

# RAFAEL PIESTUN

## EDUCATION

Stanford University,  
Postdoctoral Researcher, 1999-2000

Technion – Israel Institute of Technology,  
Ph.D. in Electrical Engineering, 1998  
M.Sc. in Electrical Engineering, 1994

Universidad de la Republica, Montevideo, Uruguay,  
Electrical Engineer, 1990

## AWARDS AND HONORS

*Lab Venture Challenge Award – 2019*

*SPIE and Photonics Media Prism Award to Double Helix LLC\* – 2019*

*Double Helix LLC wins First Place Luminate Accelerator among 125 companies in  
Optics and Photonics (\$1M investment prize) –2018*

*Double Helix LLC wins Startup pitch event at CLEO conference –2017*

*SPIE Startup Challenge to Double Helix LLC –2016*

*NSF Science and Technology Center on Real Time Functional Imaging –STROBE (co-PI)  
(2016 - present)*

*Director and PI of the Computational Optical Sensing and Imaging program; an NSF -  
Integrative graduate education & research traineeship (IGERT) program (2008 - 2015)*

*Fellow of the Optical Society of America – 2010*

*Provost Faculty Achievement Award – University of Colorado Boulder, 2010*

*Fulbright Fellowship, United States – Israel Educational Foundation, 1998-1999*

*Honda Initiation Grant award – Honda Research Institute, 2007*

*Dean's Faculty Fellowship – University of Colorado, 2010*

*Dean's Faculty Fellowship – University of Colorado, 2007*

*SAOT Award Ceremony Lecture Award – Erlangen Graduate School in Advanced Optical  
Technologies, 2015*

*El-Op Prize, "El Op original work competition in the fields of optics and electro-optics",  
commemorating 60 years of electro-optics in Israel, 1997*

*Eshkol Fellowship, Ministry of Science of Israel, 1996-1998*

*Minerva Award, Minerva Komitee (German foundation), granted "In recognition of  
outstanding achievements", 1996*

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\* Double Helix LLC is startup company founded by Piestun and commercializing 3D imaging technology developed in his lab

*Gutwirth Prize*, granted for “Excellence in Graduate Studies”, 1994

Paper award at *IEEE* conference Ingelectra'90, 1990

Member of the *Advising Editorial Committee* of the magazine *OPN (Optics and Photonics News)*, 1997-present

*Topical Editor* - *Applied Optics*, 2004 - 2010

Listed for Marquis *Who's Who* in the World

*Technion fellowship*, 1992-1998

Swiss government fellowship for research at the EPFL (Lausanne), declined, 1991

## RESEARCH INTERESTS

Computational optical imaging and sensing, Aperiodic volume optics, Single molecule nanoscopy, Imaging through highly scattering media, Three-dimensional ultrashort pulse laser nano/micro-fabrication

## ACADEMIC APPOINTMENTS AND TEACHING EXPERIENCE

*University of Colorado at Boulder,*

**Department of Electrical and Computer Engineering and Department of Physics,**

2011 – present: **Professor**

2007 – 2011: **Associate Professor**

2001 – 2007: **Assistant Professor**

- *Co-Founder Co-PI, NSF Science and Technology Center on Real Time Functional Imaging – STROBE*
- *Director and PI* of the Computational Optical Sensing and Imaging program; an NSF - Integrative graduate education & research traineeship (IGERT) program (2008 - 2015).
- Member of the executive board of the Optical Science and Engineering program
- Member of the Dissertation/Thesis committee of forty graduate students
- Chair and member of preliminary and qualifying Ph.D. exams
- Developed the following graduate courses: (1) *Fundamentals of Photonics*, (2) *Nanophotonics*, (3) *Imaging Systems*, (4) *Microoptics*, (5) *Computational Optical Imaging Lab*, (6) *Computational Optical Sensing and Imaging Seminar*
- Developed the undergraduate course (7) *Photonics*
- Revised the following graduate courses: (8) *Fourier Optics*, (9) *Physical Optics*
- Taught the undergraduate courses (10) *Electromagnetic Fields and Waves*, (11) *Linear Systems*, and (12) *Electromagnetics*
- Supervised five one-semester graduate research rotations within the OSEP program
- Supervised ten one-semester graduate research rotations within the COSI program
- Advisor for 15 summer Research Experience for Undergraduate (REU) students
- Advisor for CU undergraduate students
- Supervised three overseas graduate students for one-year visits. Supported by Chinese government, Spanish scholarship, and Colombian Government fellowships
- Invited to be *opponent* of PhD dissertation at Helsinki University of Technology, PhD dissertation committee at Institut Fresnel (France), and EPFL (Switzerland)
- Participated in teaching workshops “Performance in a nutshell” aimed at improving lecturing, “Well Argued? Well Written”, “Course Development project”, and the “Leadership Workshop” (LEAP program) at the Univ. of Colorado Boulder

**Stanford University**, Department of Electrical Engineering, 1998-2000.

- Invited lecturer
- Supervised graduate students

**Technion –Israel Institute of Technology**, Department of Electrical Engineering, 1992-1998.

- *Teaching assistant lecturer*: Visual and Auditory Systems, Signals and Systems, Electrooptical Systems, Introduction to Electrical Engineering
- *Instructor*: Electrooptics Laboratory, Electronics Laboratory
- *Supervisor*: Graduate students, supervised ten undergraduate projects in optics and signal processing

**Universidad de la Republica**, Department of Electrical Engineering, School of Engineering (1987-1991) and Department of Physics, School of Humanities and Sciences (1987), Montevideo, Uruguay,

- *Visiting Lecturer*, Electrooptical Systems (1995, 1996)
- *Lecturer*: Electronics, Semiconductor devices
- *Teaching assistant lecturer*: Electronics, Electrical and Electronic Devices, Physics I
- *Instructor*: Electronics and Physics Laboratory

**High School Zorrilla de San Martin** and D. A. Larranaga, Uruguay, *Physics Teacher*

## PROFESSIONAL AND ACADEMIC SERVICES

### Entrepreneurship

- *Founder* of Double Helix LLC – Startup company has received funding from the NSF-SBIR program (two Phase I, two Phase II and two Phase IIB grants), the NIH (current SBIR Phase I), the Bioscience Discovery Evaluation Grant Program and \$1M investment from the Luminate Accelerator
- *CTIO* of Double Helix LLC

### Journal, conference, and professional society leadership

- *Topical Editor* of the Journal *Applied Optics*
- *Guest Editor* Special Feature issue of the Journal of the Optical Society of America A on “Single Molecule Imaging” (2015)
- *Guest Editor* Special Feature issue of Optics Express on “Controlled light propagation through complex media” (2014)
- *Guest Editor* Special Feature issue of Applied Optics on “Signal Recovery and Computational Sensing and Imaging” (2010)
- Advising Editorial Committee of the magazine *Optics and Photonics News*
- Chair *Gordon Conference on Image Science* (2020, 2022)
- Co-Chair of the international workshop *Computational optical microscopy*, Prague (Czech Republic), 2019
- Co-Chair of the international workshop *Optics for information processing in the 21th century*, Florence (Italy), 2018
- Vice-Chair *Gordon Conference on Image Science* (2018)
- Program Chair of Optical Soc. of America conference *Computational Optical Sensing and Imaging* (2009, 2011)

- General Chair of Optical Soc. of America conference *Computational Optical Sensing and Imaging* (2011)
- Chair of IEEE conference *Computational Photography* (ICCP) (2010)
- Program committee of Photonics West BIOS Conference on "Adaptive Optics and Wavefront Control for Biological Systems" (2013 - present)
- Chair of "The Inter-Continental Advanced Materials for Photonics (I-CAMP) Summer School" (2011)
- *Faculty Advisor* for the SPIE and OSA student chapters at the University of Colorado
- Participated in 9 National Science Foundation review panels
- Participated in 4 National Institute of Health (NIH) review panels
- Member of the Instrumentation and Systems Development Study Section at the National Institute of Health (NIH)
- Reviewer for American Federal organizations, NSF, NIH, DOE, the Bi-national Science Foundation (Israel-US)
- Reviewer for the journals Science, Nature (Photonics, Communications, Methods, Scientific Reports), Optica, Optics Letters, Journal of the Optical Society of America A, Journal of the Optical Society of America B, Applied Optics, Journal of Modern Optics, Optical Engineering, Journal of Optics, and IEEE Photonics Technology Letters
- Colorado Photonics and Optoelectronics Program (CPOP) director (2002)
- Member of the 1<sup>st</sup> Optical Society of America Emmett Leith Award Committee (2008)
- Member of the Optical Society of America Esther Hoffman Beller Medal Award Committee (2004)
- Member of the organizing committee of the conference Computational Optical Sensing and Imaging (2005, 2007, 2009 - 2017)
- Member of the Program Committee of IEEE conference *Computational Photography* (ICCP) (2010)
- Member of the International Program Committee of the Symposium on Photonics, Networking and Computing (PNC 2005) held in conjunction with the 8<sup>th</sup> Joint Conference on Information Systems (JCIS 2005)
- Member of the program committee for the conference "Wave-Optical Systems Engineering", International Symposium on Optical Science and Technology, San Diego, CA (2001, 2003)
- Co-organized the Colorado Photonics Industry Association (CPIA) annual meeting
- Organized the conference: "Photonics Research in Colorado" held at the University of Colorado, 2002 and 2003
- Active member of the Optical Society of America (OSA), The International Society for Optical Engineering (SPIE), and the Institute of Electrical and Electronics Engineers (IEEE)
- Invited to participate in three OSA Leadership Conferences (1997-1999)

#### **Academic service**

- *Member* of Graduate Studies Committee, Search Committee, Curriculum Committee, and Executive Committee of the department of Electrical and Computer Engineering, University of Colorado Boulder
- *Member* of the First-Level Faculty Review Committee, University of Colorado Boulder (2020)
- *Chair* of the Biomedical Engineering Program Faculty Search committee (2019-2020)

- *Member of the ECEE faculty Search Committee (2018-2020)*
- *Chair of the campus-wide interdisciplinary Faculty Search committee for the Optics Initiative (2009-2010)*
- *Director of the Computational Optical Sensing and Imaging program (2008 - 2015)*
- *Chair of the COSI-IGERT conference and Advisory Board Meeting, Breckenridge, CO (2012)*
- *Chair of Promotion and Tenure committee, University of Colorado Boulder*
- *Member of the Curriculum committee, University of Colorado Boulder*
- *Referee for multiple faculty tenure cases in the US and abroad*
- *Director of the Optoelectronics Computing Systems Center (2005)*
- *Elected Member for the Student Council of the School of Engineering, Univ. de la Republica, Uruguay. Participated in development of new curricula and new career disciplines.*
- *Elected Member for the Student Council of the Department of Electrical Engineering, School of Engineering, Universidad de la Republica, Uruguay.*

## KEY RESEARCH CONTRIBUTIONS

**University of Colorado at Boulder, Department of Electrical and Computer Engineering,**  
2001- present.

- *First in-vivo (and functional) imaging through a multimode fiber (in collaboration with James DiCarlo)*
- *First demonstration of control of nonlinear interactions (in multi-mode fibers) using wavefront shaping*
- *Invention of azimuthal multiplexing diffractive optics*
- *Invention of (super-resolution) Engineered (illumination/PSF) Image Scanning Microscopy – Modalities: 3D, spectral, multiphoton, deconvolution (in collaboration with Alexander Jesacher)*
- *First demonstration of sub-acoustic resolution using photo-acoustic imaging through scattering media*
- *High speed imaging through highly scattering media – Developed adaptive scattering compensation techniques that twice broke the speed record by more than three orders of magnitude [*
- *Super-resolution microscopy – Invention and demonstration of 3D PSF engineering for z-superresolution. Introduction of methods for resolving overlapping emitters in 3D using a combination of PSF engineering and advanced algorithms (compressive, ICA, MLE)*
- *Single-molecule microscopy – In collaboration with W.E. Moerner: First demonstration of 3D super-resolution fluorescence microscopy using engineered (Double Helix) PSF. First demonstration of multi-color 3D DH-PSF microscopy.*
- *5D (orientation/position) imaging of single molecules - In collaboration with W.E. Moerner: First demonstration of simultaneous 3D orientation and localization of single molecules using DH-PSF.*
- *Adaptive and optimal 3D imaging of single molecules – First demonstration of phase retrieval with optimal estimation algorithms in super-resolution fluorescence microscopy*
- *Integrated optical/computational imaging systems, unconventional imaging systems based on joint optical-electronic-digital processing – Invention of Depth from Diffraction, 3D PSF engineering, Fisher Information Guided Wave-Optical Design*

- Aperiodic volume optics – *First design and demonstration of Volumetric Diffractive Optics, First use of 3D diffraction theory for 3D Optics design*
- 3D imaging using a Double-Helix point spread function
- Optical metamaterials with index of refraction less than unity – *Introduction of low index metamaterials (later known as Epsilon Near Zero materials)*
- Ultralow pulse-energy 3D micromachining of dielectric materials – *Fabrication of Waveguides in the bulk of glass*
- 3D nano-manufacturing of photonic devices - *First fabrication of subwavelength (polarization sensitive) diffractive optics using femtosecond lasers*
- Spatial information transfer in electromagnetic optics – *Analytic work quantifies the degrees of freedom in nanophotonic devices*
- *Solitons in optical lattices with intentional defects and quasicrystals*
- Coherent generation of defects within optical lattices and *optical tweezers with 3D optical lattices*

