

David Maxwell

Professor
Department of Mathematics and Statistics
University of Alaska Fairbanks
Fairbanks, AK, 99775
(907) 385-7970
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Education

| | | |
|-------|---|-----------|
| PhD | University of Washington Thesis: <i>Initial Data for Black Holes and Rough Spacetimes</i> Adviser: Daniel Pollack | 2000–2004 |
| MSc | University of British Columbia | 1995–1997 |
| BMath | University of Waterloo | 1990–1995 |

Preprints

- M. Disconzi, J. Isenberg, and D. Maxwell *Initial Data for First-order Causal Viscous Conformal Fluids in General Relativity*, arXiv:2406.17945
- M. Holst, D. Maxwell, and G. Tsogtegregel *A Scaling Approach to Elliptic Theory for Geometrically-Natural Differential Operators with Sobolev-Type Coefficients*, arXiv:2306.15842
- P. T. Allen, J. M Lee and D. Maxwell, *Sobolev-class asymptotically hyperbolic manifolds and the Yamabe problem*, arXiv:2206.12854
- J. Isenberg and D. Maxwell, *A Phase Space Approach to the Conformal Construction of Non-Vacuum Initial Data Sets in General Relativity*, arXiv:2106.15027
- J. Dilts, M. Holst, T. Kozareva, and D. Maxwell, *Numerical bifurcation analysis of the conformal method*, arXiv:1710.03201

Publications

- M. Holst, D. Maxwell, and R. Mazzeo, *Conformal fields and the structure of the space of solutions of the Einstein constraint equations*, Advances in Theoretical and Mathematical Physics, Volume 26, Number 5, 1157-1201, 2022
- D. Maxwell, *Initial data in general relativity described by expansion, conformal deformation and drift*, Comm. Anal. Geom., 2021
- J. Dilts and D. Maxwell, *Yamabe classification and prescribed scalar curvature in the asymptotically Euclidean setting*, Comm. Anal. Geom., 2018
- M. Habermann, M. Truffer and D. Maxwell, *Error sources in basal yield stress inversions for Jakobshavn Isbræ, Greenland, derived from residual patterns of misfit to observations*, J. Glaciology, December 2017
- D. Maxwell, *Conformal parameterizations of flat Kasner spacetimes*, Annales Henri Poincaré, December 2015
- D. Maxwell, *The conformal method and the conformal thin-sandwich method are the same*, Classical and Quantum Gravity 31, 2014
- D. Maxwell, *Kozlov-Maz'ya iteration as a form of Landweber iteration*, Inverse Problems and Imaging 8, 2014
- M. Habermann, M. Truffer, and D. Maxwell, *Changing basal conditions during the speed-up of Jakobshavn Isbræ, Greenland*, The Cryosphere 7, 2013
- M. Habermann, D. Maxwell and M. Truffer, *Stopping criteria for the reconstruction of basal properties in ice sheets*, J Glaciol. 58, 2012

D. Maxwell, *A model problem for conformal parameterizations of the Einstein constraint equations*, Comm. Math. Phys. 302, 2011

D. Maxwell *A class of solutions of the vacuum Einstein constraint equations with freely specified mean curvature*, Math. Res. Letters. 16, 2009.

S. Avdonin, V. Kozlov, D. Maxwell, and M. Truffer. *Iterative methods for solving a nonlinear boundary inverse problem in glaciology*, J. Inverse Ill-Posed Problems 17, 2009.

D. Maxwell, M. Truffer, S. Avdonin, M. Steuffer, *An iterative scheme for determining glacier velocities and stresses*, J. Glaciol. 54, 2008.

D. Maxwell, *Rough solutions of the Einstein constraint equations*, J. Reine Angew. Math. 590, 2006.

J. Isenberg, D. Maxwell, D. Pollack, *A gluing construction for non-vacuum solutions of the Einstein constraint equations*, Adv. Theor. Math. Phys. 9, 2005.

D. Maxwell, *Rough solutions of the Einstein constraint equations on compact manifolds*, J. Hyp. Diff. Eq. 2, 2005.

D. Maxwell, *Solutions of the Einstein constraint equations with apparent horizon boundaries*, Comm. Math. Phys. 256, 2005.

