David Carchedi

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Research Interests

- Higher Category Theory, and its applications to topology and geometry
- Derived $\mathbf{C}^\infty$-(super)geometry
- Higher Topos Theory
- Mathematical Physics / Quantum Field Theory
- Étale Homotopy Theory
- Logarithmic geometry
- Motivic homotopy theory
- K-theory (étale, logarithmic...)

Employment

2015–Present **Assistant Professor**, *George Mason University*, Fairfax, VA, USA.

2014–2015 **Postdoc**, *University of British Columbia*, Vancouver, Canada.

2011–2014 **Postdoc**, *Max Planck Institute for Mathematics (MPI)*, Bonn, Germany.

Education

2007–2011 **Ph.D. in Pure Mathematics**, *Utrecht University*, The Netherlands.

— Thesis

Categorical Properties of Topological and Differentiable Stacks

adviser Ieke Moerdijk

2006–2007 **Master Class in "Symplectic Geometry and Beyond"**, *Mathematical Research Institute*, The Netherlands.

— Thesis

title *Path Groupoids as an Exponent for Smooth Étendue.*

adviser	Ieke Moerdijk
2004–2008	**M.Sc. Pure Mathematics**, *Purdue University*, West Lafayette, IN, USA.
Fall of 2002	**"Math in Moscow" program**, *Independent University of Moscow*, Moscow, Russia.
2000–2004	**B.Sc. Mathematics**, *Worcester Polytechnic Institute*, Worcester, MA, USA.
2000–2004	**B.Sc. Physics**, *Worcester Polytechnic Institute*, Worcester, MA, USA.
—	Undergraduate Thesis (For both majors)
title	*Gravitational Fields of Azimuthally Symmetric Bodies in General Relativity*
math adviser	Mayer Humi
physics adviser	Lok C. Lew Yan Voon

Awarded Grants

2018 **NSF Topology**, *Proposal Title:* ***Derived Differential Geometry and Field Theory***, collaborative proposal with Owen Gwilliam, Award 1811864.

Grants Under Consideration

2020 **NSF CAREER**, *Proposal Title:* ***Career: Derived Differential Geometry and Quantization***.

Award Nominations

2018 **Nominated for 2019 Mason Teaching Excellence Award**.

Publications

1) Carchedi, D., Higher orbifolds and Deligne-Mumford stacks as structured infinity- topoi, *Memoirs of the Amer. Math. Soc.* 264 (2020), no. 1282 (120 pages).
2) Carchedi, D. Étale Stacks as Prolongations
Advances in Mathematics, Volume 352, 20 August 2019, Pages 56-132
3) Carchedi, D. Scherotzke S., Sibilla, N., and Talpo, M. Kato-Nakayama spaces, infinite root stacks, and the profinite homotopy type of log schemes. *Geometry & Topology*, Volume 21, Issue 5, 2017, Pages 3093–3158.
4) Carchedi, D. On the homotopy type of higher orbifolds and Haefliger classifying spaces

Advances in Mathematics, Volume 294, 2016, Pages 756–818.

5) Carchedi, D. Erratum: "An Étalé Space Construction for Stacks". *Journal of Algebraic and Geometric Topology*, Volume 16, Issue 1, 2016, Pages 541–546.
6) Carchedi, D. and Roytenberg, D. On Theories of Superalgebras of Differentiable Functions
Theory and Applications of Categories Volume 28, No. 30, 2013, Pages 1022–1098.
7) Carchedi, D. An Étalé Space Construction for Stacks.
Journal of Algebraic and Geometric Topology, Volume 13, Issue 2, 2013, Pages 831–903.
8) Carchedi, D. Compactly Generated Stacks: A Cartesian Closed Theory of Topological Stacks.
Advances in Mathematics, Volume 229, Issue 6, April 1 2012, Pages 3339–3397.

