

# NICOLAS C. PÉGARD, PH.D.

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## EDUCATION

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**Ph.D. in Electrical Engineering** *Princeton University, Princeton, NJ, 2009-2014*  
Thesis: Computational methods for microfluidic microscopy and phase-space imaging. (08/05/2014)  
Majors: solid state physics, nonlinear optics.  
Advisor: Prof. Jason W. Fleischer, Imaging Physics Lab.

**M.S. in Engineering and B.S. in Physics** *École Polytechnique, Palaiseau, France, 2006-2010*  
M.S. Eng Majors: opto-electronics, spintronics, material sciences  
B.S. Majors: applied mathematics, quantum physics

**Classes Préparatoires** *CPGE Louis-le-Grand, Paris, France, 2003-2006*  
Intensive preparatory science program preceding the competitive entrance into the Grandes Écoles

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## RESEARCH AND PROFESSIONAL EXPERIENCE

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**Postdoctoral Scholar** *University of California, Berkeley, 2014-Present*  
Departments of Molecular & Cell Biology, and Electrical Engineering & Computer Science.  
Advisors : Prof. Hillel Adesnik (MCB), Prof. Laura Waller (EECS)  
Instrumentation and computational methods for 3D *in vivo* holographic optogenetic photostimulation and optical tracking of neural activity. Current projects : portable instrumentation for optogenetic photostimulation, supported by the Defense Advanced Research Projects Agency (DARPA).

**Doctoral Research** *Princeton University, 2010-2014*  
Department of Electrical Engineering.  
Advisor : Prof. Jason W. Fleischer, Imaging Physics lab.  
Microfluidic microscopy & optofluidics for 3D cell tomography and phase imaging.  
Optimization of optical surface patterning to improve photon trapping for organic photovoltaic cells.

**Research intern** *Julius-Maximilian University, Würzburg, Germany, Apr-Aug 2009*  
Department of Applied Physics (EP3). Advisor : Prof. Charles Gould.  
Anisotropic thermopower characterization in diluted (Ga,Mn)As magnetic semiconductors.

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## FUNDING AND AWARDS

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Outstanding postdoc research award, MCB Department *University of California, Berkeley, 2017*  
Harold W. Dodds honorific competitive fellowship (dissertation funding) *Princeton University, 2013*  
Best research talk, 1<sup>st</sup> place *Princeton University Research Symposium, 2013*  
Outstanding Teaching Assistant award, Engineering Department *Princeton University, 2010*  
Gordon Y.S. Wu fellowship for engineering (doctoral funding) *Princeton University, 2009*  
University award for outstanding leadership and commitment to the student body *École Polytechnique, 2009*  
Carnot fellowship (funding for students pursuing Ph.D. programs abroad) *Carnot Foundation, 2008*

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## OUTREACH AND SERVICE IN RESEARCH AND EDUCATION

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Conference chair and organizer. *Sculpted Light in the Brain (www.slb2017.com)* 2017  
Raised \$20k to fund travel for 11 invited speakers. One-day conference, 35 posters, 250 attendees.  
Session chair. *Multidimensional Microscopy conference (SPIE Photonics West)* 2017

Session chair. <i>Advanced Imaging Methods (AIM) Workshop, University of California Berkeley</i>	2016 - 2017
Technical group leader. <i>Optical Biosensors Technical Group (Optical Society of America)</i>	2017 - 2020
Reviewer. <i>Nature Communications, Scientific reports, MIT Press</i>	2017 - Present
Reviewer. <i>Applied Optics, JOSAA, Biomedical Optics Express, Optica, Optics letters</i>	2012 - Present
Scientific reviewer for grant applications. <i>OSA Special Program Grants National Natural Science Foundation of China, Hong Kong Research Grant Council</i>	2016 - 2017
Volunteer scientist. <i>Bay Area Scientists In Schools (BASIS)</i>	2014

