

## JOSEPH M. KAHN

Professor of Electrical Engineering

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### Professional Experience

- 2003–Present     Stanford University, Department of Electrical Engineering. **Professor:**
- Developed and teach: two core undergraduate courses on Signal Processing and Linear Systems; three graduate courses on Optical Fiber Communications and Digital Communications.
- Research Areas:*
- Data center links: co-packaged optics, low-power analog or digital coherent receivers, advanced direct-detection modulation formats.
  - Frequency comb generators based on resonator-enhanced electro-optic modulation.
  - Ultra-long-haul submarine systems: optimized power-efficient amplification and spatial multiplexing, yielding up to 70% capacity increase.
  - Fiber Kerr nonlinearity mitigation: 2008 paper on digital backpropagation is most highly cited in field.
  - Rate-adaptive coding and modulation, as well as variable-bandwidth superchannel modulation.
  - Multi-mode fibers and spatial multiplexing: in 2005, explained principal modes and demonstrated transmission far beyond traditional bandwidth-distance limit; in 2011, derived statistics of strongly coupled group delays and gains; in 2011 and 2019, derived capacity limits and explained modal diversity and frequency diversity in spatially multiplexed systems with mode-dependent gain.
  - Endoscopic imaging through multi-mode optical fibers, including: schemes for rigid or flexible single-fiber endoscopes; enhancement of resolution and noise tolerance; biomedical applications. In 2013, derived resolution limits for coherent and noncoherent imaging.
  - Atmospheric free-space systems: modal compensation of turbulence; spatial multiplexing; transfer of frequency, time and position; optimal modes for spatial multiplexing in turbulence channels.
- 2012–2022     Stanford University, Department of Electrical Engineering. **Chair of Academic Affairs Committee:**
- Oversaw curricula and courses in the Department, including content, staffing and scheduling.
  - Organized the Department’s teaching efforts during the COVID-19 pandemic.
- 2003–2008     StrataLight Communications, Inc., Campbell, CA. **Advisory Board Member and Consultant:**
- Provided strategic technical advice. Evaluated new technologies, including digital coherent detection.
- 2000–2003     StrataLight Communications, Inc., Campbell, CA. **Co-Founder and Chief Scientist:**
- Played key role in securing \$22.7M Series A and Series B financing. StrataLight’s 40 Gb/s-per-wavelength long-haul fiber transmission systems were deployed widely by AT&T, Deutsche Telekom, and other top-tier carriers. StrataLight was acquired by Opnext, Inc. in 2009 for about \$170M.
  - In 2002, applied to patent first electronic compensation of fiber Kerr nonlinearity.
  - Developed patent portfolio on modulation methods to improve spectral efficiency and impairment tolerance in DWDM long-haul systems. Oversaw development of 40 Gb/s transceiver subsystems. Oversaw testing and simulation of 40 Gb/s DWDM long-haul systems.
- 1998–2000     University of California, Berkeley, Department of Electrical Engineering and Computer Sciences. **Vice Chairman for Graduate Matters:**
- Restructured funding and recruitment of EE and CS graduate students, achieving substantial increase in yield of top admits.

- 1996-2003 University of California, Berkeley, Department of Electrical Engineering and Computer Sciences.  
**Professor:**
- Chaired key committees, including Faculty Search and Graduate Admissions.
  - Developed and taught: core undergraduate course on Signals and Systems; graduate courses on Digital Communications, Applied Electromagnetic Theory, and Quantum Electronics.
- Research Areas:*
- Coherent optical fiber systems: in 1992, demonstrated coherent detection of optical QPSK.
  - Coding and modulation: in 1999, published first work on probabilistic shaping for optical communications.
  - Atmospheric free-space optical communication: 2002 paper is the most highly cited in the field.
  - Indoor free-space optical communications: 1993-97 papers remain the most highly cited in the field as it has shifted from infrared to visible light. Demonstrated 50 Mb/s diffuse link using decision-feedback equalization; characterized and modeled multipath channels. Studied: coded modulation techniques; equalization techniques; multiple-access techniques; transmitting and receiving optics.
  - Free-space communication for distributed sensor networks based on microelectromechanical systems (“smart dust”).
  - Multi-input multi-output wireless systems: effect of correlated fading on channel capacity; design and performance evaluation of space-time codes; optimal power-allocation techniques.
- 1993-1996 University of California, Berkeley, Department of Electrical Engineering and Computer Sciences.  
**Associate Professor.**
- 1990-1993 University of California, Berkeley, Department of Electrical Engineering and Computer Sciences.  
**Assistant Professor.**
- 1987-1990 AT&T Bell Laboratories, Lightwave Communications Research Department, Holmdel, New Jersey.  
**Member of Technical Staff:**
- In 1989, demonstrated first successful synchronous (i.e., coherent) detection using semiconductor lasers, achieving record receiver sensitivity.
  - Developed high-stability, narrow-linewidth, tunable external-cavity semiconductor lasers.
  - Developed wideband, low-noise optical phase-lock receivers.
  - Characterized and reworked traveling-wave lithium niobate phase modulators.
- 1982-1987 University of California, Berkeley. **Research Assistant:**
- Studied pure semiconductors using photothermal ionization and deep-level-transient spectroscopies. Findings overturned dynamic shallow impurity center models published previously by thesis advisors.
  - Constructed high-resolution Fourier-transform infrared spectrometer and related electronic, optical and cryogenic equipment.
  - Developed apparatus and process for tritium doping of semiconductors in a plasma.

## Education

- 1986 Ph.D. Physics, University of California, Berkeley  
 Thesis title: “Hydrogen-Related Acceptor Complexes in Germanium”  
 Thesis advisors: Professors L.M. Falicov and E.E. Haller
- 1983 M.A. Physics, University of California, Berkeley
- 1981 A.B. Physics, University of California, Berkeley

### **Awards, Honors and Fellowships**

2020	Electrical Engineering Chair's Award for Outstanding Contributions to Undergraduate Education, Stanford University
2017-18	Teaching Honor Roll, Tau Beta Pi Society, Stanford University
2003-05	Hoover Faculty Scholar, Stanford University
2000-present	Fellow, Institute of Electrical and Electronics Engineers
1991-96	Presidential Young Investigator Award, National Science Foundation
1981-82	Regents Fellowship, University of California
1981-present	Phi Beta Kappa

### **Professional Society Memberships**

1987-Present	Institute of Electrical and Electronic Engineers (Fellow Grade, Member of Communications Society and Photonics Society)
1983-87	American Physical Society

### **Professional Service**

2009-2014	IEEE/OSA <i>Journal of Optical Communications and Networking</i> , Associate Editor
1993-2000	IEEE <i>Personal Communications Magazine</i> , Technical Editor
1996	ACM/Baltzer <i>J. of Wireless Networks</i> , Guest Editor, Special Series on Free-Space Optical LANs
1996-99	<i>Intl. J. on Wireless Info. Networks</i> , Guest Editor, Special Series on Wireless Infrared Communication

### **Volunteer Work**

1987-89	Tutor at Red Bank Middle School, Red Bank, New Jersey
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### **Patents**

