

# Christopher P. Calderon

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## *Education*

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Ph.D., Chemical Engineering, **Princeton University** 2007

B.S., Chemical Engineering (summa cum laude), **Purdue University** 2001

## *Professional Positions and Postgraduate Experience*

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Adjunct Assistant Professor 2017- Present  
**U. Colorado, Boulder**

Co-founder / Serving on Board of Directors 2016 - Present  
**Quantitative BioImaging Society**

"MOOC Nano-degree", Self-Driving Car Engineer, 2016-2017  
**Udacity** (Completed Term 1: Video Analysis and Deep Learning)

Founder and Chief Scientist 2014 - Present  
**Ursa Analytics, Inc.**

Senior Research Scientist 2010- 2014  
**Numerica Corporation**

Computational Science Visiting Fellow 2009- 2010  
**Lawrence Berkeley National Laboratory**  
Scientific Computing Group

Postdoctoral Fellow 2007-2009  
**Rice University**  
Depts. of Statistics and Computational & Applied Mathematics

## *Peer-Reviewed Journal Publications*

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1. **C.P. CALDERON**, A.L. Daniels, T.W. Randolph, , Deep Convolutional Neural Network Analysis of Flow Imaging Microscopy Data to Classify Subvisible Particles in Protein Formulations, *J. Pharm. Sci.* in press DOI: [10.1016/j.xphs.2017.12.008](https://doi.org/10.1016/j.xphs.2017.12.008) (2017).

2. A. LEE, K. TSEKOURAS, **C.P. CALDERON**, C. BUSTAMANTE, S. PRESSE, Unraveling the Thousand Word Picture: An Introduction to Super-Resolution Data Analysis, *Chemical Reviews* in press DOI: [10.1021/acs.chemrev.6b00729](https://doi.org/10.1021/acs.chemrev.6b00729) (2017).

3. C.P. CALDERON, Motion Blur Filtering: A Statistical Algorithm for Extracting Confinement Forces & Diffusivity from a Single Blurred Trajectory, *Phys. Rev. E* **93** pg. 053303 (2016).
4. C.P. CALDERON AND K. BLOOM, Inferring Latent States and Refining Force Estimates via Hierarchical Dirichlet Process Modeling in Single Particle Tracking Experiments *PLoS ONE* **10** pg. e0137633 (2015).
5. C.P. CALDERON, L.E. WEISS, AND W.E. MOERNER, Robust Hypothesis Tests for Detecting Statistical Evidence of 2D and 3D Interactions in Single-Molecule Measurements *Phys. Rev. E* **89** pg. 052705 (2014).
6. C.P. CALDERON, Data-Driven Techniques for Detecting Dynamical State Changes in Noisily Measured 3D Single-Molecule Trajectories *Molecules* **19** pg. 18381 (2014).
7. C.P. CALDERON, M. THOMPSON, J. CASOLARI, R. PAFFENROTH, AND W.E. MOERNER, Quantifying Transient 3D Dynamical Phenomena of Single mRNA Particles in Live Yeast Cell Measurements. *J. Phys. Chem. B* **114** pg. 15701 (2013).
8. C.P. CALDERON, Correcting for Bias of Molecular Confinement Parameters Induced by Small Time Series Sample Sizes in Single-Molecule Trajectories Containing Measurement Noise *Phys. Rev. E* **88** pg. 012707 (2013).
9. C.P. CALDERON, Estimation and Inference of Diffusion Coefficients in Complex Biomolecular Environments, *J. Chem. Theory & Comput.*, **7** pg 280 (2011).
10. C.P. CALDERON, J.G. MARTINEZ, R.J. CARROLL, AND D.C. SORENSEN, Penalized Splines Using Derivative Information, *Multiscale Modeling & Simulation (SIAM)*, **8** pg 1562 (2010).
11. C.P. CALDERON, Detection of Subtle Dynamical Changes Induced by Unresolved Conformational Coordinates in Single-Molecule Trajectories via Goodness-of-Fit Tests, *J. Phys. Chem. B* **114** pg. 3242 (2010).
12. C.P. CALDERON, A Data-driven Approach to Decomposing Complex Enzyme Kinetics with Surrogate Models *Phys. Rev. E* **80** pg. 061118 (2009) [**Also Selected for Dec 15, 2009 issue of *Virtual Journal of Biological Physics Research***].
13. C.P. CALDERON, L. JANOSI, AND I. KOSZTIN, Using Stochastic Models Calibrated from Nanosecond Nonequilibrium Simulations to Approximate Mesoscale Information *J. Chem. Phys.*, **130**, pg. 144908 (2009) [**Also Selected for April 15, 2009 issue of *Virtual J. Biological Physics Research* and April 27, 2009 issue of *Virtual J. of Nanoscale Science & Technology***].
14. C.P. CALDERON, N.C. HARRIS, C.-H. KIANG, AND D.D. COX, Quantifying Multiscale Noise Sources in Single-Molecule Time Series *J. Phys. Chem. B*, **113**, pg.138 (2009).
15. C.P. CALDERON, W.-H CHEN, K.-J. LIN, N. C. HARRIS, AND C.-H. KIANG, Quantifying DNA Melting Transitions Using Single-Molecule Force Spectroscopy *J. Phys.: Condensed Matter*, **21**, pg. 034114 (2009).