**Stanford University**, Dept. of Electrical Engineering, E. L. Ginzton Laboratory, 1998- 2000

- Proposed a theory of information in optics based on rigorous electromagnetic theory
- Information content of the Optical Near Field
- Electromagnetic degrees of freedom in diffractive optics
- Modeling of Photonic Crystals
- Unconventional optical devices for broadband optical signals

**Technion – Israel Institute of Technology**, Department of Electrical Engineering, 1992-1998.

- *First proposal, first method, and first demonstration of the possibility of controlling a beam of light in three dimensions*
- Synthesis of unconventional beams and light distributions: nondiffracting beam arrays, spiral beams, dark beams with constant notch, and rotating beams
- *Development of novel mathematical methods used in wave front synthesis, diffractive optics, computer generated holography, and inverse problems*
- First demonstration of on-axis amplitude holograms
- Novel method and criteria for extension of focal length of optical systems
- *First demonstration and characterization of general rotating beams*
- Introduced the scaled self-imaging effect, the rotated-self-imaging effect, the eigen-Fourier functions, and the first aperiodic self-imaging wave-fields
- *Introduced the generalized propagation-invariant wave-fields*
- *Developed strategies for superresolution*
- Surface investigation with light structures, wavelet transform approach
- Rigorous electromagnetic solution of diffractive structures with the wavelet transform
- Optimal use of degrees of freedom in computer generated holography
- Control of wave front propagation with diffractive elements
- Generation of complex valued functions for the joint transform correlator

**Universidad de la Republica**, Department of Electrical Engineering, School of Engineering, Montevideo, Uruguay, 1991.

- Automatic measurement systems for agricultural and meteorological applications
- Programmable data acquisition systems

## GRANTS AWARDED

- Office of Economic Development, State of Colorado  
Ultra-thin endoscope  
2019-2021  
\$125,000  
PI: R. Piestun
- NIH  
Super-resolution imaging of the ocular funds (R21)  
2019 – 2021  
\$374,900  
PIs: R. Piestun, K. Irsch
- NSF  
Science and Technology Center on Real-Time Functional Imaging (STROBE)  
09/2016- 08/2021;  
\$24,000,000  
PIs: Margaret Murnane, Jianwei Miao, Naomi Ginsberg, Markus Raschke, Rafael Piestun
- NSF  
IDBR Type B: Point-spread function engineered parallel scanning optical subsystem for fast quantitative high-resolution  
05/01/2016 - 04/30/2018; \$449,003  
PI: Piestun
- NSF  
Non-invasive, high-resolution, 3D imaging and sensing through highly scattering materials  
06/01/2016-05/31/2018 \$410,000  
PI: Piestun, co-PI: Murray
- NIH  
“SUPPLEMENT: High-speed Deep Brain Imaging and Modulation with Ultrathin Minimally Invasive Probes”  
09/30/2016 – 09/29/2017, \$87,056  
PI: R. Piestun
- NIH  
“High-speed Deep Brain Imaging and Modulation with Ultrathin Minimally Invasive Probes”  
09/30/2015 – 09/29/2017, \$436,772  
PI: R. Piestun
- DARPA  
“Linear Refraction Materials”  
08/15/2015 – 01/31/2016, \$170,000  
PI: R. Piestun
- National Science Foundation  
“MRI: Development of an Advanced Bio-Imaging Instrument: Enabling 3D quantitative multifunctional sensing at the nanoscale,”

08/15/2014-07/31/2017, \$668,842 + \$286,000 (university matching)  
PI: Piestun, co-PI: Palmer, Amy

- National Science Foundation  
*A new paradigm in optical design*  
06/01/2013 – 05/31/2016, \$360,000  
PI: R. Piestun
- National Science Foundation  
“IGERT: Interdisciplinary Graduate Education in Computational Optical Sensing and Imaging”,  
08/01/2008 – 07/31/2013, \$3,250,000  
PI: Rafael Piestun, co-PIs: G. Beylkin, M. Murnane, A. Hoenger
- DARPA  
“3D Computational Optic Systems for Soldier-Centric Imaging”,  
08/2011-07/2015 ~\$20million. Phase I, 1<sup>st</sup> yr Piestun part: \$200,000  
PI: Joseph Ford (UCSD)
- Covidien  
"Focusing light in Deep Turbid Media with Applications in Photodynamic Treatment and Optical Monitoring", 01/2012 – 06/2013, \$160,000  
PI: Rafael Piestun
- National Science Foundation  
“IDBR: Development and Dissemination of a Flexible Multifunctional Widefield 3D Superresolution Microscopy System for Quantitative Biological Research”  
PI: Rafael Piestun, 05/2011-04/2013, \$356,697
- National Science Foundation  
“Aperiodic Volume Optics”, 09/01/2010 – 8/31/2013, \$401,000  
PI: R. Piestun
- National Science Foundation:  
"Collaborative Research: Multimode Adaptive 3D Microscopy for Quantitative Analysis of Live-Cellular Dynamic Processes in Thick Samples," 2009-2012, \$499,999  
PI: Rafael Piestun
- National Academy of Sciences  
“Adaptive Approach for Imaging Through a Highly Scattering Volume Using Spatio-Temporal Waveform Shaping and Statistical Algorithms”; 5/3/2011 - 6/30/2013, \$75,000  
PI: R. Piestun, co-PI: Liliana Borcea (Rice University)
- Center for Revolutionary Solar Photoconversion (CRSP)  
"3D plasmonic nanostructures for novel electromagnetic energy conversion devices and systems"; 2009-2011, \$70,000  
PI: R. Piestun, co-PI: W. Park.
- Sandia Excellence in Science and Engineering Fellowship, 2009-2012, \$75,000  
PI: R. Piestun
- Covidien

"Photon Path Demixing in Turbid Media", 9/01/2010 – 8/31/2011, \$119,912  
PI: Rafael Piestun

- National Science Foundation  
"Integrated Sensing: High-speed 3D Microscopy by Hybrid Optical-Digital Encoding and Processing", 9/1/02 - 8/31/06, \$250,000  
PI: Rafael Piestun, co-PIs: Yoav Schechner, Carol Cogswell
- Council on research and creative work - Grant in Aid  
"3D parallel nano-machining of transparent materials for large-scale integrated micro-optics fabrication", 01/11/02/ - 31/10/03, \$7,000  
PI: Rafael Piestun
- Council on research and creative work - Grant in Aid  
"Ultrashort pulse interaction with metal-dielectric nanostructures for 3D manufacturing of photonic systems", 07/01/03 - 06/30/04, \$7,000  
PI: Rafael Piestun
- National Science Foundation  
"NIRT: 3D nano-manufacturing processes for nanophotonic devices and systems",  
8/1/03 - 7/30/07, \$1,000,000  
PI: Rafael Piestun, co-PIs: W. Park. B. Van Zeghbroeck, S. George
- National Science Foundation  
"SUPPLEMENT: NIRT: 3D nano-manufacturing processes for nanophotonic devices and systems", 8/1/04 - 7/30/07, \$ 238,913  
PI: Rafael Piestun
- PTAP, Optoelectronics Industry Development Association - DARPA  
"Hexagonal Spatial Light Modulator for Multidimensional Light Control"  
September 2004, \$18,500  
PI: Rafael Piestun
- University of Colorado - Office of the Vice Chancellor for Research  
"Acquisition of Advanced Imaging and Lithography Systems for a shared facility in Nanophotonics, Nanoelectronics, and Biotechnology", Dec. 2004, \$50,000  
PI: Rafael Piestun
- National Science Foundation  
"Collaborative Research: Quantitative DIC microscope for Measuring 3-Dimensional Cell Attributes", 9/05-8/08, \$713,088  
PI: Carol Cogswell, Tin Tin Su, and Rafael Piestun (co-PIs)
- University of Colorado –  
"Nanophotonics Center" seed grant, May 2006, \$50,000.  
PI: Rafael Piestun
- BAE – DARPA  
"3D - ALERT: 3-Dimensional Alerts using a Lightweight Electronic Receiver Technology",  
seed grant, 10/01/06 – 06/30/07, \$400,000  
PI: Zoya Popovic, co-PIs: E. Kuester, S. Rondineau, and R. Piestun
- PTAP, DARPA - Optoelectronics Industry Development Association  
"High information content phase-only spatial light modulator for adaptive 3D nanoparticle positioning and tracking", October 2006, \$15,490  
PI: Rafael Piestun.

- Technology Transfer Office – University of Colorado – Proof of Concept Grant  
“Super-resolution, Compact, Passive Three-Dimensional Imaging System”, Approved for funding, 11/06 – 04/07, \$25,000  
PI: Rafael Piestun
- HONDA research labs  
“Computational Optical Three-Dimensional Imaging and Sensing: Towards Super-resolving, Passive, Compact, and Scalable Systems”  
\$50,000  
PI: R. Piestun
- CU seed grant  
“Ultralow Index of Refraction Metamaterials for Optical Cloaking and Integration”  
\$50,000  
PI: W. Park, co-PI: R. Piestun
- CU-NIST seed grant  
“Single-photon detectors based on 3D photonic crystals for quantum information technology”  
\$50,000  
PI: R. Piestun, co-PI: Richard Mirin
- R. Piestun was one of the key faculty members participating in the NSF-IGERT program:  
“Graduate Training in Optical Sciences and Engineering”, 09/22/2003 – 10/31/2007,  
\$3,851,637  
PI: Dana Anderson, co-PIs: Kelvin Wagner, Henry Kapteyn, David Jonas, Jun Ye
- National Science Foundation  
01/01/2013 – 06/30/2013, \$150,000  
“SBIR Phase I: Widefield 3D superresolution microscopy module”  
PI: Ginni Grover (Double Helix LLC, R. Piestun Chief Technology Innovation Officer (CTIO))
- National Science Foundation  
01/01/2014 – 12/31/2015, \$640,269  
“SBIR Phase II: Widefield 3D superresolution microscopy module”  
PI: Anurag Agrawal (Double Helix LLC, R. Piestun CTIO)
- National Science Foundation  
01/01/2014 – 06/30/2014, \$150,000  
SBIR Phase II: 3D computational imaging sensor  
PI: Rafael Piestun (Double Helix LLC)
- National Science Foundation  
09/15/2015 – 08/31/2017, \$733,549  
SBIR Phase II: 3D computational imaging sensor  
PI: Anurag Agrawal (Double Helix LLC, R. Piestun CTIO)

Prof. Piestun has also participated in the NSF-IGERT grant: “Graduate Training in Optical Sciences and Engineering”, 09/15/1998 – 08/31/2005, \$2,832,001  
PI: Dana Anderson, co-PIs: Carl Wieman, Kristina Johnson

## INVITED PRESENTATIONS IN INTERNATIONAL CONFERENCES

1. J. Shamir, R. Piestun and B. Spektor, "3D light structuring and some applications", International Conference on Optics & Optoelectronics, ICOL-98, Dec. 9-12, 1998, Dehra Dun, India, INVITED
2. J. Shamir, R. Piestun and B. Spektor, "Light patterning in 3D space and applications", OII'98 ICO Topical Meeting, Aug. 3-6, 1998, Tianjin, China, INVITED
3. J. Shamir, R. Piestun, and Y. Y. Schechner, "Propagation invariance and 3D light fields", 18<sup>th</sup> Congress of the International Commission for Optics, ICO XVIII Optics for the New Millennium, Aug. 2-6, 1999, San Francisco, USA, INVITED
4. R. Piestun, "Novel approaches to multidimensional light field synthesis", Wave Optics and Photonic Devices for Optical Information Processing I, The International Symposium on Optical Science and Technology, San Diego, August 2001, INVITED
5. R. Piestun, "Modeling and design of femtosecond optical systems", Wave-Optical Systems Engineering II, The International Symposium on Optical Science and Technology, San Diego, August 2003, INVITED
6. R. Piestun, "Shaping three-dimensional optical responses", Optical Society of America Annual Meeting, 2003, Tucson, USA, INVITED
7. R. Piestun, "Three-dimensional nanofabrication methods for photonic applications," Quantum Sensing and Nanophotonic Devices II, SPIE International Symposium, Photonics West 2005, San Jose, USA, INVITED
8. R. Piestun, "3D data acquisition with engineered point spread functions", Frontiers in Optics 2005, the 89th Annual Meeting of the OSA, INVITED
9. S. King, A. Greengard, C. Cogswell, R. Piestun, "Depth measurements using polarization information", Polarization & Remote Sensing, Optics & Photonics 2005, INVITED
10. R. Piestun, "Shaping light waves in three dimensions for integrated computational imaging", Integration of Sensing and Processing – Institute of Mathematics and its Applications, December 2005, INVITED.
11. R. Piestun, "Modulated Optical Crystals as Computer-Generated Volume Holograms", Frontiers in Optics, Optical Society of America Annual Meeting, 2006, Rochester, USA, INVITED
12. R. Piestun, "3D Information Retrieval Aided by Diffraction", Frontiers in Optics, Optical Society of America Annual Meeting, 2006, Rochester, USA, INVITED
13. R. Piestun, " Three-Dimensional Synthesis Problems in Diffractive Optics," in *Adaptive Optics: Analysis and Methods/Computational Optical Sensing and Imaging/Information Photonics/Signal Recovery and Synthesis Topical Meetings on CD-ROM*, OSA Technical Digest (CD) (Optical Society of America, 2007), paper SMD1. INVITED
14. R. Piestun, "Nonlinear optics in nanofabrication and imaging", Third 'Rio de la Plata' Workshop on Noise, Chaos and Complexity in Lasers and Nonlinear Optics, Punta del Este, Uruguay, December 3 7, 2007.
15. R. Piestun, "Fundamental limits to optical systems", Computational Imaging and Superresolution, June 10 - 12, 2008. INVITED
16. R. Piestun, "Computational Optical Three-Dimensional Imaging and Sensing", Honda Initiation Grant awardees conference, INVITED, Cary, NC (2008)