1. E. Chen, J. M. Kahn, B. Buscaino and L. A. Coldren, "Frequency Comb-Based Analog Coherent Receiver for Multi-Wavelength Optical Links, U. S. Patent Application filed February 14, 2023.
2. H. Srinivas, O. Krutko and J. M. Kahn, "Integrated Multimode Amplifiers for Scalable Long-Haul SDM Transmission" U. S. Provisional Patent Application filed December 9, 2022.
3. M. Zhang, C. Wang, M. Loncar, B. Buscaino and J. M. Kahn, "Optical Frequency Comb Generation in Integrated Lithium Niobate Devices", U. S. Patent 11,537,026 B2, December 27, 2022.
4. J. K. Perin, J. M. Kahn and A. K. Shastri, "DSP-Free Coherent Receiver", U. S. Patent 11,218,224, January 4, 2022.
5. K. J. Boucher Anand, O. Solgaard, J. M. Kahn and C. Jan, "Multimode Fiber for Spatial Scanning", U.S. Patent 9,280,003, March 8, 2016.
6. J. M. Kahn, M. A. Horowitz, O. Solgaard and S. Fan, "Adaptive Optical Signal Processing with Multimode Waveguides", U. S. Patent 7,844,144, November 30, 2010.
7. J. M. Kahn, S. Fan, M. A. Horowitz and O. Solgaard, "Adaptive Optical Signal Processing with Multimode Waveguides", U. S. Patent 7,509,002, March 24, 2009.
8. J. M. Kahn, S. Fan, M. A. Horowitz and O. Solgaard, "Adaptive Optical Signal Processing with Multimode Waveguides", U. S. Patent 7,327,914, February 5, 2008.
9. K.-P. Ho and J. M. Kahn, "Method and System to Provide Modular Parallel Precoding in Optical Duobinary Transmission Systems", U. S. Patent 7,287,213, October 23, 2007.
10. J. M. Kahn, M. A. Horowitz, E. Alon and V. Stojanovic, "Adaptive Control for Mitigating Interference in a Multimode Transmission Medium", U. S. Patent 7,194,155, March 20, 2007.
11. K.-P. Ho and J. M. Kahn, "Differential Complex Modulation Optical Receiver Having Compensation for Kerr Effect Phase Noise", U.S. Patent 7,162,163, January 9, 2007.
12. K.-P. Ho and J. M. Kahn, "Optical FSK Receiver Having Compensation for Kerr Effect Phase Noise", U.S. Patent 7,133,620, November 7, 2006.

13. K.-P. Ho and J. M. Kahn, "Optical Receiver Having Compensation for Kerr Effect Phase Noise", U.S. Patent 7,013,089, March 14, 2006.
14. K.-P. Ho and J. M. Kahn, "Optical Receiver Having Compensation for Kerr Effect Phase Noise", U.S. Patent 6,915,084, July 5, 2005.
15. K.-P. Ho and J. M. Kahn, "Multilevel Optical Signals Optimized for Systems having Signal-Dependent and Signal-Independent Noises, Finite Transmitter Extinction Ratio and Intersymbol Interference", U.S. Patent 6,690,894, February 10, 2004.
16. J. M. Kahn and K.-P. Ho, "Transmission and Reception of Duobinary Multilevel Pulse-Amplitude-Modulated Optical Signals Using Finite-State Machine-Based Encoder", U.S. Patent 6,592,274, July 15, 2003.
17. J. M. Kahn and K.-P. Ho, "Transmission and Reception of Duobinary Multilevel Pulse-Amplitude-Modulated Optical Signals Using Subtraction-Based Encoder", U.S. Patent 6,490,069, December 3, 2002.
18. J. M. Kahn and K.-P. Ho, "Transmission and Reception of Duobinary Multilevel Pulse-Amplitude-Modulated Optical Signals Using Subsequence-Based Encoder", U.S. Patent 6,445,476, September 3, 2002.
19. J. M. Kahn and K.-P. Ho, "Transmission and Reception of Duobinary Multilevel Pulse-Amplitude-Modulated Optical Signals Using Finite-State Machine-Based Encoder", U.S. Patent 6,424,444, July 23, 2002.
20. J. M. Kahn and B. L. Kasper, "Optical Homodyne Receiver", U.S. Patent 5,007,106, April 9, 1991.

#### **Books and Book Chapters**

21. A. Belmonte and J. M. Kahn, "Satellite Downlink Coherent Laser Communications", in *Optical Wireless Communications—An Emerging Technology*, M. Uysal, C. Capsoni, Z. Ghassemlooy and A. Boucouvalas, Eds., Springer, 2016.
22. K.-P. Ho and J. M. Kahn, "Mode Coupling and its Impact on Spatially Multiplexed Systems", in *Optical Fiber Telecommunications VI B: Systems and Networks*, I. P. Kaminow, T. Li and A. E. Willner, Eds., Elsevier, Amsterdam, 2013.
23. M. B. Shemirani and J. M. Kahn, *Principal Modes in Multimode Fiber: Modeling and Compensation of Dispersion*, VDM Verlag, Saarbrücken, Germany, 2010.
24. E. Ip and J. M. Kahn, "Nonlinear Impairment Compensation using Backpropagation", in *Optical Fibre, New Developments*, C. Lethien, Ed., In-Tech, Vienna Austria, December 2009.
25. X. Zhu and J. M. Kahn, "Communication Techniques and Coding for Atmospheric Turbulence Channels", in *Free-Space Laser Communications: Principles and Advances*, A. K. Majumdar and J. C. Ricklin, Eds., Springer, New York, 2008.

#### **Journal Articles**

26. E. M. Liang and J. M. Kahn, "Geometric Shaping for Distortion-Limited Intensity Modulation/Direct Detection Data Center Links", *IEEE Photonics J.*, vol. 15, no. 6, pp. 1-17, December 2023
27. H. Jia, E. M. Liang and J. M. Kahn, "Optimal Shaping for the Stokes Vector Receiver", *J. of Lightwave Technol.*, vol. 41, no. 22, pp. 6884-6897, November 15, 2023.
28. E. Chen, L. A. Coldren and J. M. Kahn, "Design of Mode-Locked Semiconductor Laser Comb-Based Analog Coherent Links", *J. of Lightwave Technol.*, vol. 41, no. 18, pp. 5930-5941, September 15, 2023.
29. R. L. Smith, M. Hossain, C. W. Werner, J. M. Kahn and T. H. Lee, "Differential Edge Modulation Signaling for Low-Energy, High-Speed Wireline Communication", *IEEE Trans. Circuits Systems*, vol. 70, no. 8, pp. 3359-3372, August 2023.
30. H. Srinivas, O. Krutko and J. M. Kahn, "Efficient Integrated Multimode Amplifiers for Scalable Long-Haul SDM Transmission", *J. of Lightwave Technol.*, vol. 41, no. 15, pp. 4989-5002, August 1, 2023.
31. A. Vijay and J. M. Kahn, "Effect of Higher-Order Modal Dispersion in Direct-Detection Mode-Division-Multiplexed Links", *J. of Lightwave Technol.*, vol. 41, no. 6, pp. 1670-1683, March 15, 2023.
32. E. Chen, B. Buscaino and J. M. Kahn, "Phase Noise Analysis of Resonator-Enhanced Electro-Optic Comb-Based

