

# CURRICULUM VITAE: NICHOLAS J. DERR

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29 Oxford Street, Cambridge, MA 02138  
920-382-2939 — derr@g.harvard.edu

## EDUCATION

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- Harvard University** S.M. 2019, Ph.D. 2022  
Applied Mathematics  
Advisor: Prof. Chris H. Rycroft  
Thesis: Modeling and simulation of fluid–structure interaction in physics and biology
- Cambridge University** M.A.St. with Merit, 2016  
Applied Mathematics  
Part III of the Mathematical Tripos  
Essay: Artificial phoretic microswimmers
- University of Wisconsin-Madison** B.S. with Distinction, 2015  
Applied Math, Engineering and Physics (AMEP); Astronomy-Physics  
Certificates: Computer Science; Business  
Thesis: An examination of trends in lunar exospheric potassium emission

## RESEARCH INTERESTS

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Continuum mechanics, poroelasticity, biomechanics, fluid-solid interaction, high-performance scientific computing, low-Reynolds number flow, cellular locomotion, numerical methods, elastoplasticity

## EXPERIENCE

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- Harvard University**, Research Fellow 2016–2022  
Advisor: Prof. Chris Rycroft
- NASA Goddard Space Flight Center**, Research Assistant 2013–2016  
Advisor: Dr. Ronald J. Oliverson
- UW-Madison Physics Department**, Research Assistant 2012–2014  
Advisor: Prof. Edwin J. Mierkiewicz

## AWARDS/FELLOWSHIPS

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- QBio Graduate Student Fellowship** NSF-Simons MathBio Center at Harvard, 2019-2022  
Provides 50% tuition and stipend support for each academic year.
- Certificate of Distinction in Teaching** Bok Center for Teaching and Learning, 2018-2022
- NDSEG Fellowship** Department of Defense, 2015 (applied 2016-2019)  
Provides full tuition and stipend support for three years. Approximately 200 awarded annually.
- Marcus L. Urann Fellowship** Honor Society of Phi Kappa Phi, 2015  
Provides \$15,000 towards one year of graduate study. Six awarded annually.

**Theodore Herfurth Award**

UW-Madison, 2015

Awards \$2,000 to the two (of 7,000) graduating students each year who have made the most effective use of their time at UW-Madison, demonstrating productivity in the classroom and commitment to the community.

**AMEP Leadership Prize**

UW-Madison Mathematics Department, 2015

Given annually to an outstanding AMEP student with demonstrated leadership and solid academic record.

**Hilldale Undergraduate Research Fellowship**

UW-Madison, 2014

Provides \$3,000 to support research with faculty sponsor. Approximately 100 awarded annually.

**Academic Excellence Scholarship**

WI Higher Education Aids Board, 2010

**National Merit Scholarship**

2010

**PUBLICATIONS**

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**N.J. Derr**, T. Dombrowski, C.H. Rycroft, and D. Klotz, *Reciprocal swimming at intermediate Reynolds number*, arxiv:2202.03669 (2022). Under revision.

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**(1), e2105338118 (2022).

**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. Robertson, D.C.P. Kuruppuaratchi, **N.J. Derr**, M.A. Gallant, and F.L. Roesler, *High-resolution potassium observations of the lunar exosphere*, Geophysical Review Letters **46**(12), 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 LADEE mission*, Journal of Geophysical Research: Planets **123**(9), 2430–2444 (2018).

\* denotes equal contribution

**PRESENTATIONS**

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

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

*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 Quantitative Approaches in Biology at Northwestern University, Evanston, 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*, MathBio Journal Club at Brandeis University, Waltham, May 1, 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.

## CURRENT RESEARCH

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With Prof. Chris Rycroft:

Eulerian simulation of incompressible flow through porous media, using Chorin-type approximate projection methods and the reference map technique for finite-strain elasticity

With Prof. L. Mahadevan, Dr. Christoph Weber, Prof. Chris Rycroft:

Phase separation, pattern formation, and structure emergence in cross-linked polymer gels subject to active stresses induced by fuel-dependent molecular motor binding dynamics

With Prof. Dave Mooney, Dr. Kyle Vining, Prof. Chris Rycroft:

Modeling decreased collagen fiber formation within artificial extracellular matrices as a function of cross-linker mediated changes in rheology

## PROGRAMMING

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C++ (OpenMP, Open MPI), Python (numpy, scipy, matplotlib), Mathematica, PETSc, Matlab, Java

## TEACHING

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Course	Instructor	Term
Applied Math 104: Complex and Fourier Analysis*	Prof. Ariel Amir	Fall 2021
Applied Math 205: Advanced Scientific Computing I*	Prof. Chris Rycroft	Fall 2020
Engineering Sciences 240: Solid Mechanics*	Prof. Joost Vlassak	Fall 2019
Applied Math 225: Advanced Scientific Computing II*	Prof. Chris Rycroft	Spring 2019
Engineering Sciences 220: Fluid Dynamics	Prof. James Rice	Fall 2018
Applied Math 225: Advanced Scientific Computing II*	Prof. Chris Rycroft	Spring 2018

\* Bok Certificate of Distinction in Teaching