Pre-prints

1) Carchedi, D., Steffens, P., *On the Universal Property of Derived Manifolds.* arXiv:1905.06195 (2019) (59 pages)
2) Carchedi, D. Scherotzke S., Sibilla, N., and Talpo, M., *On the profinite homotopy type of log schemes.* arXiv:1810.05544 (2019) (37 pages)
3) Carchedi, D., Elmanto, E., *Relative étale realizations of motivic spaces and Dwyer-Friedlander K-theory of non-commutative schemes.* arXiv:1810.05544 (2018) (81 pages)
4) Carchedi, D. *Étale homotopy types of higher stacks.* arXiv:1511.07830 (2015) (60 pages)
5) Carchedi, D. and Roytenberg, D. *Homological Algebra for Superalgebras of Differentiable Functions* arXiv:1212.3745 (2012) (62 pages)
6) Carchedi, D. *Sheaf Theory for Étale Geometric Stacks* arXiv:1011.6070 (2010) (74 pages)

Refereeing

I have refereed papers for:

- Memoirs of the AMS
- Geometry & Topology
- Advances in Mathematics
- Mathematische Zeitschrift
- Kyoto Journal of Mathematics

Reviewing

I served as a reviewer for:

- the NSF (panel reviewer)
- the NSF (external reviewer)

- French National Research Agency (external reviewer)

Funded Visiting Positions

Jun. 2018 - Jun. 2019 **Visiting Scientist**, *Max Planck Institute for Mathematics*, (on sabbatical).

Jun.-Aug. 2017 **Visiting Scientist**, *Max Planck Institute for Mathematics*.

Jun.-Aug. 2016 **Visiting Scientist**, *Max Planck Institute for Mathematics*.

Visiting Scholar Positions

Jan.- May 2014 **Visiting Scholar**, *University of California, Berkeley*.

Summer 2013 **Visiting Scholar (Topology Group)**, *Massachusetts Institute of Technology*.

Summer 2012 **Visiting Scholar (Topology Group)**, *Massachusetts Institute of Technology*.

Summer 2010 **Visiting Scholar (Topology Group)**, *Massachusetts Institute of Technology*.

Summer 2009 **Visiting Scholar (Topology Group)**, *Massachusetts Institute of Technology*.

Teaching Experience

Spring 2020 George Mason University
Discrete Math (two sections)

Fall 2019 George Mason University
Discrete Math

Fall 2019 George Mason University
Category Theory (graduate)

Spring 2018 George Mason University
Moduli Spaces and Invariant Theory (graduate).

Spring 2018 George Mason University
Calculus II.

Fall 2017 George Mason University
Calculus II (two sections)

Spring 2017 George Mason University
Algebraic Topology (graduate)

Fall 2016 George Mason University
Category Theory (graduate)

Spring 2016	George Mason University Topology (graduate)
Fall 2015	George Mason University Abstract Algebra (undergraduate)
Spring 2015	University of British Columbia Calculus II
Spring 2013	University of Bonn. Topos Theory (graduate).
Spring 2013	MPI Taught a mini-course entitled "A Differential Graded Approach to Derived Differential Geometry."
Utrecht University	Teaching Assistant (TA) for Linear Algebra (Fall 2007, Fall 2010), Vector Calculus (Fall 2007), Differentiable Manifolds (Master course) (Spring 2008), Group Theory (Fall 2008, Fall 2009), Real Analysis (Spring 2009), Multivariable Real Analysis (Spring 2010), Functions and Series (Fall 2010).
GEX Inc.	Content designer for educational mathematics software accompanying college calculus textbooks (Summer 2006)
Purdue University	Teaching Assistant (TA) for Integral Calculus for Engineers (Fall 2005) and Taylor Series for Engineers (Spring 2006)
Norwood High School	Substitute Math Teacher (during undergraduate breaks)

Seminars Organized

Spring 2020–Present	Primary organizer of TADS seminar , GMU
Fall 2017–Fall 2019	Co-organizer of TADS seminar , GMU
Spring 2012-Summer 2014	Co-organizer of the "Higher Differential Geometry" seminar at the MPI, together with Christian Blohmann and Peter Teichner.

Advising Experience

2018 George Mason Unversity

Organized an undergraduate research project on *The Riemann-Hilbert correspondence* as part of MEGL (Mason's experimental geometry lab).

2011 Utrecht University

Joint supervision of Camilo Angulo's master class thesis, together with Ieke Moerdijk.

Professional Service and Outreach

Fall 2017–Present: Primary faculty mentor of GMU's **Association for Women in Mathematics** (AWM)

Fall 2017–Present: Math department representative on the curriculum committee at GMU

March 2017: Suggested and helped organize the AWM event "Professional Development Event for Aspiring Mathematicians," GMU

Conference and Workshop Talks

May 2019: **Invited Speaker**,
"The universal property of derived manifolds",
Current Directions in Homotopical Algebra
IBS Center for Geometry and Physics, Pohang, Korea

January 2019: **Invited Speaker**,
"Dg-manifolds and a universal property for derived manifolds",
Higher Geometric Structures along the Lower Rhine XII
Radboud University Nijmegen, the Netherlands