17. SRP Pavani and R. Piestun, "3D microscopy with double-helix point spread functions", INVITED PAPER, BIOS, SPIE Photonics West (2008)
18. T. Gerke and R. Piestun, "Volumetric photonic structures fabricated with femtosecond lasers", INVITED PAPER, LASE, SPIE Photonics West (2008).
19. W. E. Moerner, M. Thompson, M. Lew, M. Badieirostami, S. J. Lord, N. R. Conley, H. D. Lee, S. R. P. Pavani, and R. Piestun, "Three-Dimensional Superresolution Using Single-Molecule Photoswitches and a Double-Helix PSF," in Computational Optical Sensing and Imaging, OSA Technical Digest (CD) (Optical Society of America, 2009), paper CTuD1.
20. R. Piestun, "Three-Dimensional Imaging by Three-Dimensional Point Spread Function Encoding," in Digital Holography and Three-Dimensional Imaging (also appears in Optical Trapping Applications), OSA Technical Digest (CD) (Optical Society of America, 2009), paper JMB2.
21. T. D. Gerke and R. Piestun, "Multifunctional Volume Optics Generated by Direct Femtosecond Laser Writing," in Femtosecond Laser Microfabrication, OSA Technical Digest (CD) (Optical Society of America, 2009), paper LMTuB3.
22. Sri Rama Prasanna Pavani, Rafael Piestun, "3D microscopy with double-helix point spread functions," Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XVI, Jose-Angel Conchello; Carol J. Cogswell; Tony Wilson, Editors, SPIE Proceedings Vol. 7184.
23. Timothy Gerke, Rafael Piestun, "Volumetric photonic structures fabricated with femtosecond lasers," Commercial and Biomedical Applications of Ultrafast Lasers IX, Photonics West, San Jose, California, January 24-29, 2009.
24. R. Piestun, "Diffraction unlimited 3D imaging - Foundations of a revolution in far-field optical nanoscopy", Fourth 'Rio de la Plata Workshop on Laser Dynamics and Nonlinear Photonics', Piriapolis, Uruguay, 8-11 December, 2009.
25. INVITED LECTURER at the Inter-Continental Advanced Materials for Photonics (I-CAMP) Summer School, held June 28 to July 19 2009 in China.
26. R. Piestun, "Polarization sensitive, three-dimensional, single-molecule imaging of cells with a double-helix system," Novel Approaches to Bioimaging II, Janelia Farm, May 2<sup>nd</sup>-5 (2010)
27. S. Quirin and R. Piestun, "3-D Imaging Using Helical Point Spread Functions," in *Imaging Systems*, OSA technical Digest (CD) (Optical Society of America, 2010), paper IWC1
28. R. Piestun, "PLENARY: What Can Digital Processing Do for 3-D Super-Resolution Microscopy?," in *Digital Image Processing and Analysis*, OSA Technical Digest (CD) (Optical Society of America, 2010), paper DTuA1
29. INVITED LECTURER at the Inter-Continental Advanced Materials for Photonics (I-CAMP) Summer School, held June 20 to July 10 2010 in Sydney and Brisbane, Australia
30. R. Piestun, "Degrees of Freedom in Computational Volume Optics," Frontiers in Optics, Rochester, NY (2010)
31. S. Quirin and R. Piestun, "Novel helical point spread functions for 3D imaging", Visual Information Processing XX, 25 - 29 April 2011, Orlando, Florida.
32. INVITED LECTURER at the Inter-Continental Advanced Materials for Photonics (I-CAMP) Summer School, held May 28 - June 17, 2011 in Montevideo (Uruguay) and Buenos Aires (Argentina)

33. R. Piestun, "3D Far-field Nanoscopy", Applied Industrial Optics: Spectroscopy, Imaging, & Metrology (AIO), July 10-14 2011, Toronto, Canada
34. R. Piestun, "3D processing using femtosecond lasers for aperiodic volume optics", Laser-based Micro- and Nanopackaging and Assembly VI, LASE SPIE Photonics West, January 2012
35. R. Piestun, "3D Ultrashort Pulse Laser Micro and Nano-processing for Multifunctional Aperiodic Volume Optics", LPM'2012, 13th International Symposium on Laser Precision Microfabrication, June 12-15, 2012, The Catholic University of America Washington, DC
36. S. Quirin, G. Grover, R. Piestun, "Optimal 3D single-molecule super-resolution microscopy with engineered point spread functions", 9<sup>th</sup> IEEE International Symposium on Biomedical Imaging, ISBI 2012 2-5 May 2012, Barcelona, Spain
37. R. Piestun, "Optimal 3D single-molecule super-localization microscopy with engineered point spread functions and aberrations", 2nd Swiss Single Molecule Localization Microscopy Symposium August 29-31 2012, Lausanne, Switzerland
38. R. Piestun, "Computational Optical Sensing and Imaging – A new paradigm to overcome physical limits," NSF IGERT PI Meeting, Washington DC, June 1<sup>st</sup> 2012
39. INVITED LECTURER at the CUSO Winter School 2013 on Computational Photography and Display, held January 21st to 25th, 2013 in Lenk, Switzerland (organized by the Doctoral Program in Computer Science of the Universities of Fribourg, Geneva, Lausanne, Neuchâtel, Bern and the EPFL)
40. Rafael Piestun, "Scattering optics, from random to deterministic – limitations and opportunities", Janelia Farm Conference: Shaping the Waves: Engineering Optical Wavefront for Biomedical Imaging, November, 2013
41. Donald B. Conkey, Antonio M. Caravaca-Aguirre, Eyal Niv, and Rafael Piestun, "High-speed optical phase control for focusing and imaging through dynamic turbid media", Bio-Optics: Design and Applications (2013)
42. R. Piestun, "Patterning light in 3D and through scattering media - Then and now", Spatially Precise Optogenetics - OSA Incubator Meeting December, 2013 INVITED
43. R. Piestun, "High Resolution Imaging through Scattering Media with Photo-Acoustic Feedback", Scattering Media - OSA Incubator Meeting March 6, 2014 INVITED
44. Antonio Caravaca-Aguirre, Don Conkey, Jacob Dove, Hangyi Ju, Todd W. Murray, Rafael Piestun, "Non-invasive imaging through a scattering wall", Physics of Quantum Electronics, Utah, January 2015
45. Eyal Niv, Antonio Caravaca-Aguirre, Don Conkey, Rafael Piestun, "High-speed phase modulation using the DLP: Application in imaging through complex media", Emerging Digital Micromirror Device Based Systems and Applications VII, SPIE Photonics West, February 10, 2015
46. R. Piestun, "Overcoming the Diffraction and Multiple Scattering Limitations in Optical Imaging", GE Photonics Symposium, April 2015
47. R. Piestun, "Overcoming Diffraction and Multiple Scattering in Optical Imaging", IEEE - International Conference on Computational Photography (ICCP2015), Houston 2015
48. R. Piestun, "Beyond Super-resolution Localization Microscopy: Three Dimensions, Dense Scenes, Fast Drift-less Acquisition, and Multicolor Samples", Advances in Optics for Biotechnology, Medicine, and Surgery XIV, Vail, June 2015

49. R. Piestun, "Nanoscopia Optica en tres dimensiones", XXVI Congreso Nacional de Fisica, Manizales, Colombia, September 2015
50. R. Piestun, "Computational Optical Imaging For Super-resolution Microscopy And Sensing Through Complex Media", Frontiers in Optics, San Jose, CA, October 2015
51. R. Piestun, "The Mathematical Arsenal of Super-resolution Microscopy," in Imaging and Applied Optics 2016, OSA Technical Digest (online) (Optical Society of America, 2016), paper MTh2H.1. INVITED
52. R. Piestun, "Compressive Localization Microscopy," SMLM – Lausanne, August 30, 2016. INVITED
53. R. Piestun, "Compressive Optical and Digital Signal Processing for Super-resolution Microscopy", LAOP Latin American Optics and Photonics Conference August 24, 2016 (Medellin). INVITED
54. R. Piestun, "Enhancing the feedback loop for focusing and imaging through complex media", From Light to Sound: Frontiers in Deep Tissue Imaging June 4 - 7, 2017 (Janelia Farm Conference)
55. R. Piestun, "Sculpting Light in 3D Space, Time and Complex Media", Sculpted Light in the Brain, June 9th, 2017, University of California Berkeley (2017)
56. R. Piestun, "40 years in the making: Direct imaging through a fiber, from concept to live functional imaging", Advances in Optics for Biotechnology, Medicine and Surgery XV, July 23-26, 2017, Snowmass, Colorado, USA
57. R. Piestun, "Computational Optical Imaging at the Nanoscale & Through Scattering Materials", Small Eyes & Smart Minds Optical Soc of America Incubator Meeting, 2017
58. R. Piestun, "Depth from engineered diffraction," Quantitative Biological Imaging, Texas, 2017
59. R. Piestun, "Adaptive Wave-front shaping in Linear and Nonlinear Complex Media", Conference on Lasers and Electro Optics (CLEO) 2018
60. Tzang O, Caravaca-Aguirre AM, Wagner K, Piestun R. "Wave-front shaping for nonlinear dynamics control." In Adaptive Optics and Wavefront Control for Biological Systems IV, SPIE Photonics West, March 15, 2018
61. R. Piestun, "Fundamentals and Applications of Adaptive Wavefront Shaping in Linear and Nonlinear Complex Media", European Optical Society Annual Meeting (EOSAM), Delft, Netherlands, October 10, 2018.
62. KEYNOTE SPEAKER: R. Piestun: Manipulation of light in complex Media Rafael Piestun LANE 2018 10th CIRP Conference on Photonic Technologies, Fürth, Germany September 4, 2018
63. R. Piestun, "Adaptive Wave-front control in linear and nonlinear complex media", Latin American Optics And Photonics, LAOP 2018 Lima, Peru; November 13, 2018
64. R. Piestun, "3D femtosecond nano-processing for multifunctional aperiodic volume optics", Progress in Laser Modifications of Materials - June 15, 2018 Telluride, Colorado, USA

65. R. Piestun, "Wavefront Control in Linear and Nonlinear Multimode Fibers," Erlangen Graduate School in Advanced Optical Technologies Rafael Piestun PLENARY TALK
66. Rafael Piestun, "Real-time Mode Control for Compressive Imaging through Multimode Fibers," PIERS 2019 - DISORDERED PHOTONICS June 18, 2019, Rome, Italy INVITED
67. Rafael Piestun, "Fast and Nonlinear Wavefront Control in Multimode Fibers," PIERS 2019, June 19, Rome, Italy INVITED
68. Rafael Piestun "Computational microscopy: looking towards the future" Computational Optical Microscopy Prague, Czech Republic July 2nd 2019
69. Rafael Piestun, "Computational optical microscopy: a look towards the future," Frontiers and Challenges in Laser-Based Biological Microscopy July 22nd, 2019 Telluride, Colorado INVITED
70. R. Piestun, "Wavefront Shaping in Linear and Nonlinear Complex Media," Asia Pacific Optical Sensors Conference (APOS) 2019 November 19, 2019 Auckland, New Zealand INVITED
71. Sakshi Singh, Simon Labouesse, Omer Tzang, Eyal Niv, Antonio Caravaca, Rafael Piestun, "Multimodal Imaging through Multimode Fibers," 2020 IEEE Photonics Society Summer Topicals Meeting Series (SUM), Mexico. INVITED
72. R. Piestun, "Point Spread Function Engineering for 3D High Resolution Microscopy," Interferometric Scattering Microscopy Workshop, Erlangen, Germany (2020) INVITED
73. R. Piestun, "Computational imaging through ultra-thin endoscopes," IEEE ISBI (2020) INVITED
74. R. Piestun, "Fast wavefront modulation for microscopy through complex media," Adaptive Optics and Wavefront Control for Biological Systems VI, SPIE BIOS, San Francisco, CA (2020) INVITED

## **OTHER INVITED PRESENTATIONS**

75. R. Piestun, "Wavefront control in linear and nonlinear complex media" June 28 2019, Brno, Czech Republic INVITED
76. Rafael Piestun, "Fast wavefront control for imaging in complex media," Presentation at Silicon Light Machines, California October 16, 2019
77. R. Piestun, "Easy imaging with speckle illumination" Simon Labouesse, Sakshi Singh, R. Piestun, M. Allain, A. Sentenac, J. Idier, T. Mangeat. UC Berkeley seminar in Computational Optical Imaging October 2019 INVITED
78. Rafael Piestun, "A look towards the future of computational optical microscopy," Institut Fresnel, Marseille, France December 18, 2019 INVITED
79. R. Piestun, "Overcoming Diffraction and Scattering Limitations in Optical Imaging", Tel Aviv University, May 30, 2018
80. R. Piestun, "Overcoming diffraction and multiple-scattering limitations in optical imaging," University of Washington, Seattle, 2017
81. R. Piestun, "Overcoming Diffraction and Scattering Limitations in Optical Imaging", Chinese Academy of Sciences, Xian, June 2017.

