Stanford

Joseph Kahn

Professor of Electrical Engineering

Bio

BIO

Joseph M. Kahn is a Professor of Electrical Engineering at Stanford University. His research addresses communication and imaging through optical fibers, including modulation, detection, signal processing and spatial multiplexing. He received A.B. and Ph.D. degrees in Physics from U.C. Berkeley in 1981 and 1986. From 1987-1990, he was at AT&T Bell Laboratories, Crawford Hill Laboratory, in Holmdel, NJ. He was on the Electrical Engineering faculty at U.C. Berkeley from 1990-2003. In 2000, he co-founded StrataLight Communications, which was acquired by Opnext, Inc. in 2009. He received the National Science Foundation Presidential Young Investigator Award in 1991 and is a Fellow of the IEEE.

ACADEMIC APPOINTMENTS

- Professor, Electrical Engineering
- Member, Bio-X

ADMINISTRATIVE APPOINTMENTS

- Chair, Academic Affairs Committee, Department of Electrical Engineering, (2012- present)

HONORS AND AWARDS

- Fellow, IEEE (2000)
- Presidential Young Investigator, National Science Foundation (1991-1996)
- Hoover Faculty Scholar, Stanford University (2003-2005)

PROFESSIONAL EDUCATION

- PhD, University of California, Berkeley , Physics (1986)
- MS, University of California, Berkeley , Physics (1983)
- BA, University of California, Berkeley , Physics (1981)

LINKS

- Profile at EE Department: http://ee.stanford.edu/~jmk
- Curriculum Vitae: http://ee.stanford.edu/~jmk/biographical/Joseph.M.Kahn.resume.pdf
- Google Scholar Profile: http://scholar.google.com/citations?user=D22GptUAAAAJ&hl=en

Teaching

COURSES

2023-24

- Advanced Optical Fiber Communications: EE 348 (Aut)
- Signals and Systems I: EE 102A (Win)

2022-23

- Digital Communication: EE 379 (Win)
- Introduction to Optical Fiber Communications: EE 247 (Aut)
- Signal Processing and Linear Systems I: EE 102A (Win)

2021-22

- Advanced Optical Fiber Communications: EE 348 (Aut)
- Signal Processing and Linear Systems I: EE 102A (Win)

2020-21

- Digital Communication: EE 379 (Win)
- Introduction to Optical Fiber Communications: EE 247 (Aut)
- Signal Processing and Linear Systems I: EE 102A (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Aivar Abrashuly, Oguz Tolga Celik, Hongxiang Jia, Richelle Smith

Doctoral Dissertation Advisor (AC)

Elizabeth Chen, Ethan Liang, Anirudh Vijay

Master's Program Advisor

Evan Cheng, Ben Choi, Erika Hunting

Doctoral (Program)

Mohammed Azzouz, Elizabeth Chen, Jonathan Fisher, Hongxiang Jia, Oleksiy Krutko, Louise Schul, Anirudh Vijay

Publications

PUBLICATIONS

- **Geometric Shaping for Distortion-Limited Intensity Modulation/Direct Detection Data Center Links** *IEEE PHOTONICS JOURNAL*
  Liang, E. M., Kahn, J. M.
  2023; 15 (6)
- **Optimal Shaping for the Stokes Vector Receiver** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Jia, H., Liang, E., Kahn, J. M.
  2023; 41 (22): 6884-6897
- **Design of Mode-Locked Semiconductor Laser Comb-Based Analog Coherent Links** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Chen, E., Coldren, L. A., Kahn, J. M.
  2023; 41 (18): 5930-5941
- **Efficient Integrated Multimode Amplifiers for Scalable Long-Haul SDM Transmission** *JOURNAL OF LIGHTWAVE TECHNOLOGY*