May 2018: **Invited Speaker**,
"Galois Equivariant Étale Realization of Motivic Spaces"
Infinity-Categories, Infinity-Operads, and their Applications
Casa Matemática Oaxaca, Mexico (Banff research station)

September 2017: **Invited Speaker**,
"Galois Equivariant Étale Realization" **Étale and Motivic Homotopy Theory**,
University of Heidelberg, Germany

July 2017: **Invited Speaker**,
"Higher Orbifolds as Structured Infinity-Topoi" **Higher Structures Lisbon**,
Instituto Superior Técnico, Lisbon, Portugal

June 2016: **Contributed Talk**,
"Dg-manifolds as derived manifolds. " **GAP XIV: Graded geometry and applications to physics**,
University of Sheffield, UK

June 2016: **Invited Speaker**,
"Étale homotopy types of higher stacks" **Higher structures in geometry and physics**,
University of Melbourne, Creswick campus MATRIX center, Australia

October 2014 **Invited Speaker**,
"Dg-manifolds as derived manifolds" **Higher Structures in Geometry and Physics 2014**,
University of Geneva, Switzerland

October 2014 **Invited Speaker**,
"Dg-manifolds as derived manifolds" **AMS Western Sectional Meeting, Special Session on Homotopy Theory**,
San Francisco State University, San Francisco, CA

March 2014 **Invited Speaker**,
"A differential graded approach to derived manifolds" **Geometry, Topology and Physics Workshop**,
University of Pittsburgh, PA, USA

October 2013 **Invited Speaker**,
"Dg-supermanifolds as derived supermanifolds" **String Geometry Meeting**,
MPI, Bonn, Germany

January 2012 **Invited Speaker**,
"Sheaf theory for étale stacks",
Higher Structures Along the Lower Rhine I,
MPI, Bonn, Germany

June 2009 **Invited Speaker**,
"Compactly Generated Stacks",
Link to Notes: Compactly Generated Stacks,
CRCG Workshop - Higher Structures in Topology and Geometry III,
Göttingen, Germany

May 2009 "Introduction to Topological Stacks"
"Compactly Generated Stacks",
Topology in the Swiss Alps,
Le Châtelard, Switzerland

May 2008 "Lie Groupoids, Smooth Stacks, and Foliation Theory",
Topology in the Swiss Alps,
Le Châtelard, Switzerland

April 2008 "Foliations and Mapping Stacks of Groupoids",
Workshop on Topological and Differentiable Stacks,
CRM, Bellaterra, Spain

April 2003 "Lie Groups and Quantum Mechanics"
"Representation Theory's 'Toughest' Theorem",
Hudson River Undergraduate Mathematics Conference,
Union College, NY, USA

April 2002 "Pythagorean Triplets",
Hudson River Undergraduate Mathematics Conference,
Hamilton College, NY, USA

Invited Seminar Talks

March 2019 "What are derived manifolds?",
Mathematics and String Theory Seminar, Kavli Institute for the Physics and Mathematics of the Universe, Tokyo

November 2018 "Galois-Equivariant Étale Realization of Motivic spaces and semi-topological K-Theory",
Topology Seminar, University of Münster

November 2018 "The Universal Property of Derived Manifolds",
Department Colloqium, Trinity College, Dublin

October 2018 "Dg-Manifolds and a Universal Property for Derived Manifolds",
Topology Seminar, University of Copenhagen

April 2017 "Dg-manifolds as a model for derived manifolds",
Topology Seminar, University of Virginia

December 2016 "Dg-manifolds as a model for derived manifolds",
Topology Seminar, John Hopkins

October 2016 "Dg-manifolds as a model for derived manifolds",
Joint Cornell-PennState Symplectic Seminar, PennState

September 2016 "A new approach to étale homotopy theory",
Algebra-Number Theory Seminar, University of Maryland

July 2016 "A new approach to étale homotopy theory",
Topology Seminar, University of Osnabrück

April 2016 "A new approach to étale homotopy theory",
Topology Seminar, University of Illionois at Urbana-Champaign

August 2014 "Dg-manifolds as derived manifolds",
MPI-Oberseminar

September 2013 "A Differential Graded Approach to Derived Manifolds", **Topology Seminar, Massachusetts Institute of Technology**

September 2013 "A Differential Graded Approach to Derived Manifolds", **Topology Seminar, University of Illinois at Urbana-Champaign**

September 2013 "A Differential Graded Approach to Derived Manifolds", **Topology Seminar, University of California, Berkeley**