- Analog Coherent Receivers”, *J. of Lightwave Technol.*, vol. 40, no. 21, pp. 7117-7128, November 1, 2022.
33. Y. Hu, M. Yu, B. Buscaino, N. Sinclair, D. Zhu, R. Cheng, A. Shams-Ansari, L. Shao, M. Zhang, J. M. Kahn and M. Loncar, “High-Efficiency and Broadband On-Chip Electro-Optic Frequency Comb Generators”, *Nature Photonics*, vol. 16, pp. 679-685, October 2022.
  34. E. S. Chou and J. M. Kahn, “Successive Interference Cancellation on Frequency-Selective Channels with Mode-Dependent Gain”, *J. of Lightwave Technol.*, vol. 40, no. 12, pp. 3729-3738, June 15, 2022.
  35. E. S. Chou, H. Srinivas and J. M. Kahn, “Phase Retrieval-Based Coherent Receivers: Signal Design and Degrees of Freedom”, *J. of Lightwave Technol.*, vol. 40, no. 5, pp. 1296-1307, March 1, 2022 (Invited Paper).
  36. A. Belmonte and J. M. Kahn, “Optimal Modes for Spatially Multiplexed Free-Space Communication in Atmospheric Turbulence”, *Optics Express*, vol. 29, no. 26, pp. 43556-43566, December 20, 2021.
  37. H. Srinivas, J. D. Downie, J. Hurley, X. Liang, J. Himmelreich, J. K. Perin, D. A. A. Mello and J. M. Kahn, “Modeling and Experimental Measurement of Power Efficiency for Power-Limited SDM Submarine Transmission Systems”, *J. of Lightwave Technol.*, vol. 39, no. 8, pp. 2376-2386, April 15, 2021.
  38. B. Buscaino, E. Chen, J. W. Stewart, T. Pham and J. M. Kahn, “External vs. Integrated Light Sources for Intra-Data Center Co-Packaged Optical Interfaces”, *J. of Lightwave Technol.*, vol. 39, no. 7, pp. 1984-1996, April 1, 2021.
  39. J. K. Perin, A. Shastri and J. M. Kahn, “Coherent Data Center Links”, *J. of Lightwave Technol.*, vol. 39, no. 3, pp. 730-741, February 1, 2021 (Invited Paper).
  40. K. Choutagunta and J. M. Kahn, “Designing High-Performance Multimode Fibers Using Refractive Index Optimization”, *J. of Lightwave Technol.*, vol. 39, no. 1, pp. 233-242, January 1, 2021.
  41. E. S. Chou and J. M. Kahn, “Adaptive Coding and Modulation for Robust Optical Access Networks”, *J. of Lightwave Technol.*, vol. 38, no. 8, pp. 2242-2252, April 15, 2020.
  42. M. T. Taylor, A. Belmonte, L. Hollberg and J. M. Kahn, “Effect of Atmospheric Turbulence on Timing Instability for Partially Reciprocal Two-Way Optical Time Transfer Links”, *Phys. Rev. A*, vol. 101, 033843, March 30, 2020.
  43. B. Buscaino, M. Zhang, M. Loncar and J. M. Kahn, “Design of Efficient Resonator-Enhanced Electro-Optic Frequency Comb Generators”, *J. of Lightwave Technol.*, vol. 38, no. 6, pp. 1400-1413, March 15, 2020.
  44. K. Choutagunta, I. Roberts, D. A. B. Miller and J. M. Kahn, “Adapting Mach-Zehnder Mesh Equalizers in Direct-Detection Mode-Division-Multiplexed Links”, *J. of Lightwave Technol.*, vol. 38, no. 4, pp. 723-735, February 15, 2020.
  45. D. A. A. Mello, K. Choutagunta, H. Srinivas and J. M. Kahn, “Impact of Polarization- and Mode-Dependent Gain on the Capacity of Ultra-Long-Haul Systems”, *J. of Lightwave Technol.*, vol. 38, no. 2, pp. 303-318, January 15, 2020 (Invited Paper).
  46. B. Buscaino, B. D. Taylor and J. M. Kahn, “Multi-Tb/s-per-Fiber Coherent Co-packaged Optical Interfaces for Data Center Switches”, *J. of Lightwave Technol.*, vol. 37, no. 13, pp. 3401-3412, July 1, 2019.
  47. J. K. Perin, J. M. Kahn, J. D. Downie, J. Hurley and K. Bennett, “Importance of Amplifier Physics in Maximizing the Capacity of Submarine Links”, *J. of Lightwave Technol.*, vol. 37, pp. 2076-2085, May 1, 2019.
  48. M. Zhang, B. Buscaino, C. Wang, A. Shams-Ansari, C. Reimer, R. Zhu, J. M. Kahn and M. Loncar, “Broadband Electro-Optic Frequency Comb Generator in an Integrated Microring Resonator”, *Nature*, vol. 568, pp. 373-377, April 18, 2019.
  49. K. Choutagunta, I. Roberts and J. M. Kahn, “Efficient Quantification and Simulation of Modal Dynamics in Multimode Fiber Links”, *J. of Lightwave Technol.*, vol. 37, pp. 1813-1825, April 15, 2019 (Invited Paper).
  50. A. C. Jatoba-Neo, C. E. Rothenberg, D. A. A. Mello, S. Ö. Arik and J. M. Kahn, “Scaling SDM Optical Networks Using Full-Spectrum Spatial Switching”, *J. Optical Commun. Netw.*, vol. 10, no. 12, pp. 991-1004, December 2018.

