS-compatible optical bench.”
- 6,172,417: “Integrated Semiconductor Devices.”
- 6,222,206: “Wafer having Top and Bottom Emitting Vertical-Cavity Lasers.”
- 6,258,616: “Method of Making a Device having a Non-Alloyed Ohmic Contact to a Buried Doped Layer.”
- 6,271,943: “Wavelength Demultiplexing Stack Photodiode Detector with Electrical Isolation Layers.”
- 6,277,668: “Optical detector for minimizing optical crosstalk.”
- 6,307,691: “Optical filter and method for linearization of optical power equalizer.”
- 6,307,983: “Robotic optical cross-connect.”
- 6,321,010: “Optical microstructure and method of manufacture.”
- 6,337,753: “Optical power equalizer.”
- 6,388,322: “Article comprising a mechanically compliant bump.”
- 6,424,450: “Optical modulator having low insertion loss and wide bandwidth”
- 6,434,726: “System and method of transmission using coplanar bond wires.”
- 6,444,491: “Composite semiconductor devices and method for manufacture thereof.”
- 6,458,411: “Method of making a mechanically compliant bump.”
- 6,485,996: “Method of making a wafer having top and bottom emitting vertical-cavity lasers.”
- 6,501,589: “Article comprising a metallic anti-mirror.”
- 6,519,073: “Micromechanical modulator and methods for fabricating the same.”
- 6,631,246: “WDM communication system having tunable multi-channel dispersion compensating filters.”
- 6,643,052: “Apparatus comprising a micromechanical optical modulator.”
- 6,704,513: “Enhanced tilt optical power equalizer.”
- 6,707,840: “Vertical cavity surface emitting laser.”
- 6,718,086: “Article comprising a tunable filter.”
- 6,996,151: “Tin-oxide adhesion layer for metal-dielectric mirrors.”
- 7,180,902: “MARS optical modulators.”
- 7,387,451: “Composites for wireless optical communication.”
- 7,760,412: “Mechanically-active anti-reflection switch (MARS) modulator with wide angle tolerance.”
- 8,031,042: “Sensor and sensing utilizing a laser.”
- 8,417,340: “Implant with antenna array.”
- 8,635,817: “Reflective roof.”
- 8,712,203: “Formation of an optical waveguide.”
- 9,002,456: “Implant with antenna array.”