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- **Differential Edge Modulation Signaling for Low-Energy, High-Speed Wireline Communication** *IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS I-REGULAR PAPERS*
  Smith, R. L., Hossain, M., Werner, C. W., Kahn, J. M., Lee, T. H.
  2023
- **Effect of Higher-Order Modal Dispersion in Direct-Detection Mode-Division-Multiplexed Links** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Vijay, A., Kahn, J. M.
  2023; 41 (6): 1670-1683
- **Impact and Mitigation of Mode-Dependent Gain in Ultra-Long-Haul SDM Systems**
  Mello, D. A., Ospina, R. B., Srinivas, H., Choutagunta, K., Chou, E., Kahn, J. M., IEEE
  IEEE.2023
- **Phase Noise Analysis of Resonator-Enhanced Electro-Optic Comb-Based Analog Coherent Receivers** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Chen, E., Buscaino, B., Kahn, J. M.
  2022; 40 (21): 7117-7128
- **High-efficiency and broadband on-chip electro-optic frequency comb generators** *NATURE PHOTONICS*
  Hu, Y., Yu, M., Buscaino, B., Sinclair, N., Zhu, D., Cheng, R., Shams-Ansari, A., Shao, L., Zhang, M., Kahn, J. M., Loncar, M.
  2022
- **Successive Interference Cancellation on Frequency-Selective Channels With Mode-Dependent Gain** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Chou, E. S., Kahn, J. M.
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- **Phase Retrieval-Based Coherent Receivers: Signal Design and Degrees of Freedom** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Chou, E. S., Srinivas, H., Kahn, J. M.
  2022; 40 (5): 1296-1307
- **Modal Multiplexing and Atmospheric Turbulence Mitigation in Free-Space Optical Communications**
  Kahn, J. M., Belmonte, A., IEEE
  IEEE.2022
- **Optimal modes for spatially multiplexed free-space communication in atmospheric turbulence** *OPTICS EXPRESS*
  Belmonte, A., Kahn, J. M.
  2021; 29 (26): 43556-43566
- **Modeling and Experimental Measurement of Power Efficiency for Power-Limited SDM Submarine Transmission Systems** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Srinivas, H., Downie, J. D., Hurley, J., Liang, X., Himmelreich, J., Perin, J., Mello, D. A., Kahn, J. M.
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- **External vs. Integrated Light Sources for Intra-Data Center Co-Packaged Optical Interfaces** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Buscaino, B., Chen, E., Stewart, J. W., Pham, T., Kahn, J. M.
  2021; 39 (7): 1984–96
- **Coherent Data Center Links** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Perin, J., Shastri, A., Kahn, J. M.
  2021; 39 (3): 730–41
- **Designing High-Performance Multimode Fibers Using Refractive Index Optimization** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Choutagunta, K., Kahn, J. M.
  2021; 39 (1): 233–42
- **High-efficiency and broadband electro-optic frequency combs using coupled lithium-niobate microresonators**
  Hu, Y., Yu, M., Buscaino, B., Sinclair, N., Zhu, D., Shams-Ansari, A., Shao, L., Zhang, M., Kahn, J. M., Loncar, M., IEEE
  IEEE.2021

