

- 2003 Fellow of the American Physical Society, “For contributions to the understanding of soft biomaterials, quantum fields, and superstrings, using geometrical and topological methods.”
- 2001 Ira Abrams Award, highest distinguished teaching honor of Penn’s School of Arts and Sciences.
- 1997 Penn SAS Faculty Research Fellowship.
- 1988–94 NSF Presidential Young Investigator award.
- 1988–91 Young Faculty Award, University of Pennsylvania.
- 1988–91 Alfred P. Sloan Foundation Fellow.
- 1988 Department of Energy Outstanding Junior Investigator.
- 1984–87 Junior Fellow, Harvard University Society of Fellows.
- 1981–84 National Science Foundation graduate fellow.
- 1980–82 Winston Churchill Foundation fellowship.

Past research interests

Biological physics: biopolymers; molecular motors; self-assembly; DNA topology and elasticity; stochastic modeling; computational neuroscience.

Condensed matter physics: complex fluids; bilayer membranes; dynamical pattern formation; colloidal forces; entropic forces.

Geometrical methods in theoretical physics: classical and quantum fields; monopoles; anomalies; string theories; superspace and supergravity; Bose-Fermi equivalence; conformal field theory; random geometry.

Dissertation

“Global Conflicts”; advisor Prof. S. Coleman.

Teaching experience

Physics 909: Seminar on Extended Objects in Field Theory.

Physics 896: Superstring Theory.

Physics 601: Relativistic Quantum Mechanics.

Seminar on Differential Geometry in Physics.

Physics 503: Geometry, Relativity, Gravitation.

Physics 632–633: Relativistic Quantum Field Theory.

Physics 514: Mechanics, Fluids, Chaos.

Physics 240/250: Einstein’s Century.

Physics 650: Minicourse on Biopolymers and Membranes.

Physics 580: Biological Physics.

Physics 516: Electromagnetic Phenomena.

Physics 280: Physical Models of Biological Systems.

For all of these see <http://www.physics.upenn.edu/~pcn/>

Dissertations supervised

1992 Eugene Wong. Wong is on the faculty of the Department of Physics and Astronomy of the University of Western Ontario.

- 1995 Thomas Powers. Powers is currently Associate Professor of Solid Mechanics and Associate Professor of Engineering Mechanics of Solids and Structures at Brown University.
- 1998 J. David Moroz. Moroz works for the International Atomic Energy Agency.
- 2001 Yi Chen. Chen is an analyst at Tower Research Capital.
- 2010 John F. Beausang. Beausang is a postdoctoral fellow at the Bioengineering department, Stanford University.

Recent
Postdocs

- 1998 Martin Zapotocky; now Group Leader, Dept of Biological Physics, Max Planck Institute for Physics of Complex Systems.
- 2001–03 Cornelis Storm; now Assistant Professor, Eindhoven Technical Univ.
- 2006–07 Igor Kulić; now permanent faculty, CNRS (Institut Charles Sadron, Strasbourg).
- 2005–06 Prashant Purohit; now Assistant Professor, Penn MEAM Department.
- 2007–08 Kevin Towles; now at Boston Consulting Group.
- 2008–10 Gasper Tkacik; now Assistant Professor, Institute of Science and Technology, Vienna Austria.
- 2010– Timon Idema.

Conferences
attended
since 1997

- 2100 Computation and collective behavior in biological systems, Aspen.
- 2011 How Molecules Come to Life: Biophysics Vision 2016, NSF (invited short talk).
- 2011 American Association of Physics Teachers regional meeting (keynote).
- 2011 Biophysical Society, Baltimore (poster).
- 2010 Physics Meets Biology, Oxford UK (plenary invited talk).
- 2010 Challenges in Extracellular Electrophysiology, Janelia Farm.
- 2010 Mathematical and experimental approaches to dynamics of protein-DNA interactions, Ohio State (plenary invited talk).
- 2010 American Physical Society March Meeting (invited talk and contributed talk).
- 2010 Inaugural workshop, Initiative in the Theoretical Sciences, CUNY (invited talk).
- 2009 Biophysical Society (1 invited talk, 2 contributed talks).
- 2009 American Physical Society March Meeting (invited talk).
- 2009 Single Molecule Biophysics, Aspen (contributed talk).
- 2008 Invitational Summit on Undergraduate Biology Teaching, Howard Hughes Medical Institute (Biophysical Society delegate).
- 2008 SIAM Conference on Mathematical Aspects of Materials Science (invited talk).
- 2008 Biophysical Society (invited talk).
- 2007 Biophysical Society (contributed talk).