16. **C.P. CALDERON** AND K. ARORA, Extracting Kinetic and Stationary Distribution Information from Short MD Trajectories via a Collection of Surrogate Diffusion Models *J. Chem. Theory & Comput.*, **5**, pg. 47 (2009).
17. **C.P. CALDERON**, N. C. HARRIS, C.-H. KIANG, AND D. D. COX, Analyzing Single-Molecule Manipulation Experiments *J. Mol. Recognit.*, **22**, pg. 356 (2009).
18. **C.P. CALDERON** AND R. CHELLI, Approximating Nonequilibrium Processes Using a Collection of Surrogate Diffusion Models *J. Chem. Phys.*, **128**, pg. 145103 (2008) [**Also Selected for April 15, 2008 issue of *Virtual Journal of Biological Physics Research***].
19. **C.P. CALDERON**, Fitting Effective Diffusion Models to Data Associated with a “Glassy” Potential: Estimation, Classical Inference Procedures, and Some Heuristics, *Multiscale Modeling & Simulation (SIAM)*, **6**, pg. 656 (2007).
20. **C.P. CALDERON**, Local Diffusion Models for Stochastic Reacting Systems: Estimation Issues in Equation-free Numerics, *Mol. Sim.*, **33**, pg. 713 (2007).
21. **C.P. CALDERON**, On the Use of Local Diffusion Models in Path Ensemble Averaging in Potential of Mean Force Computations, *J. Chem. Phys.*, **126**, pg. 084106 (2007) [**Also Selected for March 1, 2007 issue of *Virtual Journal of Biological Physics Research***].
22. **C.P. CALDERON** AND W.T. ASHURST, Comment on “Reversing the Perturbation in Nonequilibrium Molecular Dynamics: An Easy Way to Calculate the Shear Viscosity of Fluids”, *Phys. Rev. E*, **66**, pg. 013201 (2002).

### *Conference Proceedings, Book Chapters, & Non-Proprietary Tech. Reports*

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23. A. MONT, **C.P. CALDERON** AND A. POORE, A New Computational Method for Ambiguity Assessment of Solutions to Assignment Problems *Proc. of SPIE* (2014).
24. S. LUNDBERG, **C.P. CALDERON** AND R. PAFFENROTH, Detecting Clustered Chem/Bio Signals in Noisy Sensor Feeds Using Adaptive Fusion *Proc. of SPIE* (2012).
25. **C.P. CALDERON**, A. JONES, S. LUNDBERG, AND R. PAFFENROTH, A Data-Driven Approach for Processing Heterogeneous Categorical Sensor Signals *Proc. of SPIE* (2011).
26. **C.P. CALDERON**, G. A. TSEKOURAS, A. PROVATA, AND I.G. KEVREKIDIS, *Coarse-Graining the Cyclic Lotka-Volterra Model: SSA and local maximum likelihood estimation* in Model Reduction and Coarse-Graining Approaches for Multiscale Phenomena, A. Gorban, N. Kazantzis, Y. Kevrekidis, H.C. Ottinger, C. Theodoropoulos [Eds.], Springer, Berlin–Heidelberg–New York (2006).
27. **C.P. CALDERON**, J.G. MARTINEZ, R.J. CARROLL, AND D.C. SORENSEN, PSQR: A Stable and Efficient Penalized Spline Algorithm [http://www.caam.rice.edu/tech\\_reports/2009\\_abstracts.html#TR09-15](http://www.caam.rice.edu/tech_reports/2009_abstracts.html#TR09-15) (2009).

## Referee Service

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*Proc. Natl. Acad. Sci. (USA)*  
*ACS Nano*  
*Annual Reviews of Statistics and Its Applications*  
*Biophysical J.*  
*J. Chem. Theory & Comput.*  
*J. Phys. Chem. B*  
*Macromolecules*

## Invited Presentations

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*Leveraging Time Series Analysis and Machine Learning to Quantify Intra and Inter Trajectory Heterogeneity in Particle Tracking Experiments*, APS March Meeting, New Orleans, March 2017.

