

DEREK K. WISE

CURRICULUM VITAE

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EDUCATION

Ph.D. in Mathematics, University of California, Riverside, June 2007

Advisor: Professor **John C. Baez**

Thesis title: *Topological Gauge Theory, Cartan Geometry, and Gravity*

M.S. in Mathematics, University of California, Riverside, March 2004

B.S. in Physics, Abilene Christian University, May 1998

B.A. in Mathematics, Abilene Christian University, May 1998

RESEARCH INTERESTS

Physics: quantum gravity and topological quantum field theory.

Mathematics: Cartan geometry, algebraic and geometric topology, higher categories.

PROFESSIONAL EXPERIENCE

VIGRE Postdoctoral Fellow and *Visiting Research Assistant Professor* (July 2007 – present)

Department of Mathematics, University of California, Davis.

Graduate Instructor (Summer 2006, Spring 2007)

Department of Mathematics, University of California, Riverside.

Associate in Mathematics (Summers 2004, 2005)

Department of Mathematics, University of California, Riverside.

Graduate Teaching Assistant (Fall 2003 – Spring 2007)

Department of Mathematics, University of California, Riverside.

Physicist (Sept. 2000 – Sept. 2002)

ITT Advanced Engineering and Sciences, Colorado Springs, Colorado.

(Modeling and simulation for orbital vehicles, and radiation effects on electronics.)

Environmental Scientist/Gamma Spectroscopist (Mar. 1999 – Sept. 2000)

Benchmark Environmental Corporation, White Rock, New Mexico.

(Gamma nondestructive assay for decommissioning former nuclear facilities, development of gamma spectroscopy modeling techniques, analysis of environmental data. Worksites at Los Alamos National Laboratory, and Rocky Flats Environmental Technology Site)

Research Assistant (1994–1998)

High Energy Physics Research Group, Abilene Christian University, Abilene, Texas.

(Research conducted at Fermi National Accelerator Laboratory (Experiment 866), and Paul Scherrer Institute.)

Lab Instructor / Teaching Assistant (most semesters, 1993–98)

Physics Department, Abilene Christian University, Abilene, Texas.

LANGUAGE SKILLS

English: native.

German: good reading and writing skills, basic conversational ability.

PAPERS

<http://math.ucdavis.edu/~derek/papers.html>

Papers in progress

1. *Extended topological quantum field theories from compact Lie groups*, with Jeffrey Morton.
2. *The geometry of 2-group representations*, with Aristide Baratin

Papers on mathematics and mathematical physics

3. *2-Group representations for spin foams*, with Aristide Baratin, to appear in the proceedings of the XXV Max Born Symposium: “The Planck Scale,” Wrocław, Poland. [arXiv:0910.1542\[hep-th\]](#).
4. *Symmetric space Cartan connections and gravity in three and four dimensions*, SIGMA **5** (2009), 080, 18 pages. Contribution to the Special Issue “Élie Cartan and Differential Geometry.” [arXiv:0904.1738\[math.DG\]](#).
5. *Infinite-dimensional representations of 2-groups*, with John Baez, Aristide Baratin, and Laurent Freidel. [arXiv:0812.4969\[math.QA\]](#).
6. *Topologically massive AdS gravity*, with Steve Carlip, Stanley Deser, and Andrew Waldron, *Phys. Lett. B* **666** (2008) 272276. [arXiv:0807.0486\[hep-th\]](#).
7. *Cosmological topologically massive gravitons and photons*, with Steve Carlip, Stanley Deser, and Andrew Waldron, *Class. Quantum Grav.* **26** (2009) 075008. [arXiv:0803.3998\[hep-th\]](#).
8. *MacDowell–Mansouri gravity and Cartan geometry*, [arXiv:gr-qc/0611154](#).
9. *Exotic statistics for strings in 4d BF theory*, with John Baez and Alissa Crans, *Adv. Theor. Math. Phys.* **11** (2007) 707–749. [arXiv:gr-qc/0603085](#).
10. *p-form electromagnetism on discrete spacetimes*, *Class. Quantum Grav.* **23** (2006) 5129–5176.
11. *Lattice p-form electromagnetism and chain field theory*, [arXiv:gr-qc/0510033](#).