- 2006 Molecular Motors: Point Counterpoint, Asilomar.
- 2006 New Physical Approaches to Molecular and Cellular Machines, Kavli Institute for Theoretical Physics (coorganizer).
- 2006 Interdisciplinarity and Discipline in Education, Kavli Institute for Theoretical Physics (coorganizer).
- 2005 Single Molecule Biophysics, Aspen Center for Physics (invited talk).
- 2005 Biophysical Society (invited talk).
- 2004 American Chemical Society Meeting, Philadelphia (invited talk).
- 2004 American Physical Society March Meeting, Montreal (invited talk).
- 2004 Towards a Predictive Biology, Isaac Newton Institute, Cambridge UK (invited talk).
- 2004 American Association of Physics Teachers, Miami (invited talk).
- 2003 FASEB Conference on Mechanism and Regulation of Prokaryotic Transcription (contributed poster).
- 2003 Frontiers in Biological Physics, Institute for Complex Adaptive Matter, Aspen/Snowmass (invited talk).
- 2003 Aspen Winter Workshop on Single Molecule Biophysics (contributed talk).
- 2002 Workshop on Opportunities in Materials Theory, NSF (invited talk).
- 2001 Electrostatic Interactions in Polymers, Colloids, and Biophysics, Theoretical Physics Institute, Minneapolis (invited talk).
- 2001 Principles of Soft Matter, Center for Nonlinear Studies, Los Alamos (invited plenary talk).
- 1999 American Association of Physics Teachers Regional Meeting, Philadelphia (contributed talk).
- 1999 Complex Materials Conference in Honor of Philip Pincus, Santa Barbara (invited talk).
- 1999 European Molecular Biology Organization Conference on Single Molecule Biophysics (Tours, France).
- 1999 Gordon Conference on Condensed Matter Physics (invited lecture).
- 1999 American Physical Society Centennial Meeting (invited talk).
- 1999 Cold Spring Harbor Laboratory Workshop on the Role of DNA Topology, Conformation and Associated Factors in Gene Expression (invited talk).
- 1999 Biophysical Society Meeting (contributed talk).
- 1998 Physics at the Scale of the Cell, Cargèse (invited course of lectures).
- 1998 Dynamics Days, Chapel Hill (invited talk).
- 1997 Biophysics of the Cell, Aspen.
- 1997 American Physical Society March Meeting (one invited talk, one contributed talk).
- 1997 Joint DIMACS/PMMB/MBBC Workshop on DNA Topology (invited talk).

Other invited talks:

Seminars outside Penn, since 1996:

Harvard, Cornell, Princeton ($\times 2$), Duke, and the Rockefeller University ($\times 2$).

Department Colloquia, since 1996:

MIT Applied Mathematics, Duke University Physics, Brown University Physics, University of Colorado Physics, University of Chicago Physics, Boston University Physics, Rutgers Physics ($\times 2$), Brandeis Physics, University of Illinois, Harvard University Physics, Emory University Physics, Temple University Physics, Caltech Biophysics, Princeton Physics, Renaissance Technology.

Other

professional
activities

- | | |
|---------|---|
| 2007 | Boulder Summer School in Quantitative Biology (invited lecturer). |
| 2006 | Co-organizer, workshop on “New Physical Approaches to Molecular and Cellular Devices” at the Kavli Institute for Theoretical Physics, UCSB. |
| 2005,09 | Visiting Committee of the Harvard University Physics Department. |
| 2004 | NSF Workshop on the Role of Theory in Biological Physics. and Materials, Tempe, AZ (panel participant). |
| 1992 | NSF NYI Award review panel. |
| 1991 | Workshop co-organizer, Aspen Center for Physics. |
| 1987 | Convenor and chair, superunification session, American Physical Society Division of Particles and Fields meeting, Salt Lake City. |
| 1987 | Consultant to Public Broadcasting Associates for NOVA. |

Philip Nelson

Publications since 1994

Book:

- P. Nelson**, *Biological Physics: Energy, Information, Life* (W. H. Freeman and Co., 2004); *Updated edition* (2008).
- P. Nelson**, *Física Biológica: Energía, Información, Vida* (Editorial Reverte, 2005).
- P. Nelson**, *Física Biológica: Energia, Informação, Vida* (Guanabara Koogan, 2006).
- P. Nelson**, *Sheng Wu Wu Li Xue: Neng Liang, Xing Xi, Sheng Ming* (Shanghai Scientific and Technical Publishers, 2006).