D. Maxwell, *A regularity technique for nonlinear Stokes-like elliptic systems* Navier-Stokes Equations and Related Nonlinear Problems (H. Amann, G.P. Galdi, K. Pileckas and V.A. Solonnikov eds.), VSP, 1998, pp. 165–181.

Software

GNU licensed software: Inverse problem components of PISM (Parallel Ice Sheet Model)

<http://www.pism-docs.org>

Research Grants

NSF Grant, FRG: Collaborative Research: Analysis of the Einstein Constraint Equations, PI, \$150K, 6 years, 2013

NASA Grant, A high resolution parallel ice sheet model including fast, sliding flow: advanced development and applications, (with Ed Bueler (PI), Regine Hock, Martin Truffer), \$1M, 3 years, 2009

NSF Grant, CMG Research: Boundary Inverse Problems in Glaciology, (with Martin Truffer (PI), Sergei Avdonin), \$383K, 3 years, 2007

Other Funding

UAF Strategic Enrollment Planning Grant: ES/MATH Applied Engineering Mathematics (w/ Karsten Heuffer, John Rhodes, William Schnabel), \$ 70K, 2 years, 2022

Conferences Organized

Mass, the Einstein Constraint Equations, and the Penrose Inequality Conjecture, Simons Center for Geometry and Physics, September 2023

Initial Data in General Relativity, Fairbanks, Alaska, May 2018

Geometric Analysis and General Relativity, Banff International Research Station, July 2016

Presentations

Non-vacuum initial data sets in general relativity, Vanderbilt University Mathematics Colloquium, March 2024

Non-vacuum initial data sets in general relativity, UC San Diego Mathematics Colloquium, April 2023

Sobolev-class asymptotically hyperbolic manifolds and the Yamabe problem, Advances on Scalar Curvature Problems, Simons Center for Geometry and Physics, June 2022

Representing Rotations with Quaternions, Lewis & Clark Mathematics Colloquium, March 2022

The Conformal Method Applied to Fluids (Done Right), Mathematics Congress of the Americas, Buenos Aires (via Zoom), July 2021

Representing Rotations with Quaternions, UAF Math Club, April 2021

An Unhelpful Introduction to Electricity and Magnetism, Short Lecture Series, UAF, Alaska, November 2020

The conformal method and non-vacuum initial data sets, Tübingen GAMR Seminar, Tübingen, Germany, May 2020

Interior estimates for elliptic operators associated with low regularity Riemannian metrics, Pacific Northwest Geometry Seminar, Portland, March 2020

Interior estimates for elliptic operators associated with low regularity Riemannian metrics, Upsalla Analysis Seminar, Upsalla, Sweden, November 2019

The conformal method and matter, DMV-Jahrestagung, Karlsruhe, Germany, September 2019

The conformal method in Sobolev scales, Convergence and Low Regularity in General Relativity, Simons Center for Geometry and Physics, Stony Brook, May 2019

The conformal method in the far-from-CMC setting, Initial Data in General Relativity, Fairbanks, May 2018

Prescribed scalar curvature in the asymptotically Euclidean setting, Banff International Research Station, Banff, Canada, May 2018

The conformal method in the far-from-CMC setting, AMS Section Meeting, Portland, April 2018

Solutions of the Constraint Equations with Conformal Killing Fields, Tsinghua Sanya International Mathematical Forum, Sanya, China, January 2016

Solutions of the Constraint Equations with Conformal Killing Fields, Dynamics of Self-Gravitating Matter, Institut Henri Poincaré, Paris, October 2015

Volumetric momentum and the conformal method, Mathematical Aspects of General Relativity, Mathematics Forschungsinstitut Oberwolfach, Germany, July 2015

Volumetric momentum and the conformal method, Constraint Equations and Mass-Momentum Inequalities, Fields Institute, Toronto, Canada, May 2015

Initial data in general relativity described by conformal deformation, expansion, and drift, Geometric Analysis and Relativity, Hefei, China, July 2014

Initial data in general relativity described by conformal deformation, expansion, and drift, Geometry Seminar, Stanford, April 2014

Initial data in general relativity described by conformal deformation, expansion, and drift, University of Washington DG/PDE Seminar, Seattle, May 2014

The conformal method of constructing Cauchy data for the Einstein equations, Introductory Workshop: Mathematical Relativity, MSRI, September 2013