Papers from my undergraduate research in particle physics

All papers in this section are in collaboration with FermiLab Experiment 866 (NUSEA) members.

12. *Measurement of angular distributions of Drell-Yan dimuons in $p + p$ interactions at 800 GeV/c*, *Phys. Rev. Lett.* **102**, 182001 (2009). [arXiv:0811.4589\[nucl-ex\]](#)
13. *Measurement of Υ production for $p + p$ and $p + d$ interactions at 800 GeV*, *Phys. Rev. Lett.* **100**, 062301 (2008). [arXiv:0710.2344\[hep-ex\]](#).
14. *Measurement of decay angular distributions of Drell-Yan events for $p d$ interaction at 800-GeV/c*, *AIP Conf. Proc.* **870** (2006) 681.
15. *Measurement of angular distributions of Drell-Yan dimuons in $p + d$ interaction at 800 GeV/c*, *Phys. Rev. Lett.* **99**, 082301 (2007). [arXiv:hep-ex/0609005](#).
16. *Measurement of the absolute Drell-Yan dimuon cross section in 800 GeV/c proton-proton and proton-deuterium collisions*, *AIP Conference Proceedings* **698** (5 February 2004) 100-104. [arXiv:hep-ex/0302019](#).
17. *Improved Measurement of the \bar{d}/\bar{u} asymmetry in the nucleon sea*, *Phys. Rev. D* **64**, 052002, 2001 (20 March 2001). [arXiv:hep-ex/0103030](#).
18. *Observation of polarization in bottomonium production at $\sqrt{S} = 38.8$ GeV*, *Phys. Rev. Lett.* **86** (19 March 2001) 2529-2532
19. *Light antiquark flavor asymmetry in the nucleon sea*, *Nucl. Phys.* **A663** (2000) 284-287.
20. *Measurement of the light antiquark flavor asymmetry in the nucleon sea*, *Phys. Rev. Lett.* **80** 3715 (1998). [arXiv:hep-ex/9803011](#).

21. \bar{d}/\bar{u} asymmetry and the origin of the nucleon sea, *Phys. Rev. D* **58**, 092004 (1998). [arXiv:hep-ph/9804288](https://arxiv.org/abs/hep-ph/9804288).

INVITED PRESENTATIONS AND WORKSHOPS

1. Invited participant at the *ESI Workshop on Gravity in Three Dimensions*, Erwin Schrödinger Institute, Vienna, 14–18 April 2009
<http://quark.itp.tuwien.ac.at/~gravity/>
2. Invited speaker at the *Categorical Groups Workshop*, Universitat Autònoma de Barcelona, Barcelona, Spain, 16–20 June 2008. I presented a 3-hour mini course on:
Representations of 2-groups on Higher Hilbert Spaces,

PRESENTATIONS

Abstracts and slides at <http://math.ucdavis.edu/~derek/talks.html>

1. *2-Group Representations for Topological Gauge Theory and Gravity*
XXV Max Born Symposium: *The Planck Scale*, Wrocław, Poland.
2. *Topologically Massive AdS Gravity*, 27 March 2009.
25th Pacific Coast Gravity Meeting, University of Oregon, Eugene.
3. *2-Groups and their Representations* (Parts I & II), 15 and 22 January 2009. String Theory Seminar, University of California, Davis.
4. *Topologically Massive 3d Gravity*, Centre de Physique Théorique, Marseille, France, 4 September 2008.
5. *Topologically Massive Gravity with a Cosmological Constant*, XVIIth Oporto Meeting on Geometry, Topology, and Physics (Approaches to Quantum Gravity), Universidade do Porto, 10–13 July 2008.
6. *Topologically Massive Gravity with a Cosmological Constant*, Quantum Gravity and Quantum Geometry (QG² 2008), University of Nottingham
7. *Particles and Strings in BF Theory and Gravity*, 11 January 2008.
Quantum Gravity and Strings Seminar, University of California, Davis.
8. *Which 4-manifolds admit symplectic structures?* 2 December 2007.
University of California, Davis.
9. *Gravity and Cartan Geometry*, 16 November 2007.
String Theory Seminar, University of California, Davis.
10. *A Tour of Homogeneous Spacetimes*, 16 November 2006.
Quantum Gravity Seminar, University of California, Riverside.
11. *Spacetime Geometry and Cartan Connections*, 16 March 2007
23rd Pacific Coast Gravity Meeting, Caltech, Pasadena.
12. *Loop Braids and Quandles*, 24 October 2006.
University of Ottawa, Ottawa, Ontario, Canada.
13. *Volumetric Field Theory*, 21 October 2006.
[Category Theory Octoberfest](#), University of Ottawa, Ottawa, Ontario, Canada.
14. *Higher Electromagnetism and Volumetric Field Theory*, 18 October 2006.
Topology Seminar, University of California, Riverside.
15. *Exotic Statistics and Particle Types in 3- and 4d BF Theory*, 13 July 2006.
[Perimeter Institute for Theoretical Physics](#), Waterloo, Ontario, Canada
16. *Group-valued momentum and exotic statistics in BF theory*, 4 July 2006.
University of Western Ontario, London, Ontario, Canada.
17. *Chain Field Theory*, 29 June 2006.
International Category Theory Conference, [CT 2006](#), White Point Beach, Nova Scotia, Canada.
18. *Discrete p-form electromagnetism as a Chain Field Theory*, 11 October 2005
[LOOPS '05](#) conference on background-free quantum gravity, [Albert Einstein Institut](#), Golm, Germany.