Peer-Reviewed Journal Articles (since 1994)

- W. Cai, T.C. Lubensky, **P. Nelson**, and T. R. Powers, *Measure Factors, Tension, and Correlations of Fluid Membranes*, J. Phys. II France **4**, 931–949 (1994).
- T. R. Powers, **P. Nelson**, and U. Seifert, *Dynamical Theory of the Pearling Instability in Cylindrical Vesicles*, Phys. Rev. Lett. **74** 3384–3387 (1995).
- T. R. Powers and **P. Nelson**, *Fluctuating Membranes With Tilt Order*, J. Physique II (France) **5**, 1671–8 (1995).
- R. E. Goldstein, **P. Nelson**, T. R. Powers, and U. Seifert, *Front Propagation in the Pearling Instability of Tubular Vesicles*, J. Physique II (France) **6**, 767–796 (1996).
- U. Seifert, J. Shillcock, and **P. Nelson**, *Role of Bilayer Tilt Difference in Equilibrium Membrane Shapes*, Phys. Rev. Lett. **77**, 5237–5300 (1996).
- U. Seifert, W. Wintz, and **P. Nelson**, *Straightening of Thermal Fluctuations in Semi-Flexible Polymers by Applied Tension*, Phys. Rev. Lett. **77**, 5389–5392 (1996).
- J.D. Moroz, **P. Nelson**, R. Bar-Ziv, and E. Moses, *Spontaneous Expulsion of Giant Lipid Vesicles Induced by Laser Tweezers*, Phys. Rev. Lett. **78**, 386–389 (1997).
- J. D. Moroz and **P. Nelson**, *Dynamically-Stabilized Pores in Bilayer Membranes*, Biophys. J. **72**, 2211–2216 (1997).

- R. Kamien, T. Lubensky, **P. Nelson**, and C. O’Hern, *Direct Determination of DNA Twist-Stretch Coupling*, Europhys. Lett. **38**, 237–242 (1997).
- J. D. Moroz and **P. Nelson**, *Torsional Directed Walks, Entropic Elasticity, and DNA Twist Stiffness*, Proc. Natl. Acad. Sci. USA **94**, 14418–14422 (1997).
- A.D. Dinsmore, D.T. Wong, **P. Nelson**, and A.G. Yodh, *Hard Spheres in Vesicles: Curvature-Induced Forces and Particle-Induced Curvature*, Phys. Rev. Lett. **80**, 409–412 (1998).
- R. D. Kamien, T. C. Lubensky, **P. Nelson**, and C. S. O’Hern, *Elasticity Theory of a Twisted Stack of Plates*, Eur. Phys. J. **B1**, 95–102 (1998).
- P. Nelson**, *New Measurements of DNA Twist Elasticity*, Biophys. J. **74**, 2501–2503 (1998).
- R. Bar-Ziv, E. Moses, and **P. Nelson**, *Dynamic Excitations in Membranes Induced by Optical Tweezers*, Biophys. J. **75**, 294–320 (1998).
- P. Nelson** *Sequence-Disorder Effects on DNA Entropic Elasticity*, Phys. Rev. Lett. **80**, 5810–5812 (1998).
- J.D. Moroz and **P. Nelson**, *Entropic Elasticity of Twist-Storing Polymers*, Macromolecules **31**, 6333–6347 (1998).
- P. Nelson**, *Transport of Torsional Stress in DNA*, Proc. Natl. Acad. Sci USA **96**, 14342–7 (1999).
- H. Aranda-Espinoza, Y. Chen, N. Dan, T.C. Lubensky, **P. Nelson**, L. Ramos, and D.A. Weitz, *Electrostatic Repulsion of Positively Charged Vesicles and Negatively Charged Objects*, Science **285**, 394–397 (1999).
- L. Ramos, T.C. Lubensky, N. Dan, **P. Nelson**, and D.A. Weitz, *Surfactant-Mediated Two-dimensional Crystallization of Colloidal Crystals*, Science **286**, 2325–2328 (1999).
- Y. Chen and **P. Nelson**, *Charge-Reversal Instability in Mixed Bilayer Vesicles*, Phys. Rev. **E62**, 2608–2619 (2000).
- C. Storm and **P. Nelson**, *The Bend Stiffness of S-DNA*, Europhys. Lett., **62**, 760–766 (2003).
- C. Storm and **P. Nelson**, *Theory of High-Force DNA Stretching and Overstretching*, Phys. Rev. **E67**, 051906-(1–12) (2003).
- P. Nelson**, *Comment on “Rotational Drag on DNA: A Single Molecule Experiment” by P. Thomen, U. Bockelmann, and F. Heslot*, Phys. Rev. Lett. **92**, 159801-(1) (2004); highlighted in the Virtual Journal of Biological Physics Research (May 1, 2004 issue).
- P.A. Wiggins, R. Phillips, and **P.C. Nelson**, *Exact Theory of Kinkable Elastic Polymers*, Phys. Rev. **E71**, 021909-(1–19) (2005); highlighted in the March 1, 2005 issue of Virtual Journal of Biological Physics Research.
- D.E. Segall, **P.C. Nelson**, and R. Phillips, *Excluded-Volume Effects in Tethered-Particle Experiments: Bead Size Matters*, Phys. Rev. Lett. **96**, 088306-(1–4) (2006).