51. K. Choutagunta, S. Ö. Arik, K.-P. Ho and J. M. Kahn, "Characterizing Mode-Dependent Loss and Gain in Multimode Components", *J. of Lightwave Technol.*, vol. 36, no. 18, pp. 3815-3823, September 15, 2018.
52. J. K. Perin, A. Shastri and J. M. Kahn, "Data Center Links Beyond 100 Gbit/s per Wavelength", *Optical Fiber Technology*, vol. 44, pp. 69-85, 2018 (Invited Paper).
53. I. Roberts and J. M. Kahn, "Measurement-Based Optimization of Channel Powers with Non-Gaussian Nonlinear Interference Noise", *J. of Lightwave Technol.*, vol. 36, no. 13, pp. 2746-2756, July 1, 2018.
54. S. Ö. Arik and J. M. Kahn, "Low-Complexity Implementation of Convex Optimization-Based Phase Retrieval", *J. of Lightwave Technol.*, vol. 36, no. 12, pp. 2358-2365, June 15, 2018.
55. I. Roberts, J. M. Kahn, J. Harley and D. Boertjes, "Channel Power Optimization of WDM Systems Following Gaussian Noise Nonlinearity Model in Presence of Stimulated Raman Scattering", *J. of Lightwave Technol.*, vol. 35, no. 23, pp. 5237-5249, December 1, 2017. Also see errata: *J. of Lightwave Technol.*, vol. 36, no. 11, p. 2309, June 1, 2018.
56. J. K. Perin, A. Shastri and J. M. Kahn, "Design of Low-Power DSP-Free Coherent Receivers for Data Center Links", *J. of Lightwave Technol.*, vol. 35, no. 21, pp. 4650-4662, November 1, 2017.
57. I. Roberts and J. M. Kahn, "Efficient Discrete Rate Assignment and Power Optimization in Optical Communication Systems Following the Gaussian Noise Model", *J. of Lightwave Technol.*, vol. 35, no. 20, pp. 4425-4437, October 15, 2017.
58. O. D. Domingues, D. A. A. Mello, R. Silva, S. Ö. Arik and J. M. Kahn, "Achievable Rates of Space-Division Multiplexed Submarine Links Subject to Nonlinearities and Power Feed Constraints", *J. of Lightwave Technol.*, vol. 35, no. 18, pp. 4004-4010, September 15, 2017.
59. A. Belmonte, M. T. Taylor, L. Hollberg and J. M. Kahn, "Effect of Atmospheric Anisoplanatism on Earth-to-Satellite Time Transfer over Laser Communication Links", *Optics Express*, vol. 25, no. 14, pp. 15676-15686, July 10, 2017.
60. K. Choutagunta and J. M. Kahn, "Dynamic Channel Modeling for Mode-Division Multiplexing", *J. of Lightwave Technol.*, vol. 35, no. 12, pp. 2451-2463, June 15, 2017.
61. J. M. Kahn and D. A. B. Miller, "Communications Expands its Space", *Nature Photon.*, vol. 11, no. 1, pp. 5-8, January 2017 (Invited Paper).
62. J. K. Perin, M. Sharif and J. M. Kahn, "Sensitivity Improvement in 100 Gbit/s-per-Wavelength Links using Semiconductor Optical Amplifiers or Avalanche Photodiodes", *J. of Lightwave Technol.*, vol. 33, no. 24, pp. 5542-5553, December 1, 2016.
63. S. Ö. Arik and J. M. Kahn, "Direct-Detection Mode-Division Multiplexing in Modal Basis Using Phase Retrieval", *Optics Lett.*, vol. 41, no. 18, pp. 4265-4268, September 15, 2016.
64. I. Roberts, J. M. Kahn and D. Boertjes, "Convex Channel Power Optimization in Nonlinear WDM Systems using Gaussian Noise Model", *J. of Lightwave Technol.*, vol. 34, no. 13, pp. 3212-3222, July 1, 2016.
65. S. Ö. Arik, K.-P. Ho and J. M. Kahn, "Group Delay Management and Multi-Input Multi-Output Signal Processing in Mode-Division Multiplexing Systems", *J. of Lightwave Technol.*, vol. 34, no. 11, pp. 2867-2880, June 1, 2016 (Invited Paper).
66. P. Berceau, M. T. Taylor, J. M. Kahn and L. Hollberg, "Space-Time Reference with an Optical Link", *Class. Quantum Grav.*, vol. 33, p. 135007, May 31, 2016.
67. N. Zhao, X. Li, G. Li and J. M. Kahn, "Capacity Limits of Spatially Multiplexed Free-Space Communication", *Nature Photon.*, vol. 9, pp. 822-826, December 2015.
68. J. K. Perin, M. Sharif and J. M. Kahn, "Modulation Schemes for Single-Laser 100 Gbit/s Links: Multicarrier", *J. of Lightwave Technol.*, vol. 33, no. 24, pp. 5122-5132, December 15, 2015.
69. S. Ö. Arik, K.-P. Ho and J. M. Kahn, "Delay Spread Reduction in Mode-Division Multiplexing: Mode Coupling versus Delay Compensation", *J. of Lightwave Technol.*, vol. 33, no. 21, pp. 4504-4512, November 1, 2015.

70. R. Y. Gu, R. Nasiri Mahalati and J. M. Kahn “Design of Flexible Multi-Mode Fiber Endoscope”, *Optics Express*, vol. 23, no. 21, pp. 26905-26918, October 19, 2015.
71. M. Sharif, J. K. Perin and J. M. Kahn, “Modulation Schemes for Single-Laser 100 Gbit/s Links: Single-Carrier”, *J. of Lightwave Technol.*, vol. 33, no. 20, pp. 4268-4277, October 15, 2015.
72. D. Askarov and J. M. Kahn, “Long-Period Fiber Gratings for Mode Coupling in Mode-Division-Multiplexing Systems”, *J. of Lightwave Technol.*, vol. 33, no. 19, pp. 4032-4038, October 1, 2015.
73. I. Gasulla and J. M. Kahn, “Performance of Direct-Detection Mode-Group-Division Multiplexing using Fused Fiber Couplers”, *J. of Lightwave Technol.*, vol. 33, no. 9, pp. 1748-1760, May 1, 2015.
74. S. Ö. Arik and J. M. Kahn, “Spectral and Spatial Aggregation for High-Throughput Data Transmission and Networking”, *SPIE Newsroom*, 10.1117/2.1201501.005757, February 2015 (Invited Paper).
75. S. Ö. Arik, K.-P. Ho and J. M. Kahn, “Optical Network Scaling: Roles of Spectral and Spatial Aggregation”, *Optics Express*, vol. 22, no. 24, pp. 29868-29887, November 21, 2014 (Invited Paper).
76. D. Askarov, B. Szafraniec, D. M. Baney and J. M. Kahn, “Frequency-Derivative Measurement Technique for Dispersive Effects in Single-Mode Fiber Systems”, *J. of Lightwave Technol.*, vol. 32, no. 22, pp. 3854-3861, November 15, 2014.
77. K.-P. Ho, J. M. Kahn and J. P. Wilde, “Wavelength-Selective Switches for Mode-Division Multiplexing: Scaling and Performance Analysis”, *J. of Lightwave Technol.*, vol. 32, no. 22, pp. 3724-3735, November 15, 2014.
78. R. Y. Gu, R. Nasiri Mahalati and J. M. Kahn, “Noise-Reduction Algorithms for Optimization-Based Imaging through Multi-Mode Fiber”, *Optics Express*, vol. 22, no. 12, pp. 15118-15132, June 12, 2014.
79. R. Nasiri Mahalati, D. Askarov and J. M. Kahn, “Adaptive Modal Gain Equalization Techniques in Multi-Mode Erbium-Doped Fiber Amplifiers”, *J. of Lightwave Technol.*, vol. 32, no. 11, pp. 2133-2143, June 1, 2014.
80. S. Ö. Arik and J. M. Kahn, “Diversity-Multiplexing Tradeoff in Mode-Division Multiplexing”, *Optics Lett.*, vol. 39, pp. 3258-3261, June 1, 2014.
81. M. Sharif and J. M. Kahn, “Variable-Bandwidth Superchannels Using Synchronized Colorless Transceivers”, *J. of Lightwave Technol.*, vol. 32, no. 10, pp. 1921-1929, May 15, 2014.
82. S. Ö. Arik, D. Askarov and J. M. Kahn, “Adaptive Frequency-Domain Equalization in Mode-Division Multiplexing Systems”, *J. of Lightwave Technol.*, vol. 32, no. 10, pp. 1841-1852, May 15, 2014.
83. S. Ö. Arik, J. M. Kahn and K.-P. Ho, “MIMO Signal Processing for Mode-Division Multiplexing”, *IEEE Signal Processing Magazine*, vol. 31, no. 2, pp. 25-34, March 2014 (Invited Paper).
84. L. Beygi, E. Agrell, J. M. Kahn, and M. Karlsson, “Coded Modulation for Fiber-Optic Networks”, *IEEE Signal Processing Magazine* vol. 31, no. 2, pp. 93-103, March 2014.
85. K.-P. Ho and J. M. Kahn, “Linear Propagation Effects in Mode-Division Multiplexing Systems”, *J. of Lightwave Technol.*, vol. 32, no. 4, pp. 614-628, February 15, 2014 (Invited Paper).
86. L. Beygi, E. Agrell, J. M. Kahn, and M. Karlsson, “Rate-Adaptive Coded Modulation for Fiber-Optic Communications”, *J. of Lightwave Technol.*, vol. 32, no. 2, pp. 333-343, January 15, 2014.
87. D. A. A. Mello, A. N. Barreto, T. C. Lima, T. F. Portela, L. Beygi and J. M. Kahn, “Optical Networking with Variable-Code-Rate Transceivers”, *J. of Lightwave Technol.*, vol. 32, no. 2, pp. 257-266, January 15, 2014.
88. S. Ö. Arik and J. M. Kahn, “Coupled-Core Multi-Core Fibers for Spatial Multiplexing”, *IEEE Photon. Technol. Lett.*, vol. 25, no. 21, pp. 2054-2057, November 1, 2013.
89. E. Ip and J. M. Kahn, “The Time-Reversed Twin”, *Nature Photonics* vol. 7, pp. 507-508, July 2013 (Invited Paper).
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#### **Invited Conference Presentations**