82. R. Piestun, "Overcoming Diffraction and Scattering Limitations in Optical Imaging", Huazhong University of Science and Technology, Wuhan June 13, 2017.
83. R. Piestun, "Overcoming Diffraction and Scattering Limitations in Optical Imaging", Tsinghua University, Beijing, June, 2017.
84. R. Piestun, "Overcoming Diffraction and Scattering Limitations in Optical Imaging", Beijing University, Beijing, June, 2017.
85. R. Piestun, "Overcoming diffraction and scattering effects in optical imaging: A new era in optical imaging", SAOT - Young Researcher Award, Erlangen, Germany, July 9, 2015
86. R. Piestun, "Overcoming the Diffraction and Multiple Scattering Limitations in Optical Imaging", Applied Math – Nonlinear Waves Seminar, University of Colorado, September 25, 2012
87. R. Piestun, "What can 3D superresolution microscopy do for biological imaging?," BioFrontiers Seminar, University of Colorado, September 11, 2012
88. R. Piestun, "Overcoming the Classical Limits Imposed by Diffraction and Multiple Scattering via Computational Optical Imaging," EPFL-Lausanne, August 28, 2012
89. R. Piestun, "Overcoming the diffraction and multiple-scattering limits via computational optical imaging", Rice University, April 17, 2012
90. R. Piestun, "Overcoming the diffraction and multiple-scattering limits via computational optical imaging," Schlumberger, Houston TX, April 18, 2012
91. R. Piestun, "Integrative Graduate Education and Research Traineeship Program in Computational Optical Sensing and Imaging", STEM Education at the University of Colorado – Boulder, November 2011.
92. R. Piestun, "Nano Optics for Microscopy", ESPRIT meeting, Boulder CO, November 1<sup>st</sup> 2011
93. R. Piestun, "Data Collection and Conditioning for SCENICC – 3D Optics", DARPA SCENICC Meeting, October 2011
94. R. Piestun, J. DeLuca, Advances in cellular imaging using superresolution microscopy, Colorado State University, October 31<sup>st</sup> 2011
95. R. Piestun, "3D super-resolution computational optical microscopy," Melbourne University, Australia, July 2010
96. R. Piestun, "Three-dimensional light distributions and novel superresolution microscopies," Columbia University, March 31<sup>st</sup> 2010
97. INVITED Panel Discussion, Fall OSA Optics & Photonics Congress, Ravindra Anant Athale; MITRE Corp., USA; David Brady; Duke Univ., USA; Aristide Dogariu; CREOL, College of Optics and Photonics, Univ. of Central Florida, USA; Michael A. Fiddy; Univ. of North Carolina at Charlotte, USA; Mark Allen Neifeld; Univ. of Arizona, USA; Rafael Piestun; Univ. of Colorado, USA. Computational Optical Sensing and Imaging, Fall OSA Optics & Photonics Congress, San Jose, California, October 13-15, 2009.
98. INVITED Talk at DARPA: The Next Generation Vision Sensors and Algorithms Workshop, April 1-2
99. R. Piestun, "3D nanostructures and 3D light synthesis for novel functionalities", Macquarie University 2008.

100. R. Piestun, "Novel functionalities from 3D nanostructures and 3D light synthesis ", Sydney University 2008.
101. R. Piestun, "Depth from diffracted rotation", Sydney University 2008.
102. R. Piestun, "Computational Optical Three-Dimensional Imaging and Sensing: Towards Super-resolving, Passive, Compact, and Scalable Systems", Honda Research Labs, Mountain View, CA, September 2007
103. R. Piestun, "Nanoestructuras y ondas de luz", University of Buenos Aires, July 2007
104. R. Piestun, "3D nanostructures and 3D light waves: Synthesis and applications", ECE seminar, University of Colorado at Boulder, October 2006
105. R. Piestun, "Synthesis and applications of 3D nanostructures and 3D light waves", IEEE LEOS/RMOSA, April 2006
106. R. Piestun, "3D nanostructures and 3D light waves: Synthesis and applications", University of California at San Diego, March 2006
107. R. Piestun, "3-D Nanofabrication Techniques for Novel Photonics Applications", Technion – Israel Institute of Technology, August 2005
108. R. Piestun, "The Optical Science and Engineering Program at the University of Colorado - Boulder", Colorado Photonics Industry Association Annual Meeting, November 10, 2005
109. R. Piestun, "The Optical Science and Engineering Program at the University of Colorado - Boulder", Colorado Photonics Industry Association Annual Meeting, November 10, 2004
110. R. Piestun, "Shaping light with microstructures and shaping microstructures with light", Massachusetts Institute of Technology (MIT), October 25, 2004
111. R. Piestun, "Luz y Nano/Micro Estructuras", Universidad de la Republica - Uruguay, August 19, 2004
112. R. Piestun, " Shaping light with microstructures and shaping microstructures with light", University of North Carolina at Charlotte, May 7, 2004
113. R. Piestun, "Photonics Research at the University of Colorado", Colorado Photonics Industry Association Annual Meeting, November 20, 2003
114. R. Piestun, "Control of light with microstructures", Ecole Nationale d'Ingenieurs de Brest (ENIB) - France, June 2<sup>nd</sup>, 2003
115. R. Piestun, "Control of light with microstructures and control of microstructures with light", Helsinki University of Technology - Finland, January 20, 2003
116. R. Piestun, "Photonics Education at the University of Colorado", Colorado Photonics Industry Association Annual Meeting, November 14, 2002
117. R. Piestun, "Multi-dimensional synthesis of light fields", Agilent Labs - Palo Alto, June 28, 2002
118. R. Piestun, "Shaping light with micro/nano-structures", Micro/Nano-Electronics/Photonics Colloquium, University of Colorado at Boulder, March 21, 2002
119. R. Piestun, "Beating diffraction with diffraction", OSEP seminar, University of Colorado at Boulder, February 11, 2002
120. R. Piestun, "How to control multidimensional light fields", Electromagnetics seminar, University of Colorado at Boulder, February 7, 2002

121. R. Piestun, "Applications of multidimensional light fields", Photonics Forum, University of Colorado at Boulder, October 23, 2001
122. R. Piestun, "Control of light fields by microstructures", Gross seminar, Department of Physics, University of Colorado at Boulder, April 6, 2001
123. R. Piestun, "Control of three-dimensional light fields", University of California - San Diego, March 3, 2000
124. R. Piestun, "Degrees of freedom in optics and the synthesis of 3D fields", Stanford University, November 22, 1999

## GRADUATED PhD STUDENTS

1. Name: **Brian Schwartz, Ph.D.**  
 Graduation date: August 2005  
 Dissertation title: "Ultralow refractive index metamaterials and band gap structures at optical wavelengths"  
 Currently at CDM - Optics, Boulder, CO  
**Awards** - SPIE (International society for optical engineering) scholarship, National Academies Science and Technology Policy Graduate Fellowship, OSEP fellow
2. Name: **Wenjian Cai, Ph.D.**  
 Graduation date: January 2006  
 Dissertation title: "Femtosecond micro/nano-machining of dielectric materials for the fabrication of 3D photonic devices"  
 Currently at KLA Tencor, San Jose CA.
3. Name: **Adam Greengard, ECE**  
 PhD December, 2006  
 Dissertation title: "Three-dimensional imaging and sensing based on rotating point spread functions."  
**Awards**: OSEP fellow, Collins fellowship  
 Currently at FiveFocal LLC, Boulder, CO
4. Name: **Sharon King, ECE**  
 PhD December, 2008  
 Dissertation title: "Quantitative phase information from differential interference contrast microscopy." Joint advising with Prof. Cogswell.  
**Awards**: GAANN fellowship  
 Currently at Boulder Nonlinear Systems, Boulder, CO
5. Name: **Sri Rama Prasanna Pavani, ECE**  
 PhD August, 2009  
 Dissertation title: "Three-dimensional nanoscopy with a double-helix microscope."  
**Awards**: SPIE scholarship, OSA FiO Outstanding paper award, CPIA-Photonics in Colorado best poster, CU College of Engineering Best Thesis Award  
 Currently at Ricoh Innovations, CA
6. Name: **Timothy Gerke**  
 PhD November, 2010  
 Dissertation title: "Aperiodic Volume Optical Elements,"

**Awards:** OSEP fellowship, COSI fellowship  
Currently at Phianium, OR

7. Name: **Sean Quirin**  
PhD March 2012  
Dissertation title: “Quantitative optical imaging and sensing by joint design of point spread functions and estimation algorithms”  
**Award:** COSI fellowship  
Currently at Columbia University
8. Name: **Ginni Grover**  
PhD January 2013  
Dissertation title: “Super-resolution photon-efficient imaging”  
**Award:** Women in Engineering Award  
Currently at Intel
9. Name: **Donald Conkey**  
PhD December 2013  
Dissertation title: “Light control through highly scattering media”  
**Award:** COSI Fellowship,  
Currently at EPFL, Switzerland
10. Name: **Anurag Agrawal**  
PhD August 2014  
Dissertation title: “Computational Imaging using Electromagnetic Optics”  
Currently at Double Helix LLC
11. Name: **Anthony Barsic**  
PhD December 2014  
Dissertation title: “Localization of Dense Clusters of Nanoscale Emitters for Superresolution Microscopy”  
**Award:** COSI fellowship  
Currently Adjoint Professor at the University of Colorado – Boulder
12. Name: **Antonio Caravaca-Aguirre**  
PhD May 2016  
Dissertation title: “Light control for non-invasive and minimally invasive imaging”  
Awards: SPIE scholarship, CPIA best paper award
13. Name: **Haiyan Wang**  
PhD November 2019  
Dissertation title: “Active 3D diffractive optics”

## SELECTED APPEARENCES IN THE MEDIA

- <http://blogs.physicstoday.org/thedayside/2011/03/tracking-rna-with-a-double-helix-point-spread-function.html>
- Interview “Volume Optics” – *Nature Photonics*  
<http://www.nature.com/nphoton/journal/v4/n3/full/nphoton.2010.26.html>
- 'News from Andor technology' <http://www.andor.com/company/news/?docID=1113>
- *Microscopy and Analysis*  
<http://www.microscopy-analysis.com/news/highly-sensitive-andor-emccd-camera-helps-redraw-boundaries-super-resolution-3d-imaging>
- 'Nature Photonics Technology Focus' March 2010
- *Photonics Online*  
<http://www.photonicsonline.com/article.mvc/Highly-Sensitive-EMCCD-Camera-Helps-Redraw-0001?VNETCOOKIE=NO>
- *BioSpace*  
[http://www.biospace.com/news\\_story.aspx?NewsEntityId=180696](http://www.biospace.com/news_story.aspx?NewsEntityId=180696)
- *Nature Methods*  
'PALM reading - Super-resolution fluorescence microscopy gets a boost in axial resolution from two groups of optics wizards'  
<http://www.nature.com/nmeth/journal/v6/n4/full/nmeth0409-243.html>
- *Nature*: 'Microscopy: Ever-increasing resolution'  
<http://www.nature.com/nature/journal/v462/n7273/full/462675a.html>
- *Laser Focus World*  
<http://www.optoiq.com/index/photronics-technologies-applications/lfw-display/lfw-article-display/355387/articles/laser-focus-world/volume-45/issue-3/newsbreaks/double-helix-psf-enables-superresolution-3-d-imaging.html>
- *Spotlight on Optics – OSA Optics Infobase*  
"High-speed scattering medium characterization with application to focusing light through turbid media", *Optics Express*, January 2012
- *Science Daily*, “Ultrathin endoscope captures neurons firing deep in the brain,”  
<https://www.sciencedaily.com/releases/2018/03/180326110031.htm>
- OSA News Releases: [https://www.osa.org/en-us/about\\_os/newsroom/news\\_releases/2018/ultrathin\\_endoscope\\_captures\\_neurons\\_firing\\_deep\\_i/](https://www.osa.org/en-us/about_os/newsroom/news_releases/2018/ultrathin_endoscope_captures_neurons_firing_deep_i/)
- Optics and Photonics News, OSA, “Enabled by 3-D printing,” [https://www.osa-opn.org/home/articles/volume\\_28/february\\_2017/departments/enabled\\_by\\_3-d\\_printing/](https://www.osa-opn.org/home/articles/volume_28/february_2017/departments/enabled_by_3-d_printing/)
- Nature Methods, “Super-resolution fight club: assessment of 2D and 3D single-molecule localization microscopy software”, <https://doi.org/10.1038/s41592-019-0364-4>

- <https://www.colorado.edu/venturepartners/2019/03/13/cu-boulder-spinoff-double-helix-wins-prestigious-industry-award-spindler-imaging-system>
- Technique detailed in Nature Photonics enables real-time imaging towards use in medical field  
<https://www.colorado.edu/engineering/2019/08/28/technique-detailed-nature-photonics-enables-real-time-imaging-towards-use-medical-field>
- Real-time imaging for use in medicine <https://phys.org/news/2019-09-real-time-imaging-medicine.html>

## DISSERTATIONS

Ph.D. dissertation: *Three-dimensional structuring of light fields*, by Rafael Piestun

