

## Publication List: Nicholas J. Derr

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### Education

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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

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

### Research Interests

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

### Awards and Fellowships

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Graduate Student Fellowship	NSF-Simons MathBio Center at Harvard, 2019–2022
<i>50% tuition and stipend support each academic year</i>	
Certificate of Distinction in Teaching	Bok Center for Teaching, Harvard University, 2018–2022
NDSEG Fellowship	U.S. Department of Defense, 2015, applied 2016–2019
<i>Full tuition and stipend support for three years, 200 awarded nationwide</i>	
Marcus L. Urann Fellowship	Honor Society of Phi Kappa Phi, 2015
<i>\$15,000 towards graduate study, six awarded nationwide</i>	
Theodore Herfurth Award	University of Wisconsin–Madison, 2015
<i>Awarded to two (of 7,000) graduates who made most effective use of their time at UW-Madison</i>	
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

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### *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

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**N.J. Derr**, T. Dombrowski, C.H. Rycroft, and D. Klotz. *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. Oliverson, 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. Oliverson, 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

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*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

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- 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

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| Research mentor<br><i>MIT PRIMES</i>  | 2023–present      |
| Journal reviewer<br><i>Journal of Fluid Mechanics, Journal of Computational Physics, SIAM Journal on Applied Mathematics, Communications in Applied Mathematics and Computational Science</i> | 2022–present      |
| Programming instructor<br><i>Harvard QBio Institute Summer REU Program</i>  | Summer 2020, 2021 |

## Other Works

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- 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**, *Moonlighting in physics: 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. Oliverson (2015).