- P.A. Wiggins and **P.C. Nelson**, *Generalized Theory of Semiflexible Polymers*, Phys. Rev. E **73**, 031906-(1–13) (2006).
- P.C. Nelson**, C. Zurla, D. Brogioli, J.F. Beausang, L. Finzi, and D. Dunlap, *Tethered Particle Motion as a Diagnostic of DNA Tether Length*, J. Phys. Chem. B **110**, 17260–17267 (2006).
- J. Li, **P.C. Nelson**, and M.D. Betterton, *Entropic Elasticity of DNA with a Permanent Kink*, Macromolecules **39**, 8816–8821 (2006).
- P.A. Wiggins, T. van der Heijden, F. Moreno–Herrero, A. Spakowitz, R. Phillips, J. Widom, C. Dekker, and **P.C. Nelson**, *High Flexibility of DNA on Short Length Scales Probed by Atomic Force Microscopy*, Nature Nanotechnology **1**, 137–141 (2006).
- P.K. Purohit and **P.C. Nelson**, *Effect of Supercoiling on Formation of Protein Mediated DNA Loops*, Phys. Rev. **E74**, 061907-(1–14) (2006).
- J.F. Beausang, C. Zurla, L. Sullivan, L. Finzi, and **P.C. Nelson**, *Elementary Simulation of Tethered Brownian Motion*, Am. J. Phys. **75**, 520–523 (2007).
- J.F. Beausang, C. Zurla, C. Manzo, D. Dunlap, L. Finzi, and **P.C. Nelson**, *DNA Looping Kinetics Analyzed Using Diffusive Hidden Markov Model*, Biophysical Letters section of Biophys. J. **92**, L64–L66 (2007).
- Y. Seol, J. Li, **P.C. Nelson**, T.T. Perkins, and M.D. Betterton, *Elasticity of Short DNA Molecules: Theory and Experiment for Contour Lengths of 0.6–7 μm* , Biophys. J. **93**, 4360–4373 (2007).
- J.F. Beausang and **P.C. Nelson**, *Diffusive Hidden Markov Model Characterization of DNA Looping Dynamics in Tethered Particle Experiments*, Physical Biology **4**, 205–219 (2007).
- Igor M. Kulić and **P.C. Nelson**, *Hitchhiking Through the Cytoplasm*, Europhys. Lett. **81**, 18001-(1–6) (2008).
- I.M. Kulić, A.E.X. Brown, H. Kim, C. Kural, B. Blehm, P.R. Selvin, **P.C. Nelson**, and V.I. Gelfand, *The Role of Microtubule Movement in Bidirectional Organelle Transport*, Proc. Natl. Acad. Sci. USA, **105** 10011–10016 (2008).
- J.F. Beausang, H.W. Schroeder III, **P.C. Nelson**, Y.E. Goldman, *Twirling of Actin by Myosins II and V Observed via Polarized TIRF in a Modified Gliding Assay*, Biophys. J. **95**, 5820–5831 (2008).
- L. Han, H.G. Garcia, S. Blumberg, K.B. Towles, J.F. Beausang, **P.C. Nelson**, R. Phillips, *Concentration and Length Dependence of DNA Looping in Transcriptional Regulation*, PLoS ONE **4** e5621-(1–17) (2009).
- K. Towles, J.F. Beausang, H.G. Garcia, R. Phillips, and **P.C. Nelson**, *First-principles Calculation of DNA Looping in Tethered Particle Experiments*, Physical Biology, **6** 025001-(1–22) (2009).

