

# DR. PETAR N. PETROV

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## EDUCATION

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2014-2020 **Stanford University**

PhD in Physical Chemistry

Thesis: *Improving the Precision and Accuracy of Three-Dimensional Single-Molecule Localization Microscopy*

Advisor: Prof. W. E. Moerner

2010-2013 **University of California, Berkeley**

BS in Chemistry with high honors

GPA: 3.92/4

## RESEARCH EXPERIENCE

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2020-Present **Prof. Holger Müller Lab, University of California, Berkeley**

NIH F32 Postdoctoral Fellow (2023-Present)

Postdoctoral Scholar (2020-2022)

Research area: method development for cryo-electron microscopy

2014-2020 **Prof. W. E. Moerner Lab, Stanford University**

Stanford Interdisciplinary Graduate Fellow (2017-2020)

Graduate Student Researcher (2014-2017)

Research area: method development for single-molecule fluorescence microscopy

2011-2013 **Prof. Peidong Yang Lab, University of California, Berkeley**

Undergraduate Student Researcher

Research area: synthesis and characterization of nanowire photonics

Summer 2011 **Berkeley Center for Green Chemistry**

Research Intern

Advisors: Dr. Martin Mulvihill and Dr. Michelle Douskey

Research area: solar cell design and chemical education

2007-2010 **Prof. John Bowen Lab, University of Central Oklahoma**

High School Researcher (volunteer)

Research area: synthesis and characterization of biodiesel

## RESEARCH INTERESTS

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Novel methods in optical & electron microscopy & spectroscopy; structure & spatio-temporal dynamics of molecules; theory & experiment in optical metrology; optical resonators; signal & image processing algorithms

## GRANTS & FELLOWSHIPS

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2023-2024 Ruth L. Kirschstein Postdoctoral Fellowship (F32 GM149186); NIH/National Institute of General Medical Sciences

· Awarded \$67,582

2017-2020 Stanford Interdisciplinary Graduate Fellowship (Anonymous Donor); Stanford University

· Awarded \$195,000 over three years

2011-2014 Melvin J. Heger-Horst Fellowship; College of Chemistry, UC Berkeley

· Awarded \$2,000 per year (thrice) for outstanding undergraduate academic achievement

## HONORS & AWARDS

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2019 Bio-X Travel Award; Stanford University

2018 Poster Award, Bio-X Interdisciplinary Initiatives Seed Grants Program Symposium; Stanford University  
2018 Second Best Poster; Stanford University Photonics Retreat  
2018 Bio-X Travel Award; Stanford University  
2017 Second Best Poster; Stanford University Photonics Retreat  
2017 Bio-X Travel Award; Stanford University  
2016 Best Poster; Stanford University Photonics Retreat  
2014 Glenn T. Seaborg Award for Outstanding Undergraduate Research in Chemistry; UC Berkeley  
· Awarded to the top graduating chemistry major for exceptional performance in research  
2013 Undergraduate Research Stipend; College of Chemistry, UC Berkeley  
Fall 2013 Dean's List; College of Chemistry, UC Berkeley  
Spring 2013 Dean's List; College of Chemistry, UC Berkeley  
Fall 2011 Dean's List; College of Chemistry, UC Berkeley

## TEACHING, MENTORSHIP, & OUTREACH

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### Teaching:

Fall 2016 Head Teaching Assistant; Chemical Principles Accelerated (Chem 31X); Stanford University  
Fall 2015 Teaching Assistant; Chemical Principles Accelerated (Chem 31X); Stanford University  
Winter 2015 Teaching Assistant; Physical Chemistry Laboratory (Chem 176); Stanford University  
Fall 2014 Teaching Assistant; Chemical Principles Accelerated (Chem 31X); Stanford University  
2013-2014 Independent Tutor (Mathematics, Chemistry)  
Fall 2011 Co-Facilitator; Chemistry Undergraduate Internships & Research (Chem 98/198); UC Berkeley

### Mentorship & Outreach:

2022 **The Compass Project at Berkeley**; Provided bi-weekly one-on-one mentorship to an undergraduate physics student at UC Berkeley  
2021 **Be A Scientist (Bay Area Scientists In Schools)**; Led middle school students in developing, conducting, and presenting science experiments in their classroom  
2018-2019 **Stanford Splash**; Created and taught short courses on microscopy for high school students  
2017 **Stanford Science Penpals**; Corresponded by mail with high school students from low-income backgrounds about science, college, and graduate school  
2017 **Inspiring Future Scientists Through Shadowing**; Supervised and mentored a high school student in a research project on white-light interferometry  
2016 **Stanford Summer Undergraduate Research Fellowship Program**; Trained and mentored a visiting undergraduate student in an independent research project on adaptive optics