*Leveraging Time Series Analysis and Machine Learning to Quantify Intra and Inter Trajectory Heterogeneity in Particle Tracking Experiments*, 5th Annual Quantitative BioImaging Meeting, Texas A&M, January 2017.

*Analyzing Single-Molecule Microscopy Data with Stochastic Differential Equation Models*, Math and Statistics Dept., U. Nevada, Reno, NV, April 2014.

*Analyzing 3-D Stochastic Dynamics in Live Cells*, NIH (NIHCD) hosted by Lippincott-Schwartz Lab, Bethesda MD, February 2012.

*Analyzing 3-D Stochastic Dynamics in Live Cells*, G.N. Bisanar Frontiers of Science Series, Georgia Tech, Atlanta, GA, December 2011.

*Pathwise Statistical Inference Methods for Continuous Time SDEs*, Lecture Series for "Levy Processes in Finance" at CIMAT, Guanajuato, Mexico, June 2010.

*Characterizing Nanoscale Dynamics via a Collection of Estimated Stochastic Differential Equations*, Department of Applied Mathematics Colloquium, U. Colorado, Boulder, January 2010.

*Functional Data Analysis Applications in Path Thermodynamics*, Center for Statistical Bioinformatics Lecture Series, Texas A&M, College Station, TX, October 2007.

## Selected Presentations

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*Inferring Latent States and Refining Force Estimates via Hierarchical Dirichlet Process Modeling in Single Particle Tracking Experiments*, 10th International Biennial Bayesian Nonparametrics Meeting (BNP10), Raleigh, North Carolina, June 2015.

*Inferring Latent States and Refining Force Estimates via Hierarchical Dirichlet Process Modeling in Single Particle Tracking Experiments, Quantitative BioImaging, Paris, January 2015.*

*Techniques for Statistically Scrutinizing Stochastic Model Assumptions Using a Single Noisily Measured Trajectory, APS March Meeting, Denver, March 2014.*

*Scrutinizing 2D and 3D Single Particle Tracking Data via Goodness-of-Fit Hypothesis Testing Techniques, Quantitative BioImaging, Albuquerque, January 2014.*

*Analyzing 3-D Stochastic Dynamics in Live Cells via New Single Particle Tracking Methods, Annual ACS Meeting, Denver, August 2011.*

*Extracting multiscale information from time series characterizing single-molecule systems, Annual ACS Meeting, Washington D.C., August 2009.*

*Multiscale Stochastic Dynamical Models Calibrated from AFM Single-Molecule Time Series and Computer Simulations, Annual AIChE Meeting, Philadelphia, PA, November 2008.*

*Multiscale Stochastic Dynamical Models Calibrated from Single-Molecule Force Spectroscopy Time Series, AFM BioMed Conference, Monterey, CA, October 2008.*

## Computer Skills

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Python (experience developing new data analysis libraries for industry customers; also routinely use 3rd party packages like Scipy, Sklearn, Jupyter, TensorFlow, Keras, Pandas, etc. for data analysis tasks), L<sup>A</sup>T<sub>E</sub>X, R, Git, MATLAB, C, CUDA, Mathematica, FORTRAN, MPI, C++.

## Awards

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- Nanobiology Postdoctoral Fellow 2008-2009  
(Awarded through NIH Training Grant Program at Rice University)
- Ford Foundation/ National Research Council Pre-doctoral Diversity 2001-2005  
Fellowship for Achieving Excellence in College and University Teaching
- Gordon Wu Fellowship in Engineering 2001-2005  
(Awarded provided by Princeton University College of Engineering)
- Lottes Memorial Award for Outstanding Chemical Engineering Senior 2001  
(Awarded by Purdue University)
- American Chemical Society Scholar 1997-2001
- Senator Richard G. Lugar Scholar 1997-2001

## Teaching Experience

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<b>Instructor for Stochastic Differential Equations (Graduate Level)</b> <i>Statistics Department, Rice University, Houston, TX</i>	<i>Spring 2007</i>
<b>Instructor for Elementary Applied Statistics</b> <i>Statistics Department, Rice University, Houston, TX</i>	<i>Fall 2007</i>
<b>Instructor for Elementary Applied Statistics</b> <i>Statistics Department, Rice University, Houston, TX</i>	<i>Spring 2006</i>
<b>Teaching Assistant for Introduction to Chemical Engineering</b> <i>Chemical Engineering Department, Princeton University, Princeton, NJ</i>	<i>Fall 2002</i>
<b>Teaching Assistant for Statistical Modeling and Quality Enhancement</b> <i>Chemical Engineering Department, Purdue University, W. Lafayette, IN</i>	<i>Spring 2000</i>