M.Sc. thesis: *Methods for efficient storage of information in wave front synthesis*, by Rafael Piestun

## PEER-REVIEWED JOURNAL PUBLICATIONS

1. Simon Labouesse, Samuel C. Johnson, Hans A. Bechtel, Markus B. Raschke, and Rafael Piestun, "Smart Scattering Scanning Near-Field Optical Microscopy" *ACS Photonics*, 7, 12, 3346–3352 (2020)
2. Haiyan Wang & Rafael Piestun, "Azimuthal multiplexing 3D diffractive optics," *Scientific Reports*, 10, 6438 (2020)
3. Marco A. Inzunza-Ibarra, Evolene Premillieu, Clemens Grünsteidl, Rafael Piestun, and Todd W. Murray, "Sub-acoustic resolution optical focusing through scattering using photoacoustic fluctuation guided wavefront shaping," *Opt. Express* 28, 9823-9832 (2020)
4. Evolene Premillieu and Rafael Piestun, "Measuring the transmission matrix of a scattering medium using epi-fluorescence light," *Optics Communications* 462, 125207 (2020)
5. O. Tzang, E. Niv, S. Singh, S. Labouesse, G. Myatt, R. Piestun, "Wavefront shaping in complex media with a 350 kHz modulator via a 1D-to-2D transform," *Nature Photonics* 7, 788 (2019)
6. Omer Tzang, Dan Feldkhun, Anurag Agrawal, Alexander Jesacher, and Rafael Piestun, "Two-photon PSF-engineered image scanning microscopy," *Opt. Lett.* 44, 895 (2019)
8. Daniel Feldkhun, Omer Tzang, Kelvin H. Wagner, and Rafael Piestun, "Focusing and scanning through scattering media in microseconds," *Optica* 6, 72 (2019)
10. Franziska Strasser, Martin Offterdinger, Rafael Piestun, and Alexander Jesacher, "Spectral image scanning microscopy," *Biomed. Opt. Express* 10, 2513-2527 (2019)
11. A. Caravaca-Aguirre, S. Singh, S. Labouesse, M. V. Baratta, R. Piestun, and E. Bossy, "Hybrid photoacoustic-fluorescence microendoscopy through a multimode fiber using speckle illumination," *APL Photonics* 4, 096103 (2019)
12. R. Piestun, "Free-form micro-optical elements heat up," News & Views, *Nature Photonics* 13, 583-584 (2019)
13. Caravaca AM, Piestun R. "Computer-Generated Holographic Techniques to Control Light Propagating through Scattering Media Using a Digital-Mirror-Device Spatial Light Modulator." in *Wavefront Shaping for Biomedical Imaging* ( Cambridge University Press, May 31, 2019).
14. Tzang O, Caravaca-Aguirre AM, Wagner K, Piestun R. "Adaptive wavefront shaping for controlling nonlinear multimode interactions in optical fibres," *Nature Photonics* 12 (6) 368 (2018)
15. Wang H, Piestun R. "Dynamic 2D implementation of 3D diffractive optics," *Optica* 5, 1220 (2018)
16. Boniface A, Mounaix M, Blochet B, Piestun R, Gigan S. "Transmission-matrix-based point-spread-function engineering through a complex medium," *Optica* 4 (1) 54-59 (2017)
17. Shay Ohayon, Antonio Caravaca-Aguirre, Rafael Piestun, and James J. DiCarlo, "Minimally invasive multimode optical fiber microendoscope for deep brain fluorescence imaging," *Biomed. Opt. Express* 9, 1492-1509 (2018)

18. Caravaca-Aguirre AM, Piestun R. "Single multimode fiber endoscope," *Optics Express* 25 (3) 1656-1665 (2017)
19. Tzang O, Niv E, Caravaca-Aguirre AM, Piestun R. "Thermal expansion feedback for wave-front shaping," *Optics Express* 25 (6) 6122-6131 (2017)
20. Wang D, Agrawal A, Piestun R, Schwartz DK. "Enhanced information content for three-dimensional localization and tracking using the double-helix point spread function with variable-angle illumination epifluorescence microscopy," *Applied Physics Letters* 110 (21) 211107 (2017)
21. Roider C, Piestun R, Jesacher A. "3D image scanning microscopy with engineered excitation and detection," *Optica* 4 (11) 1373-1381 (2017)
22. Tzang O, Agrawal A, Piestun R. "Material anisotropy as a degree of freedom in optical design," *Optics Express* 25 (25) 31077-31095 (2017)
23. Ashok A, Piestun R, Stallinga S. "Single molecule image formation, reconstruction and processing: introduction." *Journal of the Optical Society of America A*. 33 (7) (July 01, 2016): SM11-SM12.
24. Roider C, Heintzmann R, Piestun R, Jesacher A. "Deconvolution approach for 3D scanning microscopy with helical phase engineering," *Optics Express*. 24, 15456 (2016)
25. Tzang O, Piestun R. "Lock-in detection of photoacoustic feedback signal for focusing through scattering media using wave-front shaping," *Optics Express*. 24 28122 (2016)
26. Alexander Jesacher, Monika Ritsch-Marte, and Rafael Piestun, "Three-dimensional information from two-dimensional scans: a scanning microscope with postacquisition refocusing capability," *Optica* 2, 210-213 (2015)
27. Donald B. Conkey, Antonio M. Caravaca-Aguirre, Jacob D. Dove, Hengyi Ju, Todd W. Murray, and Rafael Piestun, "Super-resolution photoacoustic imaging through a scattering wall," *Nature Communications* 6:7902, (2015)
28. G. Grover, W. Mohram, and R. Piestun, "Real-time adaptive drift correction for super-resolution localization microscopy," *Optics Express* (2015)
29. Anthony Barsic, Ginni Grover & Rafael Piestun, "Three-dimensional super-resolution and localization of dense clusters of single molecules," *Scientific Reports*, 4 : 5388 (2014)
30. Antonio M. Caravaca-Aguirre, Donald B. Conkey, Jacob D. Dove, Hengyi Ju, Todd W. Murray, and Rafael Piestun, "High contrast three-dimensional photoacoustic imaging through scattering media by localized optical fluence enhancement," *Opt. Express* **21**, 26671-26676 (2013)
31. Anthony Barsic, Rafael Piestun, "Super-resolution of dense nanoscale emitters beyond the diffraction limit using spatial and temporal information," *Applied Physics Letters*, 102, 231103 (2013).
32. Antonio M. Caravaca-Aguirre, Eyal Niv, Donald B. Conkey, and Rafael Piestun, "Real-time resilient focusing through a bending multimode fiber," *Opt. Express* **21**, 12881-12887 (2013)
33. Andreas Gahlmann, Jerod Ptacin, Ginni Grover, Sean Quirin, Alexander von Diezmann, , Marissa Lee, Mikael Backlund, Lucy Shapiro, Rafael Piestun, W.E. Moerner, "Quantitative multicolor subdiffraction imaging of bacterial protein ultrastructures in 3D", *NanoLetters* (2013)

34. Sean Quirin and Rafael Piestun, "Depth estimation and image recovery using broadband, incoherent illumination with engineered point spread functions [Invited]", *Applied Optics*, p. A367, vol. 52, (2013)
35. Donald B. Conkey and Rafael Piestun, "Color image projection through a strongly scattering wall," *Opt. Express* **20**, 27312-27318 (2012)
36. Mikael P. Backlund, Matthew D. Lew, Adam S. Backer, Steffen J. Sahl, Ginni Grover, Anurag Agrawal, Rafael Piestun, and W. E. Moerner, "Simultaneous, accurate measurement of the 3D position and orientation of single molecules", *Proceedings of the National Academy of Sciences* (PNAS), p. 19087, vol. 109, (2012)
37. Anurag Agrawal, Sean Quirin, Ginni Grover, and Rafael Piestun, "Limits of 3D dipole localization and orientation estimation for single-molecule imaging: towards Green's tensor engineering", *Optics Express*, p. 26667, vol. 20, (2012)
38. Ginni Grover, Keith DeLuca, Sean Quirin, Jennifer DeLuca, and Rafael Piestun, "Super-resolution photon-efficient imaging by nanometric double-helix point spread function localization of emitters (SPINDLE)", *Optics Express*, p. 26681, vol. 20, (2012).
39. Anurag Agrawal, Wounjhang Park, and Rafael Piestun, "Negative permeability with arrays of aperiodic silver nanoclusters", *Applied Physics Letters* (2012)
40. Donald B. Conkey, Albert N. Brown, Antonio M. Caravaca-Aguirre, and Rafael Piestun, "Genetic algorithm optimization for focusing through turbid media in low signal to noise environments", *Optics Express* (2012)
41. Sean Quirin, S.R.P. Pavani, and Rafael Piestun, "Optimal 3D single-molecule localization for superresolution microscopy with aberrations and engineered point spread functions", *Proceedings of the National Academy of Sciences* (PNAS) **109**, 675–679 (2012). Published online before print December 30, 2011
42. Donald B. Conkey, Antonio M. Caravaca-Aguirre, and Rafael Piestun, "High-speed scattering medium characterization with application to focusing light through turbid media", *Optics Express*, **20**, 1733-1740 (2012)
43. Ginni Grover, Sean Quirin, Callie Fiedler, and Rafael Piestun, "Photon efficient double-helix PSF microscopy with application to 3D photo-activation localization imaging," *Biomed. Opt. Express* **2**, 3010-3020 (2011)
44. Donald B. Conkey, Rahul P. Trivedi, Sri Rama Prasanna Pavani, Ivan I. Smalyukh, and Rafael Piestun, "Three-dimensional parallel particle manipulation and tracking by integrating holographic optical tweezers and engineered point spread functions", *Optics Express* **19**, 3835-3842 (2011)
45. Ginni Grover, Sri Rama Prasanna Pavani, and Rafael Piestun, "Performance limits on three-dimensional particle localization in photon-limited microscopy," *Opt. Lett.* **35**, 3306-3308 (2010)
46. Tim D. Gerke and Rafael Piestun, "Aperiodic volume optics," *Nature Photonics* **4**, 188 - 193 (2010)
47. Sri Rama Prasanna Pavani, Jennifer G. DeLuca, and Rafael Piestun, "Polarization sensitive, three-dimensional, single-molecule imaging of cells with a double-helix system," *Opt. Express* **17**, 19644-19655 (2009)
48. Rafael Piestun and C. Martijn de Sterke, "Fundamental limit for two-dimensional passive devices," *Opt. Lett.* **34**, 779-781 (2009)

49. Sri Rama Prasanna Pavani, Michael A. Thompson, Julie S. Biteen, Samuel J. Lord, Na Liu, Robert J. Twieg, Rafael Piestun, and W. E. Moerner, "Three-Dimensional Single-Molecule Fluorescence Imaging Beyond the Diffraction Limit Using a Double-Helix Point Spread Function," *Proceedings of the National Academy of Sciences* (PNAS) 106, 2995 (2009)
50. Sri Rama Prasanna Pavani, Adam Greengard, and Rafael Piestun, "Three-dimensional localization with nanometer accuracy using a detector-limited double-helix point spread function system," *Applied Physics Letters*, Vol. 95 Issue 2, 021103 (2009)
51. Sri Rama Prasanna Pavani and Rafael Piestun, "Three dimensional tracking of fluorescent microparticles using a photon-limited double-helix response system," *Opt. Express* 16, 22048-22057 (2008)
52. Sri Rama Prasanna Pavani and Rafael Piestun, "High-efficiency rotating point spread functions," *Opt. Express* 16, 3484-3489 (2008)
53. Sharon V. King, Ariel Libertun, Rafael Piestun, and Carol J. Cogswell, Chrysanthé Preza, "Quantitative phase microscopy through differential interference imaging", *Journal of Biomedical Optics* 13, 2, 024020 (2008)
54. T. D. Gerke and R. Piestun, "Aperiodic computer-generated volume holograms improve the performance of amplitude volume gratings," *Opt. Express* 15, 14954-14960 (2007)
55. W. Cai, R. Piestun, "Low pulse-energy micromachining in bulk glass with a short-cavity femtosecond oscillator", *Optical Engineering* Vol. 46, 124301 (2007)
56. Mark J. Ablowitz, Boaz Ilan, Ethan Schonbrun, Rafael Piestun, Two-dimensional solitons in irregular lattice systems, *Theoretical and Mathematical Physics* 151 (3): 723-734 (2007)
57. Mark J. Ablowitz, Boaz Ilan, Ethan Schonbrun, Rafael Piestun, "Solitons in two-dimensional lattices possessing defects, dislocations and quasicrystal structures", *Phys Rev E* 74, 035601 (R) (2006)
58. Z. A. Sechrist, B. T. Schwartz, J. H. Lee, J. A. McCormick, R. Piestun, W. Park, and S. M. George, "Modification of Opal Photonic Crystals Using Al<sub>2</sub>O<sub>3</sub> Atomic Layer Deposition", *Chem. Mater.* 18, 3562-3570 (2006)
59. W. Cai, A. R. Libertun, and R. Piestun, "Polarization selective computer-generated holograms realized in glass by femtosecond laser induced nanogratings," *Opt. Express* 14, 3785-3791 (2006)
60. W. Cai, T. Reber, R. Piestun, "Computer-generated volume holograms fabricated by femtosecond laser micromachining", *Optics Letters* 31, 12 (2006)
61. W. Cai, R. Piestun, "Patterning of silica microsphere monolayers with focused femtosecond laser pulses", *Applied Physics Letters* 88, 111112 (2006)
62. A. Greengard, Y. Y. Schechner, R. Piestun, "Depth from rotation", *Opt. Lett.* 31, 181-183 (2006)
63. E. Schonbrun, R. Piestun, "Optical vortices for localized optical lattice site manipulation", *Optical Engineering* 45, 028001 (2006)
64. B. T. Schwartz and R. Piestun, "Dynamic properties of sub-wavelength structures and their effective refractive index", *J. Opt. Soc. Am. B* 22, 2018-2026 (2005)
65. E. Schonbrun, R. Piestun, P. Jordan, J. Cooper, K.D Wulff, J. Courtial, M. Padgett, "3D interferometric optical tweezers using a single spatial light modulator", *Optics Express* 13, 3777-3786, (2005)