221. J. M. Kahn and E. M. Liang, “Probabilistic Shaping for Direct-Detection Optical Systems”, tutorial presentation at Optical Fiber Commun. Conf., San Diego, CA, March 24-28, 2024.
222. D. A. A. Mello, H. Srinivas, K. Choutagunta, R. S. B. Ospina and J. M. Kahn, “Impact and Mitigation of Mode-Dependent Gain in Ultra-Long-Haul SDM Systems”, *Proc. of Optical Fiber Commun. Conf.*, San Diego, CA, March 5-9, 2023.
223. J. M. Kahn, E. Chen, L. A. Coldren and B. Buscaino, “Frequency Comb-Based Analog Coherent Links”, in Workshop S2F Slow and Wide vs. Fast and Narrow, San Diego, CA, March 5-9, 2023.
224. J. M. Kahn and A. Belmonte, “Modal Multiplexing and Atmospheric Turbulence Mitigation in Free-Space Optical Communications”, tutorial presentation at Euro. Conf. on Optical Commun., Basel, Switzerland, September 18-22, 2022.
225. E. Chou and J. M. Kahn, “Achievable Rates of Coupled SDM Systems Utilizing Successive Interference Cancellation”, *Proc. of Optica Advanced Photonics Congress on Signal Processing in Photonic Commun.*, Maastricht, Netherlands, July 25-28, 2022.
226. A. Belmonte and J. M. Kahn, “Optimal Modes for Spatially Multiplexed Free-Space Communications”, *Proc. of IEEE Phot. Soc. Summer Topical Meeting on Space Division Multiplexing*, Cabo San Lucas, Mexico, July 11-13, 2022.
227. D. A. A. Mello, H. Srinivas, K. Choutagunta, R. S. B. Ospina and J. M. Kahn, “Impact of Mode-Dependent Gain on the Capacity of Ultra-Long-Haul SDM Systems”, *Proc. of IEEE Phot. Soc. Summer Topical Meeting on Space Division Multiplexing*, Cabo San Lucas, Mexico, July 11-13, 2022.
228. E. Chen, B. Buscaino and J. M. Kahn, “Frequency Comb-Based Analog Coherent Data Center Links”, in Workshop S1E Time to Face the Cost Per Bit “Crunch”: Trends and Expectations for the Next Decade, Optical Fiber Commun. Conference, San Diego, CA, March 6-10, 2022.
229. J. M. Kahn, “Extremes: From Coherent Data Center Links to Amplifier Physics-Optimized Submarine Cables”, plenary talk at Extremely Advanced Optical Transmission Technologies Symposium, Matsue, Japan, November 3-5, 2021.
230. H. Srinivas, J. D. Downie, J. M. Kahn, J. Hurley, X. Liang, J. Himmelreich, J. K. Perin and D. A. A. Mello, “Power Efficiency Measurements in Amplifier Physics-Optimized Power-Limited SDM Submarine Transmission Systems”, *Optoelectron. and Commun. Conf.*, Hong Kong, July 3-7, 2021.

231. E. Chou, H. Srinivas and J. M. Kahn, "Phase Retrieval-Based Coherent Receivers", *Proc. of Optical Fiber Commun. Conf.*, San Francisco, CA, June 6-10, 2021.
232. J. M. Kahn, B. Buscaino, J. K. Perin and A. Shastri, "Drivers and Design Options for Coherent Links in Data Centers", plenary talk at IEEE Optical Interconnects Conf., Vancouver, BC, September 27-October 1, 2020.
233. B. Buscaino, J. M. Kahn and B. D. Taylor, "External vs. Integrated Light Sources for Co-Packaged Intra-Data Center Optics", *Proc. of IEEE Photonics Conf.*, Vancouver, BC, September 27-October 1, 2020.
234. H. Srinivas, E. Chou, D. A. A. Mello, K. Choutagunta and J. M. Kahn, "Impact and Mitigation of Polarization- or Mode-Dependent Amplifier Gain in Ultra-Long-Haul Systems", *Proc. of Intl. Conf. on Transparent Optical Networks*, July 19-23, 2020.
235. J. M. Kahn, J. K. Perin and A. Shastri, "Low-Complexity Coherent Interfaces for Intra-Data Center Networks", tutorial at IEEE Phot. Soc. Summer Topical Meeting on Coherent Optics for Short-Reach Networks, July 13-15, 2020.
236. K. Choutagunta and J. M. Kahn, "Topology Optimization of Multimode Optical Fibers", *Proc. of IEEE Phot. Soc. Summer Topical Meeting on Space Division Multiplexing*, July 13-15, 2020.
237. K. Choutagunta and J. M. Kahn, "Dynamic Mode Coupling in Mode-Division-Multiplexed Systems", *Proc. of Conf. on Lasers and Electro-Optics*, San Jose, CA, May 10-15, 2020.
238. J. M. Kahn, J. K. Perin and A. Shastri, "Data Center Links Beyond 100 Gb/s per Wavelength", tutorial at Optical Fiber Commun. Conf., San Diego, CA, March 8-12, 2020.
239. J. M. Kahn, "Revolutions at the Extremes in Optical Communications", plenary talk at Intl. Microwave and Optoelectronics Conf., Aveiro, Portugal, November 10-14, 2019.
240. B. Buscaino, J. M. Kahn and B. D. Taylor, "Coherent Co-packaged Optical Interfaces for Next-Generation Electrical Switches" *Proc. of IEEE Photonics Conf.*, San Antonio, TX, September 29-October 3, 2019.
241. J. K. Perin, J. M. Kahn, J. D. Downie, J. Hurley and K. Bennett, "Substantial Capacity Increase via Optimized Power/Bit Allocation in Spatially Multiplexed Power-Limited Submarine Systems", *Proc. of OSA Signal Processing in Photonic Communications*, July 29-August 1, 2019, Burlingame, CA.
242. E. S. Chou and J. M. Kahn, "Adaptive Coding and Modulation for Robust 50G PONs", *Proc. of Intl. Conf. on Transparent Optical Networks*, Angers, France, July 9-13, 2019.
243. K. Choutagunta, I. Roberts, D. A. B. Miller and J. M. Kahn, "Mach-Zehnder Mesh Adaptation Methods for Direct-Detection Mode-Division Multiplexing", *Proc. of IEEE Phot. Soc. Summer Topical Meeting on Programmable Photonics*, Ft. Lauderdale, FL, July 8-10, 2019.
244. E. S. Chou, T. Hayashi, T. Nagashima, J. M. Kahn and T. Nakanishi, "Stable Measurement of Near/Far Field Profiles of Coupled Multi-Core Fiber", *Proc. of Optoelectronics and Communications Conference*, Fukuoka, Japan, July 7-11, 2019.
245. K. Choutagunta, R. Ryf, N. Fontaine, S. Wittek, J. C. Alvarado-Zacarias, M. Mazur, H. Chen, R.-J. Essiambre, R. Amezcua-Correa, T. Hayashi, Y. Tamura, T. Hasegawa, T. Taru and J. M. Kahn, "Modal Dynamics in Spatially Multiplexed Links", *Proc. of Optical Fiber Commun. Conf.*, San Diego, CA, March 3-7, 2019.
246. J. K. Perin, A. Shastri and J. M. Kahn, "Sensitivity and Power Consumption of Direct Detection and Coherent Receivers for Intra- and Inter-Data Center Systems", presentation in workshop on Will Advanced Direct-Detection Systems Ever Be the Solution of Choice for Metro, Access, and Data Center Applications?, Optical Fiber Commun. Conf., San Diego, CA, March 3-7, 2019.
247. J. M. Kahn, B. Buscaino and B. D. Taylor, "Coherent Co-Packaged Optical Interfaces in Next-Generation Electrical Switches", presentation in workshop on Will Coherent Optics Become a Reality for Intra-Data Center Applications?, Optical Fiber Commun. Conf., San Diego, CA, March 3-7, 2019.
248. K. Choutagunta, S. O. Arik, K.-P. Ho and J. M. Kahn, "Modal Dispersion and Mode-Dependent Loss in Multimode fibers: Modeling, Measurement and Compensation", *Proc. of IEEE Intl. Photon. Conf.*, Reston, VA, September 30-October 4, 2018.