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JOURNAL PUBLICATIONS

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3D Scanless Holographic Optogenetics with Temporal Focusing <i>*N. Pégard, *A. Mardinly, I. Oldenburg, S. Sridharan, L. Waller, and H. Adesnik (*Equal contributors)</i>	2017 Nature Communications, <b>8</b> , 1228
3D Computer Generated Holography by Nonconvex Optimization <i>*J.Zhang, *N. Pégard, J.Zhong, and L.Waller (*Equal contributors)</i>	2017 Optica, <b>4</b> , 1306-1313
Compressive light-field microscopy for 3D neural activity recording <sup>†</sup> <i>N. Pégard, H-Y. Liu, N. Antipa, M. Gerlock, H. Adesnik, and L. Waller</i>	2016 Optica, <b>3</b> , 517-524
<sup>†</sup> Featured research in Optics & Photonics News special issue : “Optics in 2016”	
Flow-scanning optical tomography <sup>†</sup> <i>N. Pégard, M.Toth, M.Driscoll, and J. W. Fleischer</i>	2014 Lab-on-a-Chip, <b>14</b> , 4447-4450
<sup>†</sup> Classified as “Hot article” due to receiving particularly high scores at peer review.	
Flow-based Structured Illumination <i>C-H. Lu, N. Pégard, and J. W. Fleischer</i>	2013 Applied Physics Letters, <b>102</b> , 161115
3D Deconvolution Microfluidic Microscopy using a Tilted Channel <i>N. Pégard, and J. W. Fleischer</i>	2013 Journal of Biomedical Optics, <b>18</b> , 040503
Wrinkles and deep folds as photonic structures in photovoltaics <i>*J-B. Kim, *P. Kim, *N. Pégard(* Equal contributors) S. Oh, C. Kagan, J. W. Fleischer, H. Stone, and Y-L. Loo</i>	2012 Nature Photonics, <b>6</b> , 327-332
Optimizing holographic data storage using a Fractional Fourier Transform <i>N. Pégard, and J. W. Fleischer</i>	2011 Optics Letters, <b>36</b> , 2551-2553
Diffusion thermopower of (Ga,Mn)As/GaAs tunnel junctions <i>Ts. Naydenova, P. Durrenfeld, K. Tavakoli, N. Pégard, L. Ebel K. Pappert, K. Brunner, C. Gould, and L. Molenkamp</i>	2011 Physical Review Letters, <b>107</b> , 197-201

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MANUSCRIPTS UNDER CONSIDERATION

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Bi-directionally editing neuronal population codes with millisecond precision and single-cell resolution <i>*A.Mardinly, *I. Oldenburg, *N. Pégard, S. Sridharan, E. Lyall, K. Chesnov, S. Brohawn, L. Waller and H. Adesnik (*Equal contributors)</i>	Manuscript in review
All-optical contrast enhancement by phase-conjugate multiple transmission <i>N. Pégard, and J. W. Fleischer</i>	Manuscript in preparation

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BOOK CHAPTER

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Flow-scanning microfluidic imaging <i>N. Pégard, C-H. Lu, M. Toth, M. Driscoll and J. W. Fleischer</i>	2016 Applications of Microfluidics InTech, ISBN 978-953-51-4623-0
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- UC Berkeley Sculpted Light in the Brain 2017 debates future technologies to communicate with the brain 2017  
*A. Shanker, N. Pégard, R. Eckert, and L. Waller* Neurophotonics special guest editorial, **4**, 4-5
- Holographic Temporal Focusing for 3D Photo-activation With Single Neuron Resolution 2017  
*N. Pégard, A. Mardinly, J. Zhang, S. Sridharan, L. Waller, and H. Adesnik* Optics in the brain, BrM3B4, San Diego, CA
- 3D all-optical control of functionally defined neurons with cellular resolution and sub-ms precision 2017  
*A. Mardinly, N. Pégard, I. Oldenburg, S. Sridharan, R. Hakim* Optics in the brain, BrM3B4, San Diego, CA  
*L. Waller, and H. Adesnik*
- Functional brain imaging at cellular resolution with Compressive Light-Field Microscopy 2015  
*N. Pégard, H-Y. Liu, N. Antipa* Computational Optical Sensing & Imaging (COSI), JTh4A.3, Arlington, VA  
*L. Waller, and H. Adesnik*
- High-speed 3D brain activity quantification with Compressive Light-Field Microscopy 2015  
*N. Pégard, E. Lyall, A. Mardinly, N. Antipa* Bio-Optics: Design and Application (BODA), NW2C.3  
*L. Waller, and H. Adesnik*
- Microfluidic Flow-Scanning Optical Tomography 2013  
*N. Pégard, and J. W. Fleischer* Frontiers in Optics (FIO), Orlando, FL
- Tomographic Microfluidic Microscopy 2013  
*J. W. Fleischer and N. Pégard* 2<sup>nd</sup> EOS Conference on Optofluidics, (EOSOF), Munich, Germany
- 3D Microfluidic Microscopy 2013  
*J. W. Fleischer, and N. Pégard* Optics in the Life Sciences, BW5A.1., Waikoloa Beach, Hawaii
- 3D deconvolution microscopy using a microfluidic tilted channel 2012  
*N. Pégard, and J. W. Fleischer* Computational Optical Sensing & Imaging (COSI), CM3B.6., Monterey, CA
- Microfluidic Structured Illumination Microscope 2012  
*C. Lu, N. Pégard, and J. W. Fleischer* Imaging and Applied Optics, (COSI), CM3B.7., Monterey, CA
- 3D microscopy using a tilted microfluidic channel 2012  
*N. Pégard, and J. W. Fleischer* Frontiers in Optics 2012, XXVIII, Rochester, NY
- Microfluidic Structured Illumination Microscopy 2012  
*C-H. Lu, N. Pégard, and J. W. Fleischer* Frontiers in Optics 2012, XXVIII, Rochester, NY
- Wrinkles and Folds as Photonic Structures in Polymer Photovoltaics 2012  
*Y-L. Loo, J-B. Kim, P. Kim, H. Stone, N. Pégard* American Physical Society, APS March Meeting, L46.002  
*J. W. Fleischer, S-J. Oh, and C. Kagan*
- 3D microfluidic microscopy using a tilted channel 2012  
*N. Pégard, and J. W. Fleischer* Biomedical Optics and 3-D Imaging congress, BM4B.4., Miami, FL
- Optimizing holographic storage by redistribution of the space-frequency domain using a Fractional Fourier Transform 2012  
*N. Pégard, and J. W. Fleischer* International OSA Network of Students, IONS-11, Paris
- Fractional Optics for Image Processing and Measurement 2011  
*G. Situ, L. Waller, N. Pégard, and J. W. Fleischer* OSA Digital Holography and Three-Dimensional Imaging conference, DWE2, Tokyo, Japan
- Contrast Enhancement by Double Pass Phase Conjugation Microscopy 2010  
*N. Pégard, and J. W. Fleischer* Frontiers in Optics, (FIO), post-deadline paper, PDP10