66. B. T. Schwartz and R. Piestun, "Waveguiding in air by total external reflection from ultra-low index metamaterials", *Applied Physics Letters* 85, 1-3 (2004)
67. "Three dimensional field transformations for imaging" by R. Piestun, in *Encyclopedia of Modern Optics*, edited by Robert D. Guenther, Duncan G., Steel and Leopold Bayvel, Elsevier, Oxford, 2004. ISBN 0-12-227600-0.
68. B. T. Schwartz and R. Piestun, "Total external reflection from metamaterials with ultralow refractive index", *J. Opt. Soc. Am. B* 20 (12), 2448-2453 (2003)
69. R. Piestun and J. Shamir, "Synthesis of 3D light fields and applications", *Proceedings of the IEEE*, 90, 222-244 (2002)
70. "Sculpturing of three-dimensional light fields by iterative optimization" by J. Shamir and R. Piestun, in *Holography for the New Millennium*, 2002, ISBN: 0-387-95334-5
71. R. Piestun and D. A. B. Miller, "Spatio-temporal control of ultrashort optical pulses by refractive-diffractive-dispersive structured optical elements", 26, 1373-1375, *Opt. Lett.* (2001)
72. B. E. Nelson, M. Gerken, D. A. B. Miller, R. Piestun, C. C. Lin, and J. S. Harris, "Use of a Dielectric Stack as a One-Dimensional Photonic Crystal for Wavelength Demultiplexing by Beam Shifting", *Optics Letters* 25, 1502-1504 (2000)
73. R. Piestun and D. A. B. Miller, "Electromagnetic degrees of freedom of an optical system", *J. Opt. Soc. Am. A* 17, 892-902 (2000)
74. R. Piestun, Y. Y. Schechner, J. Shamir, "Generalized propagation invariant wave fields with finite energy", *J. Opt. Soc. Am. A* 17, 294-303 (2000)
75. R. Piestun and J. Shamir, "Generalized propagation invariant wave-fields", *J. Opt. Soc. Am. A*, 15, 3039-3044 (1998)
76. R. Piestun, B. Spektor, J. Shamir, "Pattern generation with extended focal depth", *Appl. Opt.* 37, 5394-5398 (1998)
77. R. Piestun, J. Shamir, B. Wesskamp, O. Bryngdahl, "On-Axis Computer Generated Holograms for 3-D Display", *Opt. Lett.* 22, 922-924 (1997)
78. R. Piestun, B. Spektor, J. Shamir, "On-Axis Binary-Amplitude Computer Generated Holograms", *Opt. Comm.* 136, 85-92 (1997).  
See also: R. Piestun, J. Shamir, "On-Axis Binary-Amplitude Computer Generated Holograms", CC PUB No. 106, Department of Electrical Engineering, Technion-I.I.T., Haifa, Israel, June 1995
79. R. Piestun, Y. Y. Schechner, J. Shamir, "Self-imaging with finite energy", *Opt. Lett.* 22, 200-202 (1997)
80. B. Spektor, R. Piestun, J. Shamir, "Dark beams with constant notch", *Opt. Lett.* 21, 456-458 (1996).
81. R. Piestun, B. Spektor, J. Shamir, "Wave fields in three dimensions: Analysis and synthesis" *J. Opt. Soc. Am. A* 13, 1837-1848, (1996).  
See also: R. Piestun, B. Spektor, J. Shamir, "Wave fields in three dimensions: Analysis and Synthesis", CC PUB No. 107, Department of Electrical Engineering, Technion-I.I.T., Haifa, Israel (1995)
82. Y.Y. Schechner, R. Piestun, J. Shamir, "Wave propagation with rotating intensity distributions", *Phys. Rev. E*, 54, R50-R53 (1996)

83. R. Piestun, B. Spektor, J. Shamir, "Unconventional Light Distributions in 3-D domains", *J. Mod. Opt.* 43, 1495-1507 (1996)
84. R. Piestun and J. Shamir, "Control of wave-front propagation with diffractive elements", *Opt. Lett.* 19, 771-773 (1994)
85. R. Piestun, J. Rosen, J. Shamir, "Generation of continuous complex valued functions for the joint transform correlator", *Appl. Opt.* 33, 4398 (1994)

## OTHER PUBLICATIONS

1. Markus Testorf, Michael Fiddy, Aristide Dogariu, Rafael Piestun, Charles Matson, and Mark Anastasio, "Signal Recovery and Computational Sensing and Imaging: introduction to the feature issue," *Appl. Opt.* **49**, SRC1-SRC2 (2010)
2. R. Won, T. Gerke, R. Piestun, "Volume optics," *Nature Photonics* 4, 3, 194-194, (2010)
3. Wenjian Cai, Timothy D. Gerke, Theodore J. Reber, Ariel Libertun, and Rafael Piestun, "Computer-generated volume holograms: optimizing the degrees of freedom in three-dimensional structures", **Optics in 2006**, *Optics and Photonics News* (December 2006) (#)
4. B. T. Schwartz and R. Piestun, "A New Path; Ultralow-index metamaterials present new possibilities for controlling light propagation," *OE magazine*, 5, 30-32 (2005)
5. R. Piestun, "Multidimensional synthesis of light fields", *Optics & Photonics News*, 28-32, November 2001
6. R. Piestun and J. Shamir, "Seeking for new propagation invariant wave-fields", *Optics and Photonics News*, special issue **Optics in 1998**, 9, No. 12, 39-40 (1998)

## CONFERENCE PUBLICATIONS

1. S. Singh, S. Labouesse, and R. Piestun, "Focusing and imaging with mode selection through multimode fibers," in *Frontiers in Optics / Laser Science*, B. Lee, C. Mazzali, K. Corwin, and R. Jason Jones, eds., OSA Technical Digest (Optical Society of America, 2020), paper FM7B.3.
2. Caravaca-Aguirre AM, Singh S, Labouesse S, Piestun R, Bossy E. "Multimodal imaging through a multimode fiber." OPTOACOUSTIC METHODS AND APPLICATIONS IN BIOPHOTONICS IV (Conference on Opto-Acoustic Methods and Applications in Biophotonics IV, June 24, 2019 - June 25, 2019) .Ed.Ntziachristos V; Zemp R: SPIE-INT SOC OPTICAL ENGINEERING, January 01, 2019
3. O. Tzang, S. Labouesse, S. Singh, E. Niv, G. Myatt, and R. Piestun, "1D to 2D modulation for ultra fast focusing through complex media," in *Imaging and Applied Optics 2019 (COSI, IS, MATH, pCAOP)*, OSA Technical Digest (Optical Society of America, 2019), paper JTh3D.1.
4. A. M. C. Aguirre, S. Singh, S. Labouesse, R. Piestun, and E. Bossy, "Multimodal imaging through a multimode fiber," in *Clinical and Preclinical Optical Diagnostics II*, Vol. EB101 of SPIE Proceedings (Optical Society of America, 2019), paper 11077\_19.
5. H. Wang and R. Piestun, "Stratified Multiplexing Computer-Generated Holograms," in *Digital Holography and Three-Dimensional Imaging 2019*, OSA Technical Digest (Optical Society of America, 2019), paper Tu4A.3.

6. Yi X, Piestun R, Weiss S. "3D super-resolution imaging using a generalized and scalable progressive re nement method on sparse recovery (PRIS)." Single Molecule Spectroscopy and Superresolution Imaging XII (Single Molecule Spectroscopy and Superresolution Imaging XII, February 02, 2019 - February 07, 2019): SPIE, February 22, 2019
7. Tzang O, Caravaca-Aguirre AM, Wagner K, Piestun R. "Adaptive Wave-front shaping in Linear and Nonlinear Complex Media." Conference on Lasers and Electro-Optics, OSA Technical Digest (online) (Optical Society of America, 2018) (Conference on Lasers and Electro-Optics): Optical Society of America, May 18, 2018.paper FF3H.5.-paper FF3H.5. *INVITED PAPER*
8. Piestun R, Wang H. "Dynamic Implementation of Computer-Generated Volume Holograms." Imaging and Applied Optics 2018 (3D, AO, AIO, COSI, DH, IS, LACSEA, LS&C, MATH, pcAOP), OSA Technical Digest (Optical Society of America, 2018) (Imaging and Applied Optics, June 25, 2018 - June 28, 2018), June 26, 2018.paper DTu5F.5.-paper DTu5F.5..
9. Tzang O, Caravaca-Aguirre Am, Wagner K, Piestun R. "Wave-front shaping for nonlinear dynamics control." Proc. SPIE 10502 (Adaptive Optics and Wavefront Control for Biological Systems IV, 1050216), March 15, 2018. *INVITED PAPER*
10. Labouesse S, Singh S, Piestun R. "Random speckle illumination patterns for compressed imaging through a multimode fiber." Proceedings of the European Optical Society Conference Waves in Complex Photonics Media (European Optical Society (EOS) Waves in Complex Photonics Media), June 05, 2018
11. Wang H, Piestun R. "Information Encoding in Aperiodic Volumetric Scattering Optics." Proceedings of the EOS Meeting on Waves in Complex Photonic Media (European Optical Society (EOS) Meeting on Waves in Complex Photonic Media), June 05, 2018
12. Boniface A, Mounaix M, Blochet B, Piestun R, Gigan S. "Sub-diffraction limit focusing through a complex medium by virtual Fourier filtering." Adaptive Optics And Wavefront Control For Biological Systems III (Conference on Adaptive Optics and Wavefront Control for Biological Systems III, January 28, 2017 - January 30, 2017) Ed.Bifano TG; Kubby J; Gigan S: SPIE-INT SOC OPTICAL ENGINEERING, January 01, 2017
13. Mounaix M, Boniface A, Blochet A, Piestun R, Gigan S. "Point-spread-function engineering through a complex medium." European Conference on Lasers and Electro-Optics and European Quantum Electronics Conference, (Optical Society of America, 2017), (European Conference on Lasers and Electro-Optics and European Quantum Electronics Conference, June 25 - June 29, 2017)
14. Jesacher A, Piestun R, Roider C, Heintzmann R. "3D imaging from 2D scanning with helical PSF engineering." OSA Technical Digest (online) (Optical Society of America, 2017) (Optics in the Life Sciences Congress, April 02 - April 05, 2017)
15. Singh S, Caravaca-Aguirre AM, Piestun R. "Focusing Through a Multimode Fiber with Selective Mode Control." OSA Technical Digest (online) (Optical Society of America, 2017) (Imaging and Applied Optics 2017, June 26 - June 29, 2017)
16. Tzang O, Piestun R. "Thermal Expansion Feedback for Wave-front Shaping." OSA Technical Digest (online) (Optical Society of America, 2017) (Conference on Lasers and Electro-Optics, May 14 - May 19, 2017)