249. K. Choutagunta, I. Roberts and J. M. Kahn, "Modeling and Tracking Dynamic Mode Coupling in MDM Systems", *Proc. of Euro. Conf. on Optical Commun.*, Rome, IT, September 23-27, 2018.
250. J. K. Perin, A. Shastri and J. M. Kahn, "DSP-Free Coherent Receivers for Data Center Links", Presentation in Workshop on Has the Time Come for Coherent Optics in the Data Centres?, Euro. Conf. on Optical Commun., Rome, IT, September 23-27, 2018.
251. J. K. Perin, I. Roberts and J. M. Kahn, "Maximizing Capacity via Channel Power Optimization under Energy Constraints", *Proc. of IEEE Phot. Soc. Summer Topical Meeting on Machine Learning-Assisted Software-Defined Optical Networks*, Waikoloa, HI, July 9-11, 2018.
252. K. Choutagunta and J. M. Kahn, "Models for Mode Coupling Dynamics for Mode-Division Multiplexing", *Proc. of IEEE Phot. Soc. Summer Topical Meeting on Space-Division Multiplexing and Beyond*, Waikoloa, HI, July 9-11, 2018.
253. I. Roberts, J. K. Perin and J. M. Kahn, "Improving the Capacity of Terrestrial and Submarine Systems via Channel Power Optimization", *Proc. of Intl. Conf. on Trans. Optical Networks, Bucharest, Romania*, July 1-5, 2018.
254. J. K. Perin, A. Shastri and J. M. Kahn, "DSP-Free Coherent Interconnects for Data Center Networks", *Proc. of IEEE Optical Intercon. Conf.*, Santa Fe, NM, June 4-6, 2018.
255. J. M. Kahn, "Capacity Limits for Spatially Multiplexed Free-Space Optical Communication", keynote talk at Signal and Image Sciences Workshop, Center for Advanced Signal and Imaging Sciences, Lawrence Livermore National Laboratory, Livermore, CA, May 23, 2018.
256. I. Roberts and J. M. Kahn "Convex Optimization for Channel Rate and Power Control", Panel Presentation in Workshop on AI-Assisted Automated Network Operation, Optical Fiber Commun. Conf., San Diego, CA, March 11-15, 2018.
257. J. K. Perin, A. K. Shastri and J. M. Kahn, "DSP-Free Coherent Receivers for Data Center Links", *Proc. of Optical Fiber Commun. Conf.*, San Diego, CA, March 11-15, 2018.
258. J. M. Kahn and A. Belmonte, "Approaching Fundamental Limits to Free-Space Communication through Atmospheric Turbulence", *Proc. of Photon. West*, San Francisco, CA, January 27-February 1, 2018.
259. J. K. Perin, A. K. Shastri and J. M. Kahn, "Data Center Links beyond 100 Gb/s per Wavelength", *Proc. of Photon. West*, San Francisco, CA, January 27-February 1, 2018.
260. A. Belmonte and J. M. Kahn, "Achieving Fundamental Limits to Free-Space Optical System Capacity Imposed by Atmospheric Turbulence", ICERM Workshop on Waves and Imaging in Random Media, Providence, RI, September 25-29, 2017.
261. K. Choutagunta and J. M. Kahn, "Low-Complexity Modeling of Dynamic Mode-Division Multiplexing Channels", *Proc. of OSA Topical Meeting on Photonic Networks and Devices*, New Orleans, LA, July 24-27, 2017.
262. J. M. Kahn, "Optical Communications for Data Centers", Panel Presentation in Workshop on Prospects and Challenges for Photonic Technologies Inside Data Centers, OSA Topical Meeting on Photonic Networks and Devices, New Orleans, LA, July 24-27, 2017.
263. J. M. Kahn and G. Li, "Capacity Limits for Spatially Multiplexed Free-Space Optical Communication", NSF Workshop on Free-Space Optical Networks, Arlington, VA, July 13-14, 2017.
264. K. Choutagunta, S. Ö. Arik, M. Moradshahi and Joseph M. Kahn, "Optical MIMO Signal Processing for Direct-Detection Mode-Division Multiplexing", *Proc. of Intl. Conf. on Trans. Optical Networks*, Girona, Spain, July 2-6, 2017.
265. J. M. Kahn, G. Li, X. Li and N. Zhao, "Capacity Limits for Spatially Multiplexed Free-Space Communication", *Proc. of Optical Fiber Commun. Conf.*, Los Angeles, CA, March 19-23, 2017.
266. S. Ö. Arik and J. M. Kahn, "Optical MIMO Processing for Direct-Detection Mode-Division Multiplexing", *Proc. of Euro. Conf. on Optical Commun.*, Düsseldorf, Germany, September 18-22, 2016.



