



# ECE Distinguished Lecture Series



## Alan Willner

Steven and Kathryn SampleChaired Professor in Engineering  
University of Southern California  
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### "High-Capacity Optical Communications using Multiplexing of Multiple Orbital-Angular-Momentum Beams"

Time: Wednesday, September 27, 2017, 1:00 pm – 2:00 pm

Location: SEH B1220

#### Abstract

Optical communications has historically experienced capacity growth by multiplexing many channels, and space-division-multiplexing (SDM) appears to be the next domain to exploit. SDM can encompass: (a) multiple parallel non-overlapping spatial channels, and (b) multiple spatially overlapping "orthogonal" modes to achieve mode-division-multiplexing (MDM). Key advantages of modal orthogonality are the ability to efficiently (de)multiplex independent data streams and co-propagate them, all with little inherent crosstalk.

An MDM approach using orbital angular momentum (OAM) has emerged as a potential method to efficiently multiplex many spatially over-lapping data-carrying beams. Each OAM beam possesses a uniquely "twisting" phasefront, such that all beams are orthogonal. OAM beams have azimuthal phase dependence that corresponds to the number of  $2\pi$  phase changes across the wavefront. Using this method, both the system's capacity and spectral efficiency can be significantly increased.

This presentation will highlight: (1) free-space Tbit/s transmission of multiple OAM modes on each of many different wavelengths, (2) Tbit/s data transmission of multiple OAM modes over vortex fiber, and (3) mitigation of atmospheric turbulence effects by adaptive optics and signal processing.

#### Biography

Alan Willner received the B.A. (1982) in Physics from Yeshiva University and the Ph.D. (1988) in Electrical Engineering from Columbia University. He was a Postdoctoral Member of the Technical Staff at AT&T Bell Laboratories and a Member of Technical Staff at Bellcore, and he is currently the Steven and Kathryn Sample Chaired Professor in Engineering at the Univ. of Southern California.

Prof. Willner has received the following honors: Member of the U.S. National Academy of Engineering, International Fellow of the U.K. Royal Academy of Engineering, Presidential Faculty Fellows Award from the White House, IEEE Eric E. Sumner Award, Guggenheim Foundation Fellowship, Packard Foundation Fellowship, NSF Young Investigator Award, Fulbright Foundation Senior Scholar Fellowship, Thomas Egleston Medal from Columbia Engineering Alumni Association, JJ Thomson Medal from IET, OSA Paul Forman Engineering Excellence Award, IEEE Photonics Society Engineering Achievement Award, SPIE President's Award, IEEE Photonics Society Distinguished Lecturer Award, OSA Robert Hopkins Leadership Award, 2014 IEEE Globecom Best Paper Award, 2001 Eddy Paper Award from Pennwell Publications for the Best Contributed Technical Article, Vannevar Bush Fellowship, Armstrong Foundation Memorial Award. He is a Fellow of the AAAS, IEEE, IET, OSA and SPIE.

Prof. Willner's activities have included: Co-Chair of the U.S. National Academies Committee on the Optics and Photonics Study, President of the OSA, President of the IEEE Photonics Society, Editor-in-Chief of OSA Optics Letters, Editor-in-Chief of the IEEE/OSA Journal of Lightwave Technology, Editor-in-Chief of the IEEE Journal of Selected Topics in Quantum Electronics, Chair of the IEEE TAB Ethics Committee, General Co-Chair of CLEO, Program Co-Chair of the OSA Annual Meeting, and General Chair of the IEEE Photonics Society Annual Meeting.

Prof. Willner has >1200 publications, including 1 book, 6 edited books, 33 U.S. patents, 26 keynotes/plenaries, and 22 book chapters. His research is in various optical technologies, including: communications, signal processing, networks, and fiber optics.