19. *Lagrangians for General Relativity: Palatini and MacDowell-Mansouri formulations*, 7 February 2006. Quantum Gravity Seminar, University of California, Riverside.
20. *The Geometry of MacDowell-Mansouri Gravity*, 9 February 2006. Quantum Gravity Seminar, University of California, Riverside.
21. *Electricity, Magnetism, and Hypercubes*, 16 September 2005. Abilene Christian University.
22. *Lattice p -form Electromagnetism*, 1 September 2005. Joint Math/Physics colloquium at the University of Colorado at Colorado Springs.
23. *Lattice p -form Electromagnetism I & II*
Mathematical Physics Seminar, University of California, Riverside.
 - Part I: *Electromagnetism and Discrete Spacetime*, 17 February 2005.
 - Part II: *Path Integral Quantization*, 24 February 2005
24. *NUSEA's Detector at FermiLab: The Meson-East Spectrometer*, 27 October 1995. Joint Meeting of the Texas Sections of the American Physical Society and American Association of Physics Teachers, Texas Tech University, Lubbock, Texas.

CONFERENCES & MINICOURSES

Conferences I have spoken at are listed under 'Presentations'. Besides these, I attended:

- Algebra and Topology in Interaction, UC Davis/MSRI Conference in honor of Professor Dmitry Fuchs on the occasion of his 70th birthday, UC Davis, 11–13 September 2009
<http://www.math.ucdavis.edu/~ekim/fuchsalgetopcon/index.php>
- 14th Summer School in Global Analysis and Mathematical Physics, Olomouc, Czech Republic, 10–14 August 2009
<http://globalanal.upol.cz/summer2009/index.html>
- XVI International Congress on Mathematical Physics, Prague, Czech Republic, 3–8 August 2009
<http://www.icmp09.com/>
- Groupoidfest, University of California, Riverside, 21–23 November 2008
<http://math.ucr.edu/~avivc/groupoidfest.html>
- Illinois/Indiana Symplectic Geometry Conference, University of Notre Dame November 8–9, 2008
- Representations of Surface Groups, CIRM, Luminy, 1–5 September 2008
<http://www.math.u-psud.fr/~repsurf/ANR/LuminyRepSurf.html>
- String Topology and Moduli Space Workshop, Stanford University, Palo Alto, CA, 24–27 March 2008.
http://math.stanford.edu/seminars/pastevents/youngmoduli_poster0308.pdf
- Barrett Lectures on Geometric Topology, University of Tennessee, Knoxville, 29 April – 1 May, 2006.

OTHER RESEARCH ACTIVITY

- [Albert Einstein Institute](#), Potsdam, Germany, July 2009. Visitor, working with Aristide Baratin.
- Organizer of NSF VIGRE research focus group *Quantum Geometry* at UC Davis, 2008–2009 academic year.
- [Albert Einstein Institute](#), Potsdam, Germany, September 2008. Visitor, working with Aristide Baratin.
- Visited the Centre de Physique Théorique, Marseille, France, September 2008. Host: [Carlo Rovelli](#)
- [Perimeter Institute for Theoretical Physics](#), Summer 2006. Short term visitor. Host: Laurent Freidel.