267. K. Choutagunta and J. M. Kahn, "Dynamic Channel Modeling for Mode-Division Multiplexing", *Proc. of Euro. Conf. on Optical Commun.*, Düsseldorf, Germany, September 18-22, 2016.
268. J. M. Kahn, G. Li, X. Li and N. Zhao, "To Twist or Not to Twist: Capacity Limits for Free-Space Channels", *Proc. OSA Topical Meeting on Signal Processing in Photonic Communication*, Vancouver, BC, July 18-20, 2016.
269. K. Choutagunta and J. M. Kahn, "Dynamic Channel Modeling for Mode-Division Multiplexing", *Proc. IEEE Photonics Society Summer Topical on Space-Division Multiplexing and Multimode Photonics*, Newport Beach, CA, July 11-13, 2016.
270. J. M. Kahn, G. Li, X. Li and N. Zhao, "Are OAM States an Optimal Basis for Spatially Multiplexed Free-Space Links?", *Proc. IEEE Photonics Society Summer Topical on Optical Wireless Communication*, Newport Beach, CA, July 11-13, 2016.
271. J. M. Kahn, G. Li, X. Li and N. Zhao, "Comparing OAM and Other Basis Sets for Spatially Multiplexed Free-Space Links", *Proc. of OSA Photonics North Conference*, Québec, QC, May 24-26, 2016.
272. J. M. Kahn, G. Li, X. Li and N. Zhao, "Capacity Limits of Spatially Multiplexed Free-Space Communication", SU2P Symposium, Edinburgh, UK, April 4-5, 2016.
273. S. Ö. Arık, K.-P. Ho and J. M. Kahn, "Group Delay Statistics and Management in Mode-Division Multiplexing", *Proc. of Asilomar Conf. on Signals, Systems and Computers*, Pacific Grove, CA, November 8-11, 2015.
274. D. A. A. Mello, A. N. Barreto, T. C. Lima, T. F. Portela, L. Beygi and J. M. Kahn, "Variable-Code-Rate Transceivers: Impact on Cost, Throughput and Survivability of Wavelength-Routed Networks", European Conference on Optical Communication, Valencia, Spain, September 27-October 1, 2015.
275. J. M. Kahn, S. Ö. Arık and K.-P. Ho, "MIMO Channel Statistics and Signal Processing in Mode-Division Multiplexing Systems", *Proc. of 16<sup>th</sup> IEEE Intl. Workshop on Signal Processing Advances in Wireless Communications*, Stockholm, Sweden, June 28-July 1, 2015.
276. S. Ö. Arık, D. Askarov and J. M. Kahn, "MIMO DSP Complexity in Mode-Division Multiplexing", *Proc. of Optical Fiber Commun. Conf.*, Los Angeles, CA, March 22-26, 2015.
277. S. Ö. Arık, D. Askarov and J. M. Kahn, "MIMO Signal Processing in Mode-Division Multiplexing Systems", *Proc. of SPIE Photonics West*, San Francisco, CA, February 7-12, 2015.
278. S. Ö. Arık, K.-P. Ho and J. M. Kahn, "Roles of Spectral and Spatial Aggregation in Optical Network Scaling", *Proc. of SPIE Photonics West*, San Francisco, CA, February 7-12, 2015.
279. S. Ö. Arık and J. M. Kahn, "Adaptive MIMO Signal Processing in Mode-Division Multiplexing", *Proc. of IEEE Photonics Society Summer Topical Meeting on Space-Division Multiplexing Technologies for High-Capacity Transmission*, Montreal, QC, July 14-16, 2014.
280. J. M. Kahn "Digital Signal Processing for Short-Reach Optical Links", Panel Presentation in Workshop on DSP for Short-Reach Applications, Optical Fiber Commun. Conf., San Francisco, CA, March 9-13, 2014.
281. J. M. Kahn, "Four-Fold Resolution Increase in Scan-Free Single-Fiber Endoscopic Imaging", Berkeley Photonics Symposium, Berkeley, CA, February 10-11, 2014.
282. J. M. Kahn and K.-P. Ho, "Modal Statistics in Mode-Division-Multiplexed Systems", *Proc. of European Conference on Optical Communication*, London, UK, September 22-26, 2013.
283. J. M. Kahn, "Four-Fold Resolution Increase in Scan-Free Single-Fiber Endoscopic Imaging", SU2P Symposium, Glasgow, UK, April 15-16, 2013.
284. J. M. Kahn and K.-P. Ho, "Mode-Division Multiplexing Systems: Propagation Effects, Performance and Complexity", *Proc. of Optical Fiber Commun. Conf.*, Anaheim, CA, March 17-21, 2013.
285. J. M. Kahn and K.-P. Ho, "Mode Coupling in Coherent Mode-Division-Multiplexed Systems: Impact on Capacity and Signal Processing Complexity", *Proc. of Asilomar Conf. on Signals, Systems and Computers*, Pacific Grove, CA, November 4-7, 2012.
286. J. M. Kahn, "Optical MIMO Transmission: Opportunities and Challenges", Plenary Talk at 30th Brazilian

Telecommunications Symposium, Brasília, Brazil, September 13-16, 2012.

287. J. M. Kahn, Daniel J. F. Barros and Sarah Kate Wilson, "Multi-Carrier versus Single-Carrier Intensity Modulation Techniques for Indoor Optical Wireless Links", *Proc. of IEEE Photonics Society Summer Topical on Optical Wireless Systems and Applications*, Seattle, WA, July 9-11, 2012.
288. J. M. Kahn, K.-P. Ho and M. B. Shemirani, "Mode-Coupling Effects in Multimode Fibers", *Proc. of Optical Fiber Commun. Conf.*, Los Angeles, CA, March 4-8, 2012.
289. J. M. Kahn, "Bandwidth-Scalable OFDM Long-Haul Transmission", *Proc. of IEEE Photonics 2011 Conference*, Arlington, VA, October 9-13, 2011.
290. D. J. F. Barros, J. M. Kahn and S. K. Wilson, "Comparison of Multi-Carrier and Single-Carrier Intensity Modulation Techniques for Indoor Optical Wireless Links", *Proc. of IEEE Photonics 2011 Conference*, Arlington, VA, October 9-13, 2011.
291. D. J. F. Barros, J. M. Kahn, J. P. Wilde and T. Abou Zeid, "System Architecture for Bandwidth-Scalable OFDM Long-Haul Transmission", *Proc. of IEEE Photon. Soc. Summer Topical Meeting on Terabit Optical Ethernet*, Montreal, QC, July 18-20, 2011.
292. J. M. Kahn, "Understanding and Exploiting Multimode Fiber Dispersion", presented at OIDA Short-Distance High Density Optical Interconnects Roadmapping Workshop, Stanford, CA, April 12-13, 2011.
293. G.-H. Gho and J. M. Kahn, "Rate-Adaptive Modulation and Coding for Optical Fiber Transmission Systems", *Proc. of SPIE Photonics West*, San Francisco, CA, January 22-27, 2011.
294. J. M. Kahn and G.-H. Gho, "Rate-Adaptive Transmission Techniques for Optical Fiber Systems", *Proc. of OSA Annual Meeting*, Rochester, NY, October 24-29, 2010.
295. G.-H. Gho and J. M. Kahn, "Rate-Adaptive Coding for Optical Fiber Transmission Systems", *Proc. of OSA Topical Meeting on Signal Processing in Photonic Communication*, Karlsruhe, Germany, June 21-24, 2010.
296. S. E. Harris, C. Belthangady, C.-S. Chuu, S. Du, P. Kolchin, S. Sensarn, I. A. Yu, J. M. Kahn and G. Y. Yin, "Modulation of Photons and Biphotons", *Proc. of OSA Conference on Lasers and Electro-Optics*, San Jose, CA, May 16-21, 2010.
297. A. Belmonte and J. M. Kahn, "Analysis of a Field-Conjugation Adaptive Array for Coherent Free-Space Optical Links", *Proc. of OSA Topical Meeting on Applications of Lasers for Sensing and Free Space Communications*, San Diego, CA, January 31-February 3, 2010.
298. A. Belmonte and J. M. Kahn, "Understanding the Performance of Atmospheric Free-Space Laser Communications Systems using Coherent Detection", *Proc. of SPIE Photonics West*, San Francisco, CA, January 23-28, 2010, paper number 7588-1.
299. A. Belmonte and J. M. Kahn, "Fundamental Limits on Diversity Coherent Reception on Atmospheric Optical Channels", *Proc. of Asilomar Conference on Signals, Systems and Computers*, Pacific Grove, CA, November 1-4, 2009.
300. M. B. Shemirani and J. M. Kahn, "Principal Modes in Graded-Index Multimode Fibers", *Proc. of OSA Annual Meeting*, San Jose, CA, October 11-15, 2009.
301. J. M. Kahn and E. Ip, "Principles of Digital Coherent Receivers for Optical Communications", *Proc. of Optical Fiber Communications Conference*, San Diego, CA, March 22-26, 2009.
302. E. Ip and J. M. Kahn, "Increasing Optical Fiber Transmission Capacity Beyond Next-Generation Systems", *Proc. of IEEE Lasers and Electro-Optics Society Annual Meeting*, Newport Beach, CA, November 9-13, 2008.
303. E. Ip, A. P. T. Lau, D. J. F. Barros and J. M. Kahn, "Compensation of Dispersion and Nonlinearity in WDM Transmission using Simplified Digital Backpropagation", *Proc. of IEEE LEOS Summer Topical on Coherent Optical Communication Systems*, Acapulco, Mexico, July 21-23, 2008.
304. E. Ip, A. P. T. Lau, D. J. F. Barros and J. M. Kahn, "Compensation of Chromatic Dispersion and Nonlinearity using Simplified Digital Backpropagation", *Proc. of OSA Topical Meeting on Coherent Optical Technologies and Applications*, Boston, MA, July 13-16, 2008.