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INVITED TALKS AND SEMINARS

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New instrumentation and computational methods for 3D optogenetic photo-stimulation <i>Invited speaker</i>	Dec. 18 <sup>th</sup> 2017 T.U. Delft, Netherlands
3D Scanless Holographic Optogenetics with Temporal focusing <i>Hellen Wills Neuroscience Institute</i>	Feb. 6 <sup>th</sup> 2017 University of California, Berkeley
Photoactivation of individual neurons with sparse holographic temporal focusing <i>14th Annual Advanced Imaging Methods (AIM) Workshop</i>	Jan. 26 <sup>th</sup> 2017 University of California, Berkeley
3D functional imaging of the living brain <i>Guest speaker</i>	May 19 <sup>th</sup> 2016 Inscopix, Palo Alto, CA
Compressive light field microscopy for 3D functional imaging of the living brain <i>Stanford Center for Image Systems Engineering (SCIEN) colloquia</i>	Apr. 6 <sup>th</sup> 2016 Stanford University
Compressive light field microscopy for 3D functional brain imaging <i>QB3 - California Institute for Quantitative Biosciences</i>	Feb. 12 <sup>th</sup> 2016 University of California, Berkeley
Compressive light field microscopy for 3D functional brain imaging <i>Redwood center seminar, Helen Wills Neuroscience Institute</i>	Feb. 5 <sup>th</sup> 2016 University of California, Berkeley
System optics optimization and application for in-vivo 3D microscopy <i>Mechanical Engineering Department Seminars</i>	Jan. 20 <sup>th</sup> 2014 Technion, Israel Institute of Technology, Haifa, Israel
Tomographic Microfluidic Microscopy <i>8<sup>th</sup> Princeton Innovation Forum</i>	Mar. 12 <sup>th</sup> 2013 Princeton University
Microfluidic devices for 3D microscopy, superresolution, and applications in biology <i>Princeton Research Symposium* (*Best Research Talk, 1st place)</i>	Oct. 20 <sup>th</sup> 2013 Princeton University
3D microfluidic microscopy <i>Research seminar, Department of Molecular Biology and Biochemistry</i>	Oct. 10 <sup>th</sup> 2012 Rutgers University

