Curriculum Vitae: Nicholas J. Derr

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EDUCATION

Harvard University, S.M., Ph.D. Candidate   2016-present
Applied Mathematics
Advisor: Prof. Chris H. Rycroft

Cambridge University, M.A.St. with Merit   2015-2016
Applied Mathematics
Part III of the Mathematical Tripos
Essay: Artificial phoretic microswimmers

University of Wisconsin-Madison, B.S. with Distinction   2010-2015
Applied Math, Engineering and Physics (AMEP); Astronomy-Physics
Certificates: Computer Science; Business
Thesis: An examination of trends in lunar exospheric potassium emission

RESEARCH INTERESTS

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

EXPERIENCE

NASA Goddard Space Flight Center, Research Assistant   2013–2016
Advisor: Dr. Ronald J. Oliversen

UW-Madison Physics Department, Research Assistant   2012–2014
Advisor: Prof. Edwin J. Mierkiewicz

AWARDS/FELLOWSHIPS

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

N.J. Derr, T. Dombrowski, C.H. Rycroft, and D. Klotsa, *Fluid inertia and the scallop theorem.* In preparation for submission to JFM.

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) (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. Oliversen, 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. 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 LADEE mission*, Journal of Geophysical Research: Planets **123**(9), 2430–2444 (2018).

* denotes shared first-authorship

PRESENTATIONS

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

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

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

TEACHING

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