March 2013 "A Differential Graded Approach to Derived Differential Geometry", **Utrecht University**

April 2012 "Sheaf Theory for Étale Differentiable Stacks and Foliation Theory", **Sapienza Università di Roma**

September 2010 "Compactly Generated Stacks", **Massachusetts Institute of Technology**

August 2010 "Compactly Generated Stacks", **University of Chicago**

July 2010 "Compactly Generated Stacks", **University of California, Riverside**

Other Seminar Talks

2018 **Seminar on K-Theory and TC of Henselian Pairs, University of Bonn**
Psuedocoherent functors

2018 **Deformation Theory Seminar, MPI**
Proof of Lurie's main theorem

2018 **Topology, Algebra, and Dynamics Seminar, George Mason**
Homotopy types of moduli spaces of foliations

2017 **Topology, Algebra, and Dynamics Seminar, George Mason**
Manifolds, Schemes, Deligne-Mumford stacks, and Orbifolds: Why they're all topoi

2016 **Higher Differential Geometry, MPI**
A new approach to étale homotopy theory

2015 **Topology, Algebra, and Dynamics Seminar, George Mason**
A new approach to étale homotopy theory

2015 **Combinatorics, Algebra, and Geometry Seminar, George Mason**
Differential graded manifolds as a model for derived manifolds

2014 **UBC Topology Seminar**
Differentiable Stacks and Foliation Theory Part II

2014 **UBC Topology Seminar**
Differentiable Stacks and Foliation Theory Part I

2014 **Seminar on Factorization Algebras, UC Berkeley**
The Factorization Condition

2013 **Graduate Student Seminar on Higher Categories II, MPI**
The Unicity Theorem for (∞, n)-categories.

2013 **Graduate Student Seminar on Higher Categories I, MPI**
The Homotopy Hypothesis.

Summer 2012 **Higher Differential Geometry Seminar, MPI**
Algebraic Theories and Super C^∞-rings.

Spring 2012 **Goodwillie Calculus, University of Bonn**
Homogeneous functors and cross-effects

2009-2010 **Model Categories and Higher Topos Theory, Utrecht University**
· Bergner's model structure on simplicial categories,
· The covariant model structure and the ∞-Grothendieck construction,
· Left-exact localizations and ∞-topoi

Spring 2009 **Seminar on Calabi-Yau Geometry and Mirror Symmetry, Utrecht University**
· A combinatorial model for the canonical bundle of a smooth toric variety,
· Canonical divisors, complex vector bundles, and the Adjunction Formula

Spring 2009 **Operads and Iterative Loop Spaces, Utrecht University**
· Geometric realization of simplicial spaces,
· Proof of the recognition principle for iterative loop spaces

Spring 2009 **Higher Operads, Higher Categories, Utrecht University**
- Multicategories and their algebras,
- Generalized endomorphism multicategories, free T-multicategories, opetopes, and structured categories.

Fall 2008 **"Friday Fish"** Seminar on Poisson Geometry, Utrecht University
- Poisson Structures,
- Symplectic groupoids and the integration of Poisson Lie algebroids

Fall 2008 **Stable Homotopy Theory, Utrecht University**
Eilenberg-Maclane spectra, Brown's representation theorem, K-theory, and connective spectra

Spring 2008 **Twisted K-Theory, Utrecht University**
- Twisted K-theory via bundles of projective space,
- Calculation of equivariant twisted K-groups of the adjoint action of a simple, connected, simply connected compact Lie Group

Fall 2007 **Higher Topos Theory, Utrecht University**
The homotopy-coherent nerve and the homotopy category of an ∞-category.

Fall 2006 **Lie Groupoids and Algebroids, Utrecht University**
Integration of Lie algebroids

Fellowships

2006-2007 Master Class fellowship, MRI

2004-2006 VIGRE fellow, Purdue University

Undergraduate Awards

2004 Senior Math Award

2004 Provost MQP (Senior Thesis) Award - Department of Mathematics

2004 Provost MQP Award - Department of Physics

2004 Putnam Exam Award* - Department of Mathematics

2002 Bulletin Board Award - Department of Mathematics

*name published in national ranking of top participants.

Professional Affiliations

2001-2004 Pi Mu Epsilon - National Mathematics Honors Society
President of WPI chapter

Miscellaneous

Citizenship: USA

Languages: English: Fluent
French: Verbally fluent, can read/write at a moderate level
Dutch: Conversational
German: Beginner, but learning more.