305. A. Belmonte and J. M. Kahn, "Performance of Synchronous or Nonsynchronous Receivers Using Atmospheric Compensation Techniques", *Proc. of OSA Topical Meeting on Coherent Optical Technologies and Applications*, Boston, MA, July 13-16, 2008.
306. J. M. Kahn, "Spectral Efficiency Limits and How to Approach Them", Panel Presentation at IEEE LEOS Summer Topical on Advanced Digital Signal Processing in Next-Generation Fiber-Optic Transmission, Portland, OR, July 23-25, 2007.
307. J. M. Kahn and E. Ip, "Advanced Modulation Formats and Digital Signal Processing in Optical Communications", *Proc. of Conference on Lasers and Electro-Optics*, Baltimore, MD, May 7-11, 2007
308. J. M. Kahn, "Compensating Multimode Fiber Dispersion using Adaptive Optics", *Proc. of Optical Fiber Communications Conference*, paper number OTuL1, Anaheim, CA, March 25 - 29, 2007.
309. J. M. Kahn and L. G. Kazovsky, "Coherent Optical Communications: Fundamentals and Future Prospects", *Proc. of OSA Annual Meeting*, Rochester, NY, October 8-12, 2006.
310. K.-P. Ho and J. M. Kahn, "Electronic Compensation of Linear and Nonlinear Impairments in Phase-Modulated Systems", *Proc. of OSA Annual Meeting*, Rochester, NY, October 8-12, 2006.
311. J. M. Kahn, "Modulation and Detection Techniques for Optical Communication Systems", *Proc. of OSA Topical Meeting on Coherent Optical Technologies and Applications*, paper number CThC1, Whistler, BC, June 28-30, 2006.
312. J. M. Kahn and K.-P. Ho, "Spectral Efficiency Limits in DWDM Systems", *Proc. of 31st Euro. Conf. on Optical Commun.*, Glasgow, Scotland, September 25-29, 2005.
313. K.-P. Ho and J. M. Kahn, "Electronic Compensation of Nonlinear Phase Noise for Phase-Modulated Signals", *Proc. of 31st Euro. Conf. on Optical Commun.*, Glasgow, Scotland, September 25-29, 2005.
314. J. M. Kahn and K.-P. Ho, "Modulation and Detection Techniques for DWDM Systems", *Proc. of 2004 Tyrrhenian International Workshop on Digital Communications*, Pisa, Italy, October 17-18, 2004. Published in: *Optical Communication Theory and Techniques*, E. Forestieri, Editor, Springer, 2004, pp. 13-20.
315. X. Zhu and J. M. Kahn, "Communication Techniques to Mitigate Atmospheric Turbulence in Free-Space Optical Links", *Proc. of IEEE Lasers and Electro-Optics Society Annual Meeting*, pp. 89-90, Tucson, AZ, October 26-30, 2003.
316. J. M. Kahn, K. S. J. Pister and O. Solgaard, "MEMS for Free-Space Optical Communications", Annual Conf. of Council for Optical Radiation Measurements, Stanford, CA, June 18-20, 2003.
317. J. M. Kahn, "Secure Free-Space Optical Communication Between Moving Platforms", *Proc. of IEEE Lasers and Electro-Optics Society Annual Meeting*, pp. 455-456, Glasgow, Scotland, November 10-14, 2002.
318. J. D. Ralston, J. M. Kahn and K.-P. Ho, "The Role of Electronic Modulation and Signal Processing in Next-Generation Fiber Transport", *Proc. of IEEE Lasers and Electro-Optics Society Annual Meeting*, pp. 432-433, Glasgow, Scotland, November 10-14, 2002.
319. J. M. Kahn, and K.-P. Ho, "Ultimate Spectral Efficiency Limits in DWDM Systems", *Proc. of Optoelectronics and Communications Conference*, pp. 552-553, Yokohama, Japan, July 8-12, 2002.
320. J. M. Kahn, "Spectral Efficiency and Coherent Detection in Optical Communications", Defense Sciences Research Council Workshop on Novel Applications of Optical Coherence, Arlington, VA, June 25, 2002.
321. J. M. Kahn, "Ultimate Spectral Efficiency Limits in DWDM Systems", Optical Fiber Commun. Conf., Anaheim, CA, March 17-22, 2002, panel session W202, "Modulation Formats and Ultimate Capacity".
322. W. Mao and J. M. Kahn, "Free-space Heterochronous Imaging Reception of Multiple Optical Signals", *Proc. of 35th Asilomar Conference on Signals, Systems and Computers*, pp. 18-22, Pacific Grove, CA, November 4-7, 2001.
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333. J. M. Kahn, "Wireless Optical Local-Area Networks", tutorial session at IEEE Hot Interconnects III Symposium, Stanford University, Stanford, CA, August 10-12, 1995.
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#### Contributed Conference Presentations

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348. J. D. Downie, J. Hurley, X. Liang, J. Himmelreich, H. Srinivas, Jose Krause Perin, D. A. A. Mello and J. M. Kahn, "Experimental Characterization of Power Efficiency for Power-Limited SDM Submarine Transmission Systems", *Proc. of Euro. Conf. on Optical Commun.*, Brussels, Belgium, December 6-10, 2020.
349. M. T. Taylor, J. M. Kahn and L. Hollberg, "Two-Way Time and Frequency Transfer via Ground-to-Satellite Optical Communications Links", *Proc. of Institute of Navigation Precise Time and Time Interval Meeting*, San Diego, CA, January 21-24, 2020.
350. B. Buscaino, B. D. Taylor and J. M. Kahn, "Temperature-Insensitive Coherent Co-Packaged Optical Interfaces for Data Center Switches", *Open Compute Project Regional Summit*, Amsterdam, NL, September 26-27, 2019.
351. B. Buscaino, M. Zhang, M. Loncar and J. M. Kahn, "Design of an Efficient Dual-Resonator Electro-Optic Frequency Comb Generator", *Proc. of Frontiers in Optics*, Washington, DC, September 15-19, 2019.
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354. R. Y. Gu, E. S. Chou, C. Rewcastle, O. Levi and J. M. Kahn, "Improved Spot Formation through Flexible Multimode Fiber Using a Partial Reflector", *Proc. of Conf. on Lasers and Electro-Optics*, San Jose, CA, May 13-18, 2018.
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