Curriculum Vitae: Nicholas J. Derr

Mathematics Department
Massachusetts Institute of Technology
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Education

Harvard University 2016–2022
Ph.D. Applied Mathematics
Advisor: Professor Chris H. Rycroft

Cambridge University 2015–2016
M.A.St. Mathematics
Part III of the Mathematical Tripos

University of Wisconsin–Madison 2010–2015
B.S. Applied Mathematics, Engineering and Physics (AMEP); Astronomy–Physics

Research Experience

Mathematics Department, Massachusetts Institute of Technology 2022–present
Instructor in Applied Mathematics

Goddard Space Flight Center, NASA 2014–2016
Summer Research Intern
Advisor: Dr. Ronald J. Oliversen

Department of Physics, University of Wisconsin–Madison 2012–2014
Research Assistant
Advisor: Professor Edwin J. Mierkiewicz

Research Interests

Data-driven inference, continuum mechanics, poroelasticity, biomechanics, fluid-solid interaction, high-performance scientific computing, low-Reynolds number flow, numerical methods, elastoplasticity

Awards and Fellowships

Graduate Student Fellowship — NSF-Simons MathBio Center at Harvard, 2019–2022
50% tuition and stipend support each academic year

Certificate of Distinction in Teaching — Bok Center for Teaching, Harvard University, 2018–2022

NDSEG Fellowship — U.S. Department of Defense, 2015, applied 2016–2019
Full tuition and stipend support for three years, 200 awarded nationwide

Marcus L. Urann Fellowship — Honor Society of Phi Kappa Phi, 2015
$15,000 towards graduate study, six awarded nationwide

Theodore Herfurth Award — University of Wisconsin–Madison, 2015
Awarded to two (of 7,000) graduates who made most effective use of their time at UW-Madison

AMEP Leadership Prize — Math Department, University of Wisconsin–Madison, 2015

Hilldale Undergraduate Research Fellowship — University of Wisconsin–Madison, 2014

Academic Excellence Scholarship — Higher Education Aids Board, State of Wisconsin, 2010

National Merit Scholarship — National Merit Scholarship Program, 2010

Teaching

Head Instructor (MIT):

Course Number	Course Name	Term
18.384	Undergraduate Seminar in Physical Mathematics	Fall 2023

Recitation Leader (MIT):

Course Number	Course Name	Lead Instructor	Term
18.03	Differential Equations	L. Demanet	Spring 2024
18.02	Multivariable Calculus	D. Alvarez-Gavela	Spring 2023
18.01	Single Variable Calculus	L. Guth	Fall 2022

Teaching Fellow (Harvard):

Course Number	Course Name	Lead Instructor	Term
Applied Math 104*	Complex and Fourier Analysis	A. Amir	Fall 2021
Applied Math 205*	Advanced Scientific Computing I	C. Rycroft	Fall 2020
Engineering Sciences 240*	Solid Mechanics	J. Vlassak	Fall 2019
Applied Math 225*	Advanced Scientific Computing II	C. Rycroft	Spring 2019
Engineering Sciences 220	Fluid Dynamics	J. Rice	Fall 2018
Applied Math 225*	Advanced Scientific Computing II	C. Rycroft	Spring 2018

* denotes Bok Certificate of Distinction in Teaching awarded

Publications

N.J. Derr and C.H. Rycroft. *A projection method for porous media flow*. arXiv: 2206.14379, current draft (2022).

N.J. Derr, T. Dombrowski, C.H. Rycroft, and D. Klotsa. *Reciprocal swimming at intermediate Reynolds number*. Journal of Fluid Mechanics **952**, A8 (2022).

Y.L. Lin, **N.J. Derr**, and C.H. Rycroft. *Eulerian simulation of complex suspensions and biolocomotion in three dimensions*. Proceedings of the National Academy of Sciences **119**, e2105338118 (2021).

N.J. Derr*, D.C. Fronk*, C.A. Weber, A. Mahadevan, C.H. Rycroft, and L. Mahadevan. *Flow-driven branching in a frangible porous medium*. Physical Review Letters **125**, 158002 (2020).