PATENTS

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3D Sparse Holographic Temporal focusing <i>L. Waller, N. Pégard, and H. Adesnik</i>	2016 Patent Application #62-429,017
Compressive plenoptic microscopy <i>L. Waller, N. Pégard, and H. Adesnik</i>	2015 Provisional Patent Application #62-188,626
Photoelectric cells incorporating wrinkles and folds to enhance efficiency and bendability <i>J.-B. Kim, P. Kim, H. Stone, N. Pégard, J. W. Fleischer, Y.-L. Loo</i>	2014 Patent Application #14-214,564 Provisional Patent Application #61-635,540
Tilted Channels for Computational Imaging in Optofluidic Microscopes <i>J. W. Fleischer and N. Pégard</i>	2013 Patent Application #14-023,455
Flow Scanning Tomography <i>J. W. Fleischer and N. Pégard</i>	2013 Provisional Patent Application #61-776,970
Rotating flow for 3D optofluidic tomography & Structured illumination optofluidic microscope <i>J. W. Fleischer and N. Pégard</i>	2011 Provisional Patent Application #61-699,003 & #61-609,991

TEACHING EXPERIENCE

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Invited lecturer, University of California, Berkeley <i>Recording neural activity in 3D with compressive light field microscopy, Neurotech/BMI class, (EE290P)</i>	2017
Guest lecturer, University of California, Berkeley <i>Introduction to Optical Engineering, Fresnel Diffraction (EE 218A)</i>	2014 - Present 2017
<i>Introduction to Optical Engineering, Lasers (EE 118)</i>	2016

Private tutor, Lessons in physics and mathematics	2013 - Present
Teaching assistant, Princeton University	2010 - 2013
<i>Algorithms and Data Structures</i> (COS 226)	2013
<i>Logic Design &amp; VLSI</i> (ELE 206), <i>Introduction to Engineering</i> (EGR 191)	2012
<i>Optoelectronics</i> (ELE 453)	2010
Undergraduate Research mentor, Princeton University	2011 - 2013
<i>MIRTHE's summer program</i> undergraduate level research internships.	

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OTHER WORK EXPERIENCE

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Optofluidic engineering research consultant, Nodexus Inc. Berkeley, CA	2016
Apprenticeship in carpentry, Far Eastern Federal University, Vladivostok, Russia	2008
Junior navigation officer, Midshipman rank, (M649 Persée) French navy, Brest Arsenal	2006
Assistant teacher in music theory, Amiens, France	2005

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SKILLS AND ACTIVITIES

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Languages: French (native speaker), English (fluent), German (fluent), Russian (conversational)

Programming languages: Matlab, Caml, Java, Labview, C, Python, PHP, HTML, L<sup>A</sup>T<sub>E</sub>X

Special Licenses: US private pilot license (Single engine, VFR, land), French offshore boating license

Music: Trumpet player for Princeton wind ensemble and marching band, Conductor and founding member of école Polytechnique Big Band

Other Hobbies: Amateur Rugby player at École Polytechnique, Woodworking, Blues dancing

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REFERENCES

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<b>Prof. Hillel Adesnik</b> Postdoctoral co-advisor Molecular & Cell Biology dpt. 205, Life Science Addition. University of California, Berkeley Berkeley, CA 94720 510-642-2107 hadesnik@berkeley.edu	<b>Prof. Laura Waller</b> Postdoctoral co-advisor Electrical Engineering & C.S. dpt. 514, Cory Hall. University of California, Berkeley Berkeley, CA 94720 510-642-2753 waller@berkeley.edu	<b>Prof. Jason W. Fleischer</b> Ph.D. advisor Electrical Engineering dpt. 318, 87 Prospect ave. Princeton University. Princeton, NJ 08544 609-258-8963 jasonf@princeton.edu
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SUPPLEMENTARY REFERENCES

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<b>Prof. Ehud Isacoff</b> DARPA collaboration (2017) Molecular & Cell Biology dpt. University of California, Berkeley Berkeley, CA 94720 ehud@berkeley.edu	<b>Prof. Ren Ng</b> DARPA collaboration (2017) Electrical Engineering dpt. University of California, Berkeley Berkeley, CA 94720 ren@eecs.berkeley.edu	<b>Prof. Bruno Olshausen</b> DARPA collaboration (2017) H. Wills Neuroscience Institute University of California, Berkeley Berkeley, CA 94720 baolshausen@berkeley.edu
<b>Prof. Howard Stone</b> Research collaboration (2012) Mech. & Aero. Eng. dpt. Princeton University Princeton, NJ 08544 hastone@princeton.edu	<b>Prof. Lynn Loo</b> Research collaboration (2011) Chem. and Bio. Eng. dpt. Princeton University Princeton, NJ 08544 lloo@princeton.edu	<b>Prof. Monica Driscoll</b> Research collaboration (2013) Molecular Biology dpt. Rutgers University Piscataway, NJ 08854 driscoll@dls.rutgers.edu