- **Phase Retrieval-Based Coherent Receivers**
  Chou, E. S., Srinivas, H., Kahn, J. M., IEEE
  IEEE.2021
- **Experimental Characterization of Power Efficiency for Power-Limited SDM Submarine Transmission Systems**
  Downie, J. D., Hurley, J., Liang, X., Himmelreich, J., Srinivas, H., Perin, J., Mello, D. A., Kahn, J. M., IEEE
  IEEE.2021
- **Adaptive Coding and Modulation for Robust Optical Access Networks** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Chou, E. S., Kahn, J. M.
  2020; 38 (8): 2242–52
- **Effect of atmospheric turbulence on timing instability for partially reciprocal two-way optical time transfer links** *PHYSICAL REVIEW A*
  Taylor, M. T., Belmonte, A., Hollberg, L., Kahn, J. M.
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- **Design of Efficient Resonator-Enhanced Electro-Optic Frequency Comb Generators** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Buscaino, B., Zhang, M., Loncar, M., Kahn, J. M.
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- **Adapting Mach-Zehnder Mesh Equalizers in Direct-Detection Mode-Division-Multiplexed Links** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Choutagunta, K., Roberts, I., Miller, D. B., Kahn, J. M.
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- **Impact of Polarization- and Mode-Dependent Gain on the Capacity of Ultra-Long-Haul Systems**
  Mello, D. A., Srinivas, H., Choutagunta, K., Kahn, J. M.
  IEEE-INST ELECTRICAL ELECTRONICS ENGINEERS INC.2020: 303–18
- **Two-Way Time and Frequency Transfer via Ground-to-Satellite Optical Communications Links**
  Taylor, M. T., Kahn, J. M., Hollberg, L., Inst Navigat
  INST NAVIGATION.2020: 207–15
- **Data Center Links Beyond 100 Gb/s per Wavelength**
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  IEEE.2020
- **Impact and Mitigation of Polarization- or Mode-Dependent Gain in Ultra-Long-Haul Systems**
  Srinivas, H., Chou, E. S., Mello, D. A., Choutagunta, K., Kahn, J. M., IEEE
  IEEE.2020
- **Multi-Tb/s-per-Fiber Coherent Co-Packaged Optical Interfaces for Data Center Switches** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
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  Perin, J., Kahn, J. M., Downie, J. D., Hurley, J., Bennett, K.
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  Zhang, M., Buscaino, B., Wang, C., Shams-Ansari, A., Reimer, C., Zhu, R., Kahn, J. M., Loncar, M.
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  IEEE.2019
- **Coherent Co-packaged Optical Interfaces for Next-Generation Electrical Switches**
  Buscaino, B., Kahn, J. M., Taylor, B. D., IEEE
  IEEE.2019
- **Modal Dynamics in Spatially Multiplexed Links**
  Choutagunta, K., Ryf, R., Fontaine, N., Wittek, S., Alvarado-Zacarias, J., Mazur, M., Chen, H., Essiambre, R., Amezcua-Correa, R., Hayashi, T., Tamura, Y., Hasegawa, T., Taru, et al
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- **Scaling SDM Optical Networks Using Full-Spectrum Spatial Switching** *JOURNAL OF OPTICAL COMMUNICATIONS AND NETWORKING*
  Jatoba-Neto, A. C., Mello, D. A., Rothenberg, C. E., Arik, S. O., Kahn, J. M.
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  Choutagunta, K., Arik, S. O., Ho, K., Kahn, J. M.
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- **Data center links beyond 100 Gbit/s per wavelength** *OPTICAL FIBER TECHNOLOGY*
  Perin, J., Shastri, A., Kahn, J. M.
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  Roberts, I., Kahn, J. M.
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- **Low-Complexity Implementation of Convex Optimization-Based Phase Retrieval** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Arik, S. O., Kahn, J. M.
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- **Channel Power Optimization of WDM Systems Following Gaussian Noise Nonlinearity Model in Presence of Stimulated Raman Scattering (vol 35, pg 5237, 2017)** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Roberts, I., Kahn, J. M., Harley, J., Boertjes, D.
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- **DSP-Free Coherent Receivers for Data Center Links**
  Perin, J., Shastri, A., Kahn, J. M., IEEE
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- **Data Center Links Beyond 100 Gbit/s per Wavelength**
  Perin, J., Shastri, A., Kahn, J. M., He, S., Lee, E. H.
  SPIE-INT SOC OPTICAL ENGINEERING.2018
- **Improving the Capacity of Terrestrial and Submarine Systems via Channel Power Optimization**
  Perin, J., Roberts, I., Kahn, J. M., Jaworski, M., Marciniak, M.
  IEEE.2018
- **Approaching fundamental limits to free-space communication through atmospheric turbulence**
  Belmonte, A., Kahn, J. M., Dingel, B. B., Tsukamoto, K., Mikroulis, S.
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- **Stable Measurement of Effective Area in Coupled Multi-core Fiber**
  Chou, E. S., Hayashi, T., Nagashima, T., Kahn, J. M., Nakanishi, T., IEEE
  IEEE.2018
- **Channel Power Optimization of WDM Systems Following Gaussian Noise Nonlinearity Model in Presence of Stimulated Raman Scattering** *JOURNAL OF LIGHTWAVE TECHNOLOGY*