17. Caravaca-Aguirre AM, Singh S, Piestun R. "Speckle Statistics for Single Fiber Endoscopy." OSA Technical Digest (online) (Optical Society of America, 2017) (Optics in the Life Sciences Congress, OSA, April 02 - April 05, 2017)
18. Piestun R, Ohayon S, Caravaca-Aguirre A, DiCarlo J. "Single fiber endoscopy for deep brain imaging." OSA Technical Digest (online) (Optical Society of America, 2017) (Imaging and Applied Optics 2017, OSA, June 29, 2017)
19. Wang H, Piestun R. "Design of Large Space-Bandwidth Multiplexing Computer-Generated Volume Optics." OSA Technical Digest (online) (Optical Society of America, 2017) (Digital Holography and Three-Dimensional Imaging, OSA, May 29 - June 01, 2017)
20. Tzang O, Caravan-Aguirre AM, Piestun R. "Wave-Front Shaping for Nonlinear Light Propagation in Multimode Fibers." OSA Technical Digest (online) (Optical Society of America, 2017) (Nonlinear Optics, OSA, July 17 - July 21, 2017)
21. Tzang O, Agrawal A, Piestun R. "Materials degrees of freedom for optical design." OSA Technical Digest (online) (Optical Society of America, 2017) (Imaging and Applied Optics 2017, OSA, June 26 - June 29, 2017)
22. Sigal I, Aguirre AMC, Gad R, Piestun R, Levi O. "Label free imaging system for measuring blood flow speeds using a single multi-mode optical fiber." Conference on Adaptive Optics and Wavefront Control for Biological Systems II (Conference on Adaptive Optics and Wavefront Control for Biological Systems II, February 13 - 15, 2016). Ed. Bifano TG; Kubby J; Gigan S: SPIE-Int Soc Optical Engineering
23. Caravaca-Aguirre AM, Piestun R. "Wavefront shaping for single fiber fluorescence endoscopy." Conference on Adaptive Optics and Wavefront Control for Biological Systems II (Conference on Adaptive Optics and Wavefront Control for Biological Systems II, February 13 - 15, 2016). Ed. Bifano TG; Kubby J; Gigan S: SPIE-Int Soc Optical Engineering
24. R. Piestun, "3D PSF Engineering and Computational Reconstruction in Scanning Optical Microscopy," in *Imaging and Applied Optics 2015*, OSA Technical Digest (online) (Optical Society of America, 2015), paper CM1E.1.
25. A. Barsic, K. Heiser, and R. Piestun, "Drift Correction in Super-resolution Localization Microscopy without Fiducial Markers," in *Imaging and Applied Optics 2015*, OSA Technical Digest (online) (Optical Society of America, 2015), paper JW3A.4.
26. A. Barsic and R. Piestun, "Dictionary Generation for Sparsity-based Three-Dimensional Super-resolution Microscopy," in *Optics in the Life Sciences*, OSA Technical Digest (online) (Optical Society of America, 2015), paper NM3C.3.
27. A. J. Barsic, G. Grover, and R. Piestun, "Compressive Three-Dimensional Localization Microscopy," in *Classical Optics 2014*, OSA Technical Digest (online) (Optical Society of America, 2014), paper CTu1C.3.
28. A. M. Caravaca-Aguirre, E. Niv, and R. Piestun, "High-Speed Phase Modulation for Multimode Fiber Endoscope," in *Imaging and Applied Optics 2014*, OSA Technical Digest (online) (Optical Society of America, 2014), paper ITh3C.1
29. A. M. Caravaca Aguirre, D. B. Conkey, J. D. Dove, H. Ju, T. W. Murray, and R. Piestun, "Three-dimensional photoacoustic imaging through scattering media," in *Biomedical Optics 2014*, OSA Technical Digest (online) (Optical Society of America, 2014), paper BS3A.53

30. R. Piestun, "Non-invasive Imaging Through a Scattering Wall," in Classical Optics 2014, OSA Technical Digest (online) (Optical Society of America, 2014), paper CW1C.1
31. A. M. Caravaca Aguirre and R. Piestun, "Robustness of multimode fiber focusing through wavefront shaping," in Latin America Optics and Photonics Conference, OSA Technical Digest (online) (Optical Society of America, 2014), paper LTh4A.23.
32. A. Barsic, R. Piestun, and G. Grover, "Three-dimensional super-resolution of dense single molecule scenes for localization microscopy," in *Frontiers in Optics 2013 Postdeadline*, I. Kang, D. Reitze, N. Alic, and D. Hagan, eds., OSA Postdeadline Paper Digest (online) (Optical Society of America, 2013), paper FW6A.8.
33. A. Barsic and R. Piestun, "Statistical Independence of Quantum Dot Blinking Signals for Imaging Beyond the Diffraction Limit," in *Imaging and Applied Optics*, OSA Technical Digest (online) (Optical Society of America, 2013), paper CTh3B.4.
34. D. Conkey and R. Piestun, "Multi-color image formation through highly scattering turbid media," in *Imaging and Applied Optics*, OSA Technical Digest (online) (Optical Society of America, 2013), paper CTh2B.3.
35. A. Caravaca Aguirre, E. Niv, D. Conkey, and R. Piestun, "Real time focusing through a perturbed multimode fiber," in *Imaging and Applied Optics*, OSA Technical Digest (online) (Optical Society of America, 2013), paper CTh2B.4.
36. I. Sigal, Y. Atchia, R. Gad, A. Caravaca, D. Conkey, R. Piestun, and O. Levi, "Laser Speckle Contrast Imaging with Extended Depth of Field for Brain Imaging Applications," in *CLEO: 2013*, OSA Technical Digest (online) (Optical Society of America, 2013), paper CTu2M.5.
37. M. Lew, M. Backlund, A. Backer, S. Sahl, G. Grover, A. Agrawal, R. Piestun, and W. Moerner, "Measuring the 3D Position and Orientation of Single Molecules Simultaneously and Accurately with the Double Helix Microscope," in *CLEO: 2013*, OSA Technical Digest (online) (Optical Society of America, 2013), paper CTu3N.3.
38. M. Backlund, M. Lew, A. Backer, S. Sahl, G. Grover, A. Agrawal, R. Piestun, and W. Moerner, "The Double-Helix Microscope Enables Precise and Accurate Measurement of 3D Single-Molecule Orientation and Localization Beyond the Diffraction Limit," in *Optics in the Life Sciences*, OSA Technical Digest (online) (Optical Society of America, 2013), paper NM2B.2.
39. D. Conkey, A. Caravaca-Aguirre, E. Niv, and R. Piestun, "High-Speed Optical Phase-Control for Focusing and Imaging through Dynamic Turbid Media," in *Optics in the Life Sciences*, OSA Technical Digest (online) (Optical Society of America, 2013), paper BW3A.1.
40. S. Quirin, G. Grover, R. Piestun, "Optimal 3D single-molecule super-resolution microscopy with engineered point spread functions", 9<sup>th</sup> IEEE International Symposium on Biomedical Imaging, ISBI 2012 2-5 May 2012, page 926 – 927, Barcelona, Spain
41. S. Quirin and R. Piestun, "Fundamental Limits of Wavefront Sensing using Microlens Arrays," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (online) (Optical Society of America, 2012), paper CTu1B.6.
42. R. Piestun, "Optimization of stochastic three dimensional fluorophore localization in optical microscopy," in *Frontiers in Optics Conference*, OSA Technical Digest (online) (Optical Society of America, 2012), paper FTu5E.1
43. Donald B. Conkey, Antonio M. Caravaca-Aguirre, and Rafael Piestun, "High-speed scattering medium characterization with application to focusing light through turbid media," *Opt. Express* **20**, 1733-1740 (2012)

44. R. Piestun, "Overcoming the Classical Limits Imposed by Diffraction and Multiple-scattering via Computational Optical Imaging," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (online) (Optical Society of America, 2012), paper JW1A.1.
45. G. Grover, K. DeLuca, S. Quirin, J. DeLuca, and R. Piestun, "3D Super-resolution Imaging of Microtubules with a Double Helix Point Spread Function Microscope," in *Biomedical Optics*, OSA Technical Digest (Optical Society of America, 2012), paper BM4B.3.
46. A. J. Barsic and R. Piestun, "Superresolution of Dense Quantum Dot Clusters using Independent Component Classification," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (online) (Optical Society of America, 2012), paper CW2C.1.
47. D. B. Conkey, A. M. Caravaca-Aguirre, and R. Piestun, "High-speed focusing of light through dynamic turbid media," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (online) (Optical Society of America, 2012), paper CTu4B.6.
48. G. Grover, K. DeLuca, S. Quirin, J. DeLuca, and R. Piestun, "Design of Double-helix Point Spread Functions for 3D Super-resolution Imaging," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (online) (Optical Society of America, 2012), paper CM3B.2.
49. Sreya Ghosh, Sean A. Quirin, Ginni Grover, Rafael Piestun, Chrysanthé Preza, "Double helix PSF engineering for computational fluorescence microscopy imaging", SPIE BIOS 2012
50. A. Agrawal, S. Quirin, G. Grover, and R. Piestun, "Limits of 3D Dipole Localization and Orientation Estimation with Application to Single-Molecule Imaging," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (CD) (Optical Society of America, 2011), paper CWA4
51. R. Piestun, "3D Far-field Optical Nanoscopy and Aperiodic Volume Optics," in *Applied Industrial Optics: Spectroscopy, Imaging and Metrology*, OSA Technical Digest (CD) (Optical Society of America, 2011), paper JWC3.
52. S. Quirin, G. Grover, and R. Piestun, "Phase mask fabrication for pupil encoding in computational optical imaging," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (CD) (Optical Society of America, 2011), paper CTuB2
53. D. B. Conkey, A. Caravaca, and R. Piestun, "Backscattering Scanning Fluorescence Microscopy," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (CD) (Optical Society of America, 2011), paper CTuA2
54. Ginni Grover, Sean Quirin, and Rafael Piestun, "Double-Helix 3D Photo-Activation Localization Microscopy with a Phase Mask for Efficient Photon Collection", in *Conference on Lasers and Electro-Optics*, OSA Technical Digest (CD) (Optical Society of America, 2011)
55. R. Piestun, "PLENARY: What Can Digital Processing Do for 3-D Super-Resolution Microscopy?," in *Digital Image Processing and Analysis*, OSA Technical Digest (CD) (Optical Society of America, 2010), paper DTuA1 - INVITED
56. S. R. P. Pavani, J. G. DeLuca, and R. Piestun, "Polarization Sensitive Three-Dimensional Nanoscopy with a Double-Helix Microscope," in *Biomedical Optics*, OSA Technical Digest (CD) (Optical Society of America, 2010), paper BMD2.
57. G. Sharma, S. R. P. Pavani, S. Quirin, and R. Piestun, "Double-Helix Microscopy for Wide-Field 3-D Single-Molecule Fluorescence Imaging," in *Conference on Lasers and Electro-Optics*, OSA Technical Digest (CD) (Optical Society of America, 2010), paper CThCC2.

58. T. D. Gerke and R. Piestun, "Volume Diffractive Optics," in *Digital Holography and Three-Dimensional Imaging*, OSA Technical Digest (CD) (Optical Society of America, 2010), paper DTuB1.
59. S. Quirin, S. R. P. Pavani, and R. Piestun, "Pattern Matching Estimator for Precise 3-D Particle Localization with Engineered Point Spread Functions," in *Digital Holography and Three-Dimensional Imaging*, OSA Technical Digest (CD) (Optical Society of America, 2010), paper DMC8.
60. S. Quirin and R. Piestun, "3-D Imaging Using Helical Point Spread Functions," in *Imaging Systems*, OSA technical Digest (CD) (Optical Society of America, 2010), paper IWC1.-INVITED
61. W. E. Moerner, M. Thompson, M. Lew, M. Badieirostami, S. J. Lord, N. R. Conley, H. D. Lee, S. R. P. Pavani, and R. Piestun, "Three-Dimensional Superresolution Using Single-Molecule Photoswitches and a Double-Helix PSF," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (CD) (Optical Society of America, 2009), paper CTuD1 – INVITED
62. A. Agrawal, W. Park, and R. Piestun, "Negative Permeability Using Arrays of Aperiodic Silver Nanoclusters," in *Conference on Lasers and Electro-Optics/International Quantum Electronics Conference*, OSA Technical Digest (CD) (Optical Society of America, 2009), paper JThE109.
63. G. Sharma, S. R. P. Pavani, and R. Piestun, "Optimization of Double-Helix Point Spread Function for Photon-Limited 3-D Imaging Systems," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (CD) (Optical Society of America, 2009), paper CTuD2.
64. S. R. P. Pavani and R. Piestun, "3-D Superlocalization with Double-Helix Microscopes," in *Frontiers in Optics*, OSA Technical Digest (CD) (Optical Society of America, 2009), paper FMK5.
65. R. Piestun, "Three-Dimensional Imaging by Three-Dimensional Point Spread Function Encoding," in *Digital Holography and Three-Dimensional Imaging* (also appears in *Optical Trapping Applications*), OSA Technical Digest (CD) (Optical Society of America, 2009), paper JMB2 - INVITED
66. T. D. Gerke and R. Piestun, "Multifunctional Volume Optics Generated by Direct Femtosecond Laser Writing," in *Femtosecond Laser Microfabrication*, OSA Technical Digest (CD) (Optical Society of America, 2009), paper LMTuB3 - INVITED
67. S. Quirin, S. R. P. Pavani, and R. Piestun, "Broadband Three-Dimensional Imaging Using a Double-Helix Point Spread Function," in *Computational Optical Sensing and Imaging*, OSA Technical Digest (CD) (Optical Society of America, 2009), paper CTuD3.
68. M. A. Thompson, S. R. Pavani, J. S. Biteen, R. Piestun, and W. E. Moerner, "Three-Dimensional Super-Resolution Single-Molecule Fluorescence Imaging Using a Double-Helix Point Spread Function," in *Conference on Lasers and Electro-Optics/International Quantum Electronics Conference*, OSA Technical Digest (CD) (Optical Society of America, 2009), paper IMG3.
69. S. R. P. Pavani, R. Piestun, M. A. Thompson, J. S. Biteen, and W. E. Moerner, "Three-Dimensional Super-Resolution Imaging with a Double-Helix Microscope," in *Novel Techniques in Microscopy*, OSA Technical Digest (CD) (Optical Society of America, 2009), paper NMA5.