## SERVICE

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2018-Present **Optica Publishing Group**; Reviewer  
2011-2014 **Berkeley Undergraduate Chemical Society**; Co-Founder & Webmaster  
2012 **Berkeley Chemical Review**; Founding Editor

## SELECTED PRESENTATIONS

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### Invited Talks:

10. From Solid State to Biophysics X; Cavtat, Croatia; June 2024 (planned)
9. I2PC Seminar Series on Image Processing; remote; October 2023
8. Gordon Research Seminar on Three Dimensional Electron Microscopy; Newry, ME, USA; June 2023
7. Rosalind Franklin Institute; Didcot, UK; April 2023
6. Laboratory of Molecular Biology; Cambridge, UK; April 2023
5. One World Cryo-EM Seminar Series; remote; March 2023

4. Institute for Pure and Applied Mathematics; Los Angeles, CA, USA; November 2022
3. University of Vienna; Vienna, Austria; September 2022
2. Max Planck Institute for the Science of Light; Erlangen, Germany; September 2022
1. Max Planck Institute of Molecular Cell Biology and Genetics; Dresden, Germany; September 2022

#### Other Talks:

8. Bay Area Cryo-EM Meeting; Redwood City, CA; October 2023
7. International Microscopy Congress 20; Busan, South Korea; September 2023
6. Quantitative BioImaging; Oxford, UK; January 2020
5. Quantitative BioImaging; Rennes, France; January 2019
4. Quantitative BioImaging; Göttingen, Germany; January 2018
3. Stanford University Single-Molecule Seminar Series; Stanford, CA, USA; February 2017
2. SPIE BiOS (Single Molecule Spectroscopy and Superresolution Imaging Conference); San Francisco, CA, USA; January 2017 [doi]
1. 55th Annual Pentasectional Meeting of the American Chemical Society; Norman, OK, USA; April 2010

#### Poster Presentations:

13. Gordon Research Conference on Three Dimensional Electron Microscopy; Newry, ME, USA; June 2023
12. eBEAM School on Nano-Optics with Free Electrons; Porquerolles, France; September 2022
11. Stanford Bio-X Interdisciplinary Initiatives Seed Grants Symposium; Stanford, CA, USA; February 2020
10. Stanford Bio-X Fellowship Symposium; Stanford, CA, USA; October 2019
9. Stanford University Photonics Retreat; Marshall, CA, USA; April 2019
8. Stanford Bio-X Interdisciplinary Initiatives Seed Grants Symposium; Stanford, CA, USA; February 2019  
· **Received Poster Award**
7. Stanford Bio-X Symposium; Stanford, CA, USA; August 2018
6. Stanford Photonics Retreat; Pacific Grove, CA, USA; April 2018  
· **Awarded Second Best Poster**
5. Stanford Bio-X Fellowship Symposium; Stanford, CA, USA; October 2017
4. NIH Common Fund 4D Nucleome 2017 Annual Meeting; Bethesda, MD, USA; September 2017
3. Stanford University Photonics Retreat; Pacific Grove, CA, USA; April 2017  
· **Awarded Second Best Poster**
2. Stanford University Photonics Retreat; Marshall, CA, USA; April 2016  
· **Awarded Best Poster**
1. UC Berkeley Saegebarth Undergraduate Research Fair; Berkeley, CA, USA; April 2013

## PUBLICATIONS

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#### Peer-Reviewed Papers:

14. JJ Axelrod, **PN Petrov**, JT Zhang, J Remis, B Buijsse, RM Glaeser, H Müller, “Overcoming resolution loss due to thermal magnetic field fluctuations from phase plates in transmission electron microscopy,” *Ultramicroscopy* **249**, 113730 (2023) [doi]
13. A-K Gustavsson, RP Ghosh, **PN Petrov**, JT Liphardt, WE Moerner, “Fast and parallel nanoscale three-dimensional tracking of heterogeneous mammalian chromatin dynamics,” *Mol. Biol. Cell* **33**(6), 1-11 (2022) [doi]  
· **Selected as a Highlight from MBoC**
12. **PN Petrov**, H Müller, RM Glaeser, “Perspective: Emerging strategies for determining atomic-resolution structures of macromolecular complexes within cells,” *J. Struct. Biol.* **214**(1), 107827 (2022) [doi]
11. C Turnbaugh, JJ Axelrod, SL Campbell, JY Dioquino, **PN Petrov**, J Remis, O Schwartz, Z Yu, Y Cheng, RM Glaeser, H Müller, “High-power near-concentric Fabry-Perot cavity for phase contrast electron microscopy,” *Rev. Sci. Instrum.* **92**, 053005 (2021) [doi]  
· **Selected as Editor’s pick**