Jason S. Prentice, Jan Homann, Kristina D. Simmons, Gasper Tkacik, Vijay Balasubramanian, and **P.C. Nelson**, *Fast, Scalable, Bayesian Spike Identification for Multi-Electrode Arrays*, PLoS ONE in press.

Reviews, lectures, proceedings, popular articles (since 1994):

- P. Nelson**, *Statistical Mechanics of Membranes*, in McGraw-Hill Yearbook of Science and Technology 1995 (McGraw-Hill, 1995) pp.395–397.
- S. Gruner, J. Langer, **P. Nelson**, and V. Vogel, *What Future Will We Choose for Physics?* Physics Today, **48**:12, 25–30 (December 1995).
- J.D. Moroz and **P. Nelson**, *Dynamically-Stabilized Pores in Bilayer Membranes*, in *Statistical Mechanics in Physics and Biology*, MRS Proceedings Vol. 463 ed. D. Wirtz, T.C. Halsey, and J. Van Zanten (Materials Research Society, Pittsburgh, 1997), pp. 161–166 (refereed).
- R.D. Kamien, T.C. Lubensky, **P. Nelson**, and C.S. O’Hern, *Twist-Stretch Elasticity of DNA*, in *Statistical Mechanics in Physics and Biology*, MRS Proceedings Vol. 463 ed. D. Wirtz, T.C. Halsey, and J. Van Zanten (Materials Research Society, Pittsburgh, 1997), pp. 43–48 (refereed).
- P. Nelson**, *Deoxyribonucleic Acid*, article in McGraw-Hill Yearbook of Science and Technology 1999 (McGraw-Hill, 1998) pp. 122–124.
- J.D. Moroz and **P. Nelson**, *Microscopic Elasticity of DNA from Torsionally-Constrained Stretching*, in *Materials Science of the Cell*, MRS Proceedings Vol. 489, edited by B. Mulder, C. Schmidt, and V. Vogel, (Materials Research Society, Pittsburgh, 1998).
- R.E. Goldstein, **P. Nelson**, and T.R. Powers, *Teaching Biological Physics*, Physics Today, **58**:3 46–51 (March 2005).
- H.G. Garcia, P. Grayson, L. Han, M. Inamdar, J. Kondev, **P.C. Nelson**, R. Phillips, J. Widom, and P.A. Wiggins, *Biological Consequences of Tightly Bent DNA: The Other Life of a Macromolecular Celebrity*, Biopolymers **85**, 115–130 (2007).
- P.C. Nelson**, *Colloidal Particle Motion as a Diagnostic of DNA Conformational Transitions*, Curr. Op. Colloid Interf. Sci. **12**, 307–313 (2007).
- P. Nelson**, *Advanced Theories*, letter to New Yorker Magazine (8 September 2008) p. 5.
- L. Han, B.H. Lui, S. Blumberg, J.F. Beausang, **P.C. Nelson**, and R. Phillips, *Calibration of Tethered Particle Motion Experiments*, in *Mathematics of DNA Structure, Function and Interactions* eds. C. J. Benham, S. Harvey, W. K. Olson, D. L. Sumners, and D. Swigon (Springer, 2009), pp. 123–138.
- John F. Beausang, Yale E. Goldman, and **P.C. Nelson**, *Changeoint Analysis for Single-Molecule Polarized Total Internal Reflection Fluorescence Microscopy Experiments*, Meth. Enzymol. **487** 431–463 (2011).

Jason S. Prentice, Jan Homann, Kristina D. Simmons, Gasper Tkacik, Vijay Balasubramanian, and **P.C. Nelson**, *Spike Sorting for Multi-Electrode Array Data*, to appear in Encyclopedia of Applied and Computational Mathematics.