70. T. D. Gerke and R. Piestun, "Femtosecond Laser Micromachining for Volume Optics Fabrication," in Conference on Lasers and Electro-Optics/International Quantum Electronics Conference, OSA Technical Digest (CD) (Optical Society of America, 2009), paper CFI2.
71. S. R. P. Pavani and R. Piestun, "3-D Fluorescent Particle Tracking with Nanometer Scale Accuracies Using a Double-Helix Point Spread Function," in Conference on Lasers and Electro-Optics/International Quantum Electronics Conference, OSA Technical Digest (CD) (Optical Society of America, 2009), paper CTuAA7.
72. Sri Rama Prasanna Pavani, Rafael Piestun, "3D microscopy with double-helix point spread functions," Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XVI, Jose-Angel Conchello; Carol J. Cogswell; Tony Wilson, Editors, SPIE Proceedings Vol. 7184 - INVITED.
73. S. R. P. Pavani and R. Piestun, "3-D Localization of Fluorescent Microparticles Using a Rotating Point Spread Function," in Frontiers in Optics, OSA Technical Digest (CD) (Optical Society of America, 2008), paper FWT3.
74. S. R. P. Pavani and R. Piestun, "Passive 3-D Imaging with Quasi-Rotating PSFs," in Digital Holography and Three-Dimensional Imaging, OSA Technical Digest (CD) (Optical Society of America, 2008), paper DMA2.
75. R. Piestun and M. de Sterke, "Fundamental Limits for 2-D Optical Components," in Frontiers in Optics, OSA Technical Digest (CD) (Optical Society of America, 2008), paper FThW3.
76. T. D. Gerke and R. Piestun, " Diffraction Efficiency of Computer-Generated Volume Holograms Directly Written with a Femtosecond Laser," in *Adaptive Optics: Analysis and Methods/Computational Optical Sensing and Imaging/Information Photonics/Signal Recovery and Synthesis Topical Meetings on CD-ROM*, OSA Technical Digest (CD) (Optical Society of America, 2007), paper DWB2.
77. S. R. P. Pavani and R. Piestun, " Efficient Diffractive Optical Elements for Depth from Diffracted Rotation Systems," in *Adaptive Optics: Analysis and Methods/Computational Optical Sensing and Imaging/Information Photonics/Signal Recovery and Synthesis Topical Meetings on CD-ROM*, OSA Technical Digest (CD) (Optical Society of America, 2007), paper CMD6.
78. B. Ilan, M. J. Ablowitz, E. Schonbrun, and R. Piestun, " Multidimensional Solitons in Irregular-Lattice Media," in *Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides*, OSA Technical Digest (CD) (Optical Society of America, 2007), paper JME1.
79. B. Ilan, M. J. Ablowitz, E. Schonbrun, and R. Piestun, " Multidimensional Solitons in Irregular-Lattice Media," in *Nonlinear Photonics*, OSA Technical Digest (CD) (Optical Society of America, 2007), paper JME1.
80. S. R. P. Pavani and R. Piestun, " Efficient Rotating Point Spread Functions for 3D Imaging," in *Frontiers in Optics*, OSA Technical Digest (CD) (Optical Society of America, 2007), paper FMH2.
81. N. Lemke, T. D. Gerke, A. R. Libertun, and R. Piestun, " Characterization of Femtosecond Laser Induced Nanogratings in Fused Silica," in *Frontiers in Optics*, OSA Technical Digest (CD) (Optical Society of America, 2007), paper FThM4.
82. E. Schonbrun and R. Piestun, "Optical lattice manipulation by nested vortices", Proceedings of SPIE Vol. 5508, p. 32-40, Complex Mediums V: Light and Complexity; Martin W. McCall, Graeme Dewar; Eds. (2004)

83. B. T. Schwartz and R. Piestun, "Waveguiding light in air with ultralow index metamaterials", *Proceedings of SPIE Vol. 5515*, p. 180-186, Nanoengineering: Fabrication, Properties, Optics, and Devices; Elizabeth A. Dobisz, Louay A. Eldada; Eds. (2004)
84. A. Greengard, Y. Y. Schechner, R. Piestun, "Depth from rotating point spread functions", *Proceedings of SPIE Vol. 5557*, p. 91-97, Optical Information Systems II; Bahram Javidi, Demetri Psaltis; Eds. (2004)
85. B. T. Schwartz and R. Piestun, "Metamaterials with ultralow index of refraction: properties and applications", *Proceedings of SPIE Vol. 5218*, Complex Mediums IV: Beyond Linear Isotropic Dielectrics (2003)
86. A. W. Lohmann, A. Pe'er, D. Wang, R. Piestun, and A. A. Friesem, "Optics in flatland", *Proceedings of SPIE Vol. 4829*, pp. 6-7, Optics for the Quality of Life, Giancarlo C. Righini, Anna Consortini, Editors (2003)
87. B. T. Schwartz and R. Piestun, "Total external reflection at optical wavelengths", in *OSA Trends in Optics and Photonics (TOPS) Vol 75, Diffractive Optics and Micro-optics*, pp.175-177 (2002)
88. B. T. Schwartz and R. Piestun, "Optical properties of artificial dielectrics with refractive index less than unity", in *OSA Trends in Optics and Photonics (TOPS) Vol 77, Integrated Photonics Research* (2002)
89. R. Piestun, "Novel approaches to multidimensional light field synthesis", *Proceedings of SPIE Vol. 4435*, Wave Optics and Photonic Devices for Optical Information Processing I, (2001)
90. R. Piestun and D. A. B. Miller, "Electromagnetic degrees of freedom in diffractive optics", *European Optical Society Topical Meeting on Diffractive Optics, EOS Topical Meetings Digest Series vol. 22*, pp. 4 (1999)
91. J. Shamir, R. Piestun, and Y. Y. Schechner, "Propagation invariance and 3D light fields", *Technical Digest of the 18<sup>th</sup> Congress of the International Commission for Optics, Optics for the New Millennium*, *Proceedings SPIE Vol. 3749*, pp.110-111 (1999) –INVITED
92. R. Piestun and D. A. B. Miller, "Degrees of freedom of an electromagnetic wave", *Technical Digest of the 18<sup>th</sup> Congress of the International Commission for Optics, Optics for the New Millennium*, *SPIE Vol. 3749*, pp. 108-109 (1999)
93. J. Shamir, R. Piestun and B. Spektor, "3D light structuring and some applications," *Optics and Optoelectronics: Theory, Devices and Applications*, O.P. Nijhawan, A.K. Gupta, A.K. Musla and K. Singh, Eds., Narosa Publishing House, New Delhi, pp. 238-244 (1998) INVITED
94. M. Friedmann, R. Piestun, J. Shamir, "3D light structures applied for surface analysis", *Proceedings of the 2nd International Austrian-Israeli Symposium, Laser Technology and Space Technology*, pp. 43 (1997)
95. B. Wesskamp, O. Bryngdahl, R. Piestun, J. Shamir, "Computer-based generation of on-axis near-field holograms for 3-D display", *European Optical Society Topical Meeting on Diffractive Optics (Finland), EOS Topical Meetings Digest Series vol. 12*, pp. 98 (1997)
96. R. Piestun, B. Spektor, J. Shamir, "Diffractive Optics for the generation of light structures with extended focal depth", *European Optical Society Topical Meeting on Diffractive Optics (Finland), EOS Topical Meetings Digest Series vol. 12*, pp. 46 (1997)
97. R. Piestun, Y. Y. Schechner, J. Shamir, "Generalized Self-Imaging in Free Space", *European Optical Society Topical Meeting on Diffractive Optics (Finland), EOS Topical Meetings Digest Series vol. 12*, pp. 128 (1997)

98. R. Piestun, M. Friedmann, B. Spektor, J. Shamir, "Diffractive Elements for Surface Investigation with Light Structures", European Optical Society Topical Meeting on Diffractive Optics (Finland), EOS Topical Meetings Digest Series vol. 12, pp. 82 (1997)
99. Friedmann, R. Piestun, E. Paquet, J. Shamir, "Surface analysis using multiple coherent beams", The 19th Convention of the IEEE in Israel, IEEE Proceedings, 537-540 (1996)
100. R. Piestun, B. Spektor and J. Shamir, "Diffractive Optics for Unconventional Light Distributions", Proc. SPIE Vol. 2404: Photonics West, Optoelectronic and Micro-Optical Devices, San Jose, paper 54 (1995)
101. R. Piestun, B. Spektor, J. Shamir, "Three-dimensional distribution of light generated by a diffractive element", Proceedings of the Conference on Optical Computing OC'94, Edinburgh, Scotland (1994).
102. A. Luna and R. Piestun, "Sistema Adquisidor de Datos Ambientales Para Aplicaciones Agrometeorologicas", Proceedings of the IEEE Conf. INGELECTRA 90, Valdivia, Chile (1990).

## PATENTS

1. United States Patent **Issued** 2010 (**US 7,705,970 B2**), “Method and System for Passive Optical Imaging and Ranging”, R. Piestun, A. Greengard, C. Cogswell, and Y. Y. Schechner
2. United States Patent **Issued** 2013 (**US 8,620,065 B2**), “Methods and Systems for Three Dimensional Optical Imaging, Sensing, Particle Localization and Manipulation”, R. Piestun, S. Quirin
3. United States Patent **Issued** 2014 (**US 20100278400 A1**), “Three-dimensional single-molecule fluorescence imaging beyond the diffraction limit using a double-helix point spread function”, S.R.P. Pavani, Thompson, J. Biteen, W.E. Moerner, R. Piestun
4. U.S. Patent **Issued** 2018 (**US 9,881,355**), “Three-dimensional single-molecule fluorescence imaging beyond the diffraction limit using a double-helix point spread function”, S.R.P. Pavani, Thompson, J. Biteen, W.E. Moerner, R. Piestun
5. U.S. Patent **Issued** 2017 (**US 9,560,338**), “Methods and Systems for Three-Dimensional Optical Imaging, Sensing, Particle Localization and Manipulation,” Rafael Piestun, Sean Albert Quirin
6. U.S. patent **Issued** 2017 (**US 9,538,157**), “Methods and Systems for Three-Dimensional Optical Imaging, Sensing, Particle Localization and Manipulation,” Rafael Piestun, Sean Albert Quirin
7. United States patent **Issued** 2019 (**US 10,215,975**), “Method and/or system for stabilization, tracking, and/or control of microscopic systems,” Rafael Piestun, Wyatt Mohrman, Ginni Grover
8. U.S. Patent **Issued** 2020 (**US10657346B2**), “3-D Localization and Imaging of Dense Arrays of Particles”, R. Piestun, A. Barsic
9. European patent **Issued** 2019 (2973403), “3-D Localization and Imaging of Dense Arrays of Particles,” Rafael Piestun, Anthony Barsic. Serial No.: 14764021.3 Int’l Filed: March 14, 2014
10. U.K. Patent **Issued** (2973403), “3-D Localization and Imaging of Dense Arrays of Particles,” Rafael Piestun, Anthony Barsic
11. German Patent **Issued** (2973403), “3-D Localization and Imaging of Dense Arrays of Particles,” Rafael Piestun, Anthony Barsic
12. United States Patent **Issued** 2019 (**US10254534B2**); “Single Multimode Fiber Endoscope,” Antonio Miguel Caravaca-Aguirre, Rafael Piestun
13. U.S Patent **Issued** 2016 (**US9509956B2**), "High-Speed Wavefront Optimization", R. Piestun, D. Conkey
14. U.K. Patent **Issued** 2015 (2518548), “Imaging or Measurement Methods and Systems,” Rafael Piestun, Ginni Grover
15. European Patent **Issued** 2020 (**EP 2 864 468 B1**), “Method and system for estimating a position and an angular orientation of a particle,” Piestun, Rafael; Agrawal, Anurag; Quirin, Sean; Barsic, Anthony; Grover, Ginni
16. PCT/ US2013 / 047379: “Method and System to Generate Helical Beams and Helical Point Spread Functions”, R. Piestun, S. Quirin
17. U.S. Patent **Issued** 2018 (**US9967541B2**), “3D Imaging, Ranging and/or Tracking Using Active Illumination and PSF Engineering”, R. Piestun
18. U.S. Application, Serial No.: 15/973,750 Filed: May 8, 2018, “3D Imaging, Ranging, and/or Tracking Using Active Illumination and Point Spread Function Engineering,” Rafael Piestun

19. U.S. Patent **Issued** 2018 (US 10036735B2), “Imaging Through Scattering Media with High Signal to Noise Ratio and Resolution,” Rafael Piestun, Hengyi Ju, Jacob Dove, Antonio Miguel Caravaca-Aguirre, Todd Murray, Donald Conkey
20. PCT/US2014/052756: “Imaging Through Scattering Media with High Signal to Noise Ratio and Resolution,” Ju, Dove, Caravaca-Aguirre, Murray, Conkey and Piestun
21. U.S. Application **Issued** (2019) (US10514586B2), “Methods and Systems for Control of Nonlinear Light Transmission,” Omer Tzang, Rafael Piestun, Antonio Miguel Caravaca-Aguirre, Kelvin Wagner
22. U.S. Patent Application No. 62/676,675. Title: Methods and Systems for Scanning Probe Sample Property Measurement and Imaging. Filed: May 25, 2018
23. U.S. Patent Application (16/431,412), “3D Diffractive Optics,” Haiyan Wang, Rafael Piestun (2019)
24. U.S. Patent Application (16/780,987), “3d target for optical system characterization,” Anurag Agrawal, Leslie Kimerling, Rafael Piestun, Scott Gaumer, Warren Colomb (2020)
25. U.S. Provisional Patent Application, “Systems and Methods to Probe Ocular Structures,” Rafael Piestun, Kristina Irsch
26. U.S. Provisional Patent Application, “Imaging Of The Ocular Fundus With Speckle Illumination,” Rafael Piestun, Kristina Irsch, Simon Labouesse, Sylvain Gigan
27. Patent Application No. PCT/US2019/048173, “Wavefront Shaping with a 1D Spatial Light Modulator,” R. Piestun, O. Tzang, E. Niv

## **MISCELLANEOUS**

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