S.A. Rosborough, R.J. Oliversen, E.J. Mierkiewicz, M. Sarantos, S.D. Robertson, D.C.P. Kuruppuaratchi, **N.J. Derr**, M.A. Gallant, and F.L. Roesler. *High-resolution potassium observations of the lunar exosphere*. Geophysical Research Letters **46**, 6964-6971 (2019).

D.C.P. Kuruppuaratchi, E.J. Mierkiewicz, R.J. Oliversen, M. Sarantos, **N.J. Derr**, M.A. Gallant, S.A. Rosborough, C.W. Freer, L.C. Spalsbury, D.D. Gardner, O.L. Lupie, and F.L. Roesler. *High-resolution, ground-based observations of the lunar sodium exosphere during the Lunar Atmosphere and Dust Environment Explorer (LADEE) mission*. Journal of Geophysical Research: Planets **123**, 2430-2444 (2018).

* denotes equal contribution

Invited Talks

Reciprocal swimming at intermediate Reynolds number, Fluids Seminar at Brown University, Providence, October 10, 2023.

Reciprocal swimming at finite inertia, Physics Colloquium at Clark University, Worcester, April 5, 2023.

Fluid inertia and the scallop theorem, SIAM Conference on the Life Sciences, Pittsburgh, July 11–14, 2022.

A projection method for porous media simulation, Computational and Applied Math Seminar at Tufts University, Medford, November 8, 2021.

Active phase separation of biphasic polymer gels, MathBio Journal Club at Brandeis University, Waltham, May 1, 2019.

Contributed Presentations

Reciprocal swimming at intermediate Reynolds number, APS March Meeting, Las Vegas, March 9, 2023.

A projection method for porous media simulation, APS March Meeting, Chicago, March 14–18, 2022.

A projection method for porous media simulation, SIAM Annual Meeting, Virtual, July 19–23, 2021.

Swimming mechanisms at intermediate Reynolds number, Third Annual Conference on Qualitative Approaches in Biology at Northwestern University, Virtual, November 19–21, 2020.

Steady streaming in a simple reciprocal swimmer, APS Division of Fluid Dynamics Annual Meeting, Seattle, November 23–26, 2019.

Active phase separation in polymer gels, Second Annual Conference on Quantitative Approaches in Biology at Northwestern University, Evanston, October 4–5, 2019.

Active phase separation of biphasic polymer gels, APS March Meeting, Boston, March 4–8, 2019.

Eulerian numerical methods for flow through poroelastic media, APS Division of Fluid Dynamics Annual Meeting, Atlanta, November 18–20, 2018.

Numerical simulations of isotropic active gels, 16th Annual Northeastern Granular Materials Workshop, New Haven, June 8, 2018.

Numerical simulations of activity-driven mechanical instabilities in gels, APS March Meeting, Los Angeles, March 5–9, 2018.

Fabry-Perot observations of lunar exospheric potassium emission, UW-Madison Undergraduate Research Symposium, Madison, April 16, 2015.

Fabry-Perot observations of lunar exospheric potassium emission, NASA Goddard Space Flight Center Summer Intern Poster Session, Greenbelt, July 31, 2014.

Service

Research mentor — 2023–present
MIT PRIMES

Journal reviewer — 2022–present
Journal of Fluid Mechanics, *Journal of Computational Physics*, *SIAM Journal on Applied Mathematics*, *Communications in Applied Mathematics and Computational Science*

Programming instructor — Summer 2020, 2021
Harvard QBio Institute Summer REU Program

Other Works

N.J. Derr, *Modeling and simulation of fluid–structure interaction in physics and biology*, Doctoral thesis, advised by C.H. Rycroft (2022).

N.J. Derr, *Artificial phoretic microswimmers*, Cambridge University Part III Maths essay, advised by T. Montenegro-Johnson (2016).

N.J. Derr, *An examination of trends in lunar exospheric potassium emission*, University of Wisconsin–Madison senior thesis, advised by S. Nossal, E.J. Mierkiewicz and R.J. Oliversen (2015).