- [Perimeter Institute for Theoretical Physics](#), Summer 2007.
Graduate student visitor.
- [Paul Scherrer Institut](#), Villigen, Switzerland, Spring 1996, 1997.
 $\pi\beta$ Group.
- [Fermi National Accelerator Laboratory](#), Batavia, IL., Summers 1994–98.
NUSEA collaboration.

COURSES TAUGHT

<http://math.ucdavis.edu/~derek/teaching.html>

- **Graduate courses:**

Gauge Theory and Gravity, Fall 2008, UC Davis—online notes available at:

<http://www.math.ucdavis.edu/~derek/gtg/notes.html>

Topology Qualifier Preparation Seminar, Summer 2006, UC Riverside.

Complex Analysis Qualifier Preparation Seminar, Spring 2007, UC Riverside.

- **Undergraduate courses:**

Partial differential equations I & II

Differential geometry

Ordinary differential equations

Vector calculus I

- **Courses assisted:**

As teaching assistant:

Algebra, Calculus I, II, and III, Multivariable calculus I and II, Differential equations, Applied linear algebra, Non-euclidean geometry, Differential geometry I and II, Polynomials and number systems, History of Mathematics, Algebraic topology.

As laboratory instructor:

General physics, Astronomy observatory, Optics.

- **Professional:** At Benchmark Environmental Corp. in 2000, I designed and taught a 40 hour training course, *Nuclear Physics and Gamma Nondestructive Assay*, for gamma spectroscopists.

STUDENTS

I have supervised three undergraduate students on research projects:

Ricky Kwok and Shawn Hampton (Summer 2008), and

Alexander Nelson (Summer and Fall 2009)

LECTURE NOTES

I have a repository of lecture notes for the web. These notes—including notes for lectures I have given, as well as notes I have written based on lectures by John Baez—are designed to be a useful resource to students and researchers worldwide, and have received much positive feedback.

<http://www.math.ucdavis.edu/~derek/notes-index.html>

- Gauge Theory and Gravity (Lectures by Derek Wise and Andrew Waldron)
<http://www.math.ucdavis.edu/~derek/gtg/notes.html>
- Quantum Gravity Seminar (Lectures by John Baez)
<http://math.ucdavis.edu/~derek/qg/notes.html>
Quantization and Categorification, Fall 03, Winter 04, Spring 04,

Gauge Theory and Topology, Fall 04, Winter 05, Spring 05
 Quantization and Cohomology, Fall 06, Winter 07, Spring 07
 Classical versus Quantum Computation, Fall 06, Winter 07
 Cohomology and Computation, Spring 07

- Classical Mechanics (Lectures by John Baez)
<http://math.ucdavis.edu/~derek/cm/notes.html>

GRANTS, FELLOWSHIPS & AWARDS

VIGRE Postdoctoral Fellowship, University of California, Davis, under National Science Foundation grant number DMS-0636297, July 2007–present.

\$3600 travel grant from the International Association of Mathematical Physics, to attend the 2009 International Congress on Mathematical Physics (Prague, Czech Republic) and its satellite meetings.

Teaching Assistant Fellowship, University of California, Riverside, 2003–2007

Dean's Fellowship Award, University of California, Riverside, 2002–2003

Travel grants for most of the conferences and mini-courses listed, through conference organizers, graduate student association, or UCR Mathematics Dept.

Barton Award for Physics, Abilene Christian University, 1998.

Departmental Scholarship, Department of Mathematics, Abilene Christian University.

Undergraduate particle physics research supported by U.S. Department of Energy grants DE-FG05-88ER40451, DE-FG03-94ER40860, awarded to M.E. Sadler and L.D. Isenhower.

SERVICE

Organizer of NSF VIGRE research focus group on [Quantum Geometry](#) at UC Davis, 2008–2009 academic year.

Co-organizer of the String Theory Seminar at UC Davis (2007–present)

Mentor Teaching Assistant, Department of Mathematics, University of California, Riverside, 2004–2006.

MEMBERSHIPS

[ΣΠΣ](#) Physics Honor Society