10. **PN Petrov**, WE Moerner, “Addressing systematic errors in axial distance measurements in single-emitter localization microscopy,” *Opt. Express* **28**(13), 18616-18632 (2020) [[doi](#)]
9. HW Bennett, A-K Gustavsson, CA Bayas, **PN Petrov**, N Mooney, WE Moerner, PK Jackson, “Novel fibrillar structure in the inversin compartment of primary cilia revealed by 3D single-molecule super-resolution microscopy,” *Mol. Biol. Cell* **31**(7), 619-639 (2020) [[doi](#)]  
· **Selected as a Highlight from MBoC**
8. L Möckl, AR Roy, **PN Petrov**, WE Moerner, “BGnet: Accurate and rapid background estimation in single-molecule localization microscopy with deep neural nets,” *Proc. Natl. Acad. Sci. U.S.A.* **117**(1), 60-67 (2020) [[doi](#)]
7. L Möckl, **PN Petrov**, WE Moerner, “Accurate phase retrieval of complex 3D point spread functions with deep residual neural networks,” *Appl. Phys. Lett.* **115**, 251106 (2019) [[doi](#)]  
· **Selected as Editor’s pick**
6. A-K Gustavsson, **PN Petrov**, WE Moerner, “Light sheet approaches for improved precision in 3D localization-based super-resolution imaging in mammalian cells,” *Opt. Express* **26**(10), 13122-13147 (2018) [[doi](#)]
5. A-K Gustavsson, **PN Petrov**, MY Lee, Y Shechtman, WE Moerner, “3D single-molecule super-resolution microscopy with a tilted light sheet,” *Nat. Commun.* **9**, 123 (2018) [[doi](#)]  
· Featured in Research Highlights, Methods in Brief, *Nat. Methods* **15**(3), 163 (2018) [[doi](#)]  
· Featured in Stanford News, 22 February, 2018 [[url](#)]
4. Y Shechtman, A-K Gustavsson, **PN Petrov**, E Dultz, MY Lee, K Weis, WE Moerner, “Observation of live chromatin dynamics in cells via 3D localization microscopy using Tetrapod point spread functions,” *Biomed. Opt. Express* **8**(12), 5735-5748 (2017) [[doi](#)]
3. **PN Petrov**, Y Shechtman, WE Moerner, “Measurement-based estimation of global pupil functions in 3D localization microscopy,” *Opt. Express* **25**(7), 7945-7959 (2017) [[doi](#)]
2. MP Backlund, A Arbabi, **PN Petrov**, E Arbabi, A Faraon, WE Moerner, “Removing orientation-induced localization biases in single-molecule microscopy using a broadband metasurface mask,” *Nat. Photonics* **10**(7), 459-462 (2016) [[doi](#)]
1. A Fu, H Gao, **PN Petrov**, P Yang, “Widely Tuneable Distributed Bragg Reflectors Integrated into Nanowire Waveguides,” *Nano Lett.* **15**(10), 6909-6913 (2015) [[doi](#)]

#### Conference Proceedings:

3. JJ Axelrod, **PN Petrov**, JT Zhang, S Sandhaus, J Remis, RM Glaeser, H Müller, “Overcoming Resolution Loss in Laser Phase Plate Cryo-Electron Microscopy,” *Microsc. Microanal.* **29**(S1), 1017 (2023) [[doi](#)]
2. JJ Axelrod, JY Dioquino, **PN Petrov**, J Remis, S Sandhaus, JH Silber, J Whinnery, RM Glaeser, H Müller, “Laser Phase Plate: Advancing Beyond Proof-of-Concept,” *Microsc. Microanal.* **28**(S1), 1186-1187 (2022) [[doi](#)]
1. A-K Gustavsson, **PN Petrov**, MY Lee, Y Shechtman, WE Moerner, “Tilted light sheet microscopy with 3D point spread functions for single-molecule super-resolution imaging in mammalian cells,” *Proc. SPIE Int. Soc. Opt. Eng.* **10500**, 105000M (2018) [[doi](#)]

#### Software:

1. **PN Petrov** & WE Moerner, [Easy Pupil Finder](#), SourceForge (2017)