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- **Optical MIMO Signal Processing for Direct-Detection Mode-Division Multiplexing**
  Choutagunta, K., Arik, S. O., Moradshahi, M., Kahn, J. M., IEEE
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- **Scaling Optical Networks Using Full-Spectrum Spatial Switching**
  Jatoba-Neto, A. C., Rothenberg, C. E., Mello, D. A., Arik, S. O., Kahn, J. M., IEEE
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- **Sensitivity Improvement in 100 Gb/s-per-Wavelength Links Using Semiconductor Optical Amplifiers or Avalanche Photodiodes** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Perin, J. K., Sharif, M., Kahn, J. M.
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  Arik, S. O., Kahn, J. M.
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  Berceau, P., Taylor, M., Kahn, J., Hollberg, L.
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  Roberts, I., Kahn, J. M., Boertjes, D.
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- **Group Delay Management and Multiinput Multioutput Signal Processing in Mode-Division Multiplexing Systems** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Arik, S. O., Ho, K., Kahn, J. M.
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- **Modulation Schemes for Single-Laser 100 Gb/s Links: Multicarrier** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Perin, J. K., Sharif, M., Kahn, J. M.
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- **Capacity limits of spatially multiplexed free-space communication** *NATURE PHOTONICS*
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- **Delay Spread Reduction in Mode-Division Multiplexing: Mode Coupling Versus Delay Compensation** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
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  Gu, R. Y., Mahalati, R. N., Kahn, J. M.
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- **Modulation Schemes for Single-Laser 100 Gb/s Links: Single-Carrier** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
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- **Long-Period Fiber Gratings for Mode Coupling in Mode-Division-Multiplexing Systems** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Askarov, D., Kahn, J. M.
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- **Performance of Direct-Detection Mode-Group-Division Multiplexing Using Fused Fiber Couplers** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
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- **MIMO signal processing in mode-division multiplexing systems** *Conference on Optical Metro Networks and Short-Haul Systems VII*
  Arik, S. O., Askarov, D., Kahn, J. M.
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- **Optical network scaling: roles of spectral and spatial aggregation** *OPTICS EXPRESS*
  Arik, S. O., Ho, K., Kahn, J. M.
  2014; 22 (24): 29868-29887
- **Optical network scaling: roles of spectral and spatial aggregation.** *Optics express*
  Arik, S. Ö., Ho, K., Kahn, J. M.
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- **Frequency-Derivative Measurement Technique for Dispersive Effects in Single-Mode Fiber Systems** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
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  Gu, R. Y., Mahalati, R. N., Kahn, J. M.
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- **Noise-reduction algorithms for optimization-based imaging through multi-mode fiber.** *Optics express*
  Gu, R. Y., Mahalati, R. N., Kahn, J. M.
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- **Diversity-multiplexing tradeoff in mode-division multiplexing.** *Optics letters*
  Arik, S. Ö., Kahn, J. M.
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- **Adaptive Modal Gain Equalization Techniques in Multi-Mode Erbium-Doped Fiber Amplifiers** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Mahalati, R. N., Askarov, D., Kahn, J. M.
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- **Adaptive Frequency-Domain Equalization in Mode-Division Multiplexing Systems** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
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- **Variable-Bandwidth Superchannels Using Synchronized Colorless Transceivers** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Sharif, M., Kahn, J. M.
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  Arik, S. O., Kahn, J. M., Ho, K.
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- **Linear Propagation Effects in Mode-Division Multiplexing Systems** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Ho, K., Kahn, J. M.
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- **Optical Networking With Variable-Code-Rate Transceivers** *JOURNAL OF LIGHTWAVE TECHNOLOGY*
  Mello, D. A., Barreto, A. N., de Lima, T. C., Portela, T. F., Beygi, L., Kahn, J. M.
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- **Optical Networking with Variable-Code-Rate Transceivers** *J. of Lightwave Technol.*
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  Belmonte, A., Kahn, J. M.
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  Arik, S. O., Askarov, D., Kahn, J. M.
  2013; 31 (3): 423-431
- **Resolution limits for imaging through multi-mode fiber** *OPTICS EXPRESS*
  Mahalati, R. N., Gu, R. Y., Kahn, J. M.
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  Kahn, J. M., Ho, K.
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- **Experimental Demonstration of a Spatial Light Modulator-based Few-Mode Fiber Switch for Space-Division Multiplexing**
  Gu, R., Y., Ip, E., Li, M., J., Huang, Y., K, Kahn, J., M.
  2013
- **Adaptive Control of Mode-Dependent Gain in Multi-Mode Erbium-Doped Fiber Amplifiers**
  Mahalati, R., Nasiri, Askarov, D., Kahn, J., M.
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  2013

- **Design of Transmission Fibers and Doped Fiber Amplifiers for Mode-Division Multiplexing** *IEEE PHOTONICS TECHNOLOGY LETTERS*
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- **Field Conjugation Adaptive Arrays for Reliable Space Downlink Coherent Laser Communications**
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- **Mode Coupling Effects in Mode-Division-Multiplexed Systems**
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