Conformal parameterizations of the Einstein constraint equations, CADS V, Akko, Israel, May 2011

Determination of ice stream bed strength via the incomplete Gauss-Newton method, American Geophysical Union Fall Meeting, San Francisco, December 2010

A principled stopping criterion for bed strength reconstructions, Poster, American Geophysical Union Fall Meeting, San Francisco, December 2010

The conformal method and concrete examples, Geometric Analysis and General Relativity, Banff,

Canada, June 2010

The conformal method and non-constant mean curvature, AMS/MAA Joint Mathematics Meeting, San Francisco, January 2010

A model problem for conformal parameterizations of the Einstein constraint equations, Mathematical Problems in General Relativity, Oberwolfach, Germany, October 2009

On large data solutions of the Einstein constraint equations, CADS IV, Nahariya, Israel, May 2009

Iterative methods for reconstructing basal boundary data, Poster, American Geophysical Union Fall Meeting, San Francisco, December 2008

Determining glacier velocities from surface measurements, Inverse Problems Seminar, University of Washington, May 2008

Inferring glacier basal velocities from surface measurements, Institute of Theoretical Science Seminar, University of Oregon, May 2008

Vacuum solutions of the Einstein constraint equations with freely specified mean curvature, Geometry Seminar, Stanford University, April 2008

Vacuum solutions of the Einstein constraint equations with freely specified mean curvature, Differential Geometry and PDE Seminar, University of Washington, April 2008

Determining basal velocities by inverse methods, SIAM – Geosciences'07, Santa Fe, March 2007

Measuring velocities at the bottom of a glacier: the use and limitations of inverse methods, Colloquium, University of Alaska Fairbanks, March 2007

Rough initial data, Einstein Constraint Equations Workshop, Cambridge University, December 2005

The continuing effectiveness of the conformal method of solving the Einstein constraint equations, Colloquium, University of Oregon, May 2005

Rough solutions of the Einstein constraint equations on compact manifolds, Differential Geometry and PDE Seminar, University of Washington, January 2005

Initial data for black hole spacetimes, Colloquium, University of Alaska Fairbanks, September 2004

Solutions of the constraint equations with apparent horizon boundaries, Miami Waves 2004, University of Miami, January 2004

A boundary value problem for the Einstein constraint equations, AIM/Stanford Mathematical Relativity Workshop, Stanford University, November 2003

On the regularity of time dependent non-Newtonian flow, International Conference on Navier-Stokes Equations: Theory and Numerical Methods. Varenna, Italy, June 1997

On an elliptic regularity theorem useful in the theory of non-Newtonian flow, Sixth International Conference on Navier-Stokes Equations And Related Nonlinear Problems. Palanga, Lithuania, May 1997

Awards

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| Nominated: UAF College of Engineering and Mines Teacher of the Year | 2024 |
| Nominated: UAF Piacenza Teaching Award | 2023 |
| General Relativity and Quantum Cosmology Highlights of the Year | 2014-2015 |
| UAF College of Natural Sciences and Mathematics Outstanding Teaching | 2009 |
| University of Alaska Fairbanks Travel Award | 2005 |
| University of Washington Macfarlane Fellowship | 2003–2004 |
| University of Washington Microsoft Scholarship | 2000–2004 |
| NSERC Postgraduate Scholarship B | 2000–2002 |
| NSERC Postgraduate Scholarship A | 1995–1997 |

Teaching Experience

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|--------------------------|---|-----------|
| Professor | University of Alaska Fairbanks | 2019– |
| Associate Professor | University of Alaska Fairbanks | 2011-2019 |
| Assistant Professor | University of Alaska Fairbanks | 2005–2011 |
| Term Assistant Professor | University of Alaska Fairbanks | 2004–2005 |
| Teaching Assistant | MSRI Summer Workshop in Mathematical Graphics | 2003 |
| Teaching Assistant | University of Washington | 2000–2004 |
| Teaching Assistant | University of British Columbia | 1995–1996 |

Other Experience

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|--------------------|----------------------------------|------------|
| Software Developer | CreoScitex, Vancouver, BC | 1999–2000 |
| Software Developer | University of British Columbia | 1997–1998 |
| Intern | Waterloo Maple Software | 1993, 1994 |
| Intern | Canada Centre for Remote Sensing | 1992, 1993 |