# CHRISTOPHER L. ROGERS

Science,

# CONTACT INFORMATION

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## **RESEARCH AREAS**

Homological algebra, homotopy theory; applications of these to deformation theory, algebraic geometry, mathematical physics

# CURRENT ACADEMIC APPOINTMENT

2021–	Associate Professor of Mathematics (with tenure)
	Department of Mathematics & Statistics, University of Nevada, Reno.

## PRIOR APPOINTMENTS

2016-2020	Assistant Professor (tenure–track)
	Department of Mathematics & Statistics, University of Nevada, Reno.
2015–2016	Assistant Professor (tenure–track)
	Department of Mathematics, University of Louisiana at Lafayette.
2014–2015	Postdoctoral Research Associate, Institute for Mathematics and Computer
	District of Greinswald, Germany.
2011–2014	Postdoctoral Research Associate, Mathematics Institute University of Göttingen, Germany.

## VISITING POSITIONS

October 2023	Visiting Scholar School of Mathematics and Statistics, University of Melbourne Melbourne, Australia.
Spring 2020	Research member, "Higher Categories and Categorification" Program Mathematical Sciences Research Institute (MSRI) Berkeley, California, USA
July 2019	Research visitor Max Planck Institute for Mathematics Bonn, Germany
Fall 2010	Junior Research Fellow, "Higher Structures in Mathematics and Physics" Program Erwin Schrödinger Institute (ESI) for Mathematical Physics Vienna, Austria

## **EDUCATION**

2007-2011 Ph.D. in Mathematics, University of California, Riverside.

- Thesis: Higher Symplectic Geometry
- Advisor: John C. Baez
- 1998-2002 Graduate studies in Theoretical Physical Chemistry, University of Pennsylvania.
  - Research in applications of differential geometry to condensed matter theory.
  - Completed all requirements except submission of Ph.D. dissertation

1994–1998 B.S. in Chemistry with honors (minor in Mathematics), University of Scranton.

#### GRANTS

- 2023-2026 NSF Division of Mathematical Sciences (Topology Division) DMS-2305407 Derived Symmetries and the Alekseev-Torossian Conjecture: From Algebraic Geometry to Knotted Objects in Dimension 4 Principal Investigator: CLR
- 2018-2023 Simons Foundation Collaboration Grant for Mathematicians, Award #585631 Applications of Homotopical Algebra in Deformation Theory and Geometry. Principal Investigator: CLR
  - 2016 Louisiana Board of Regents Support Fund, 3 Yr Research Competitiveness Grant #098A-16 Cohomological and Homotopy-Theoretic Investigations Arising from Classical and Quantum Field Theory.
     Principal Investigator: CLR (Returned due to relocation to UNR.)
  - 2015 German National Research Foundation (DFG) 3 Year Research Grant, Project ZH 274/1-1: Homotopy Lie theory: Lie's 2nd Theorem for Lie n-groupoids. Principal Investigators: CLR, Chenchang Zhu (University of Göttingen). (CLR's support returned due to relocation to US.).
  - 2015 American Mathematical Society/Simons Foundation Travel Grant. Principal Investigator: CLR

#### AWARDS

- 2020 Westfall Scholar Faculty Mentor Award. College of Science, UNR
- 2020 Finalist, NSHE Board of Regents' Rising Researcher Award
- 2019 Finalist, NSHE Board of Regents' Rising Researcher Award
- 2019 Finalist, LeMay Award for Excellence in Teaching in the College of Science, UNR (declined further consideration)
- 2019 Nomination, UNR Alan Bible Teaching Excellence Award
- 2010 Oberwolfach Leibniz Graduate Student
- 2010 Dissertation Year Fellowship, University of California, Riverside.
- 2009 Department Qualifying Exam Award, University of California, Riverside.
- 2007 Chancellor's Distinguished Fellow, University of California, Riverside.

### **REFEREED PUBLICATIONS**

- On the Goldman-Millson theorem for A<sub>∞</sub>-algebras in arbitrary characteristic (Coauthored with A. Milham)
   Journal of Algebra vol. 632 (2023) 384–425 arXiv link 42 pages
- 2. Complete filtered  $L_{\infty}$ -algebras and their homotopy theory Journal of Pure and Applied Algebra vol. 227 (2023) 107403 arXiv link 47 pages
- Which homotopy algebras come from transfer? (Coauthored with M. Markl)
   Proceedings of the American Mathematical Society vol. 150 (2022) 975–990 arXiv link 15 pages
- An explicit model for the homotopy theory for finite type Lie n-algebras Algebraic and Geometric Topology vol. 20 (2020) 1371–1429 arXiv link 59 pages
- 5. On the homotopy theory for Lie ∞-groupoids, with an application to integrating L<sub>∞</sub>-algebras Coauthored with C. Zhu
   Algebraic and Geometric Topology

vol. 20 (2020) 1127–1219 arXiv link 93 pages

- The cohomology of the full directed graph complex Coauthored with V. Dolgushev
   Algebras and Representation Theory vol. 23 (2020) 917-961 arXiv link 45 pages
- Homotopical properties of the simplicial Maurer-Cartan functor In MATRIX Annals, MATRIX Book Series 1 D. Wood, J. de Gier, C. Praeger, T. Tao (Eds.) Springer Berlin, 2018 arXiv link 12 pages
- 8. On an enhancement of the category of shifted  $L_{\infty}$ -algebras Coauthored with V. Dolgushev

Applied Categorical Structures vol. 25 (2017) 489–503 arXiv link 15 pages

- Homotopy moment maps Coauthored with M. Callies, Y. Frégier and M. Zambon Advances in Mathematics vol. 303 (2016) 954–1043 arXiv link 90 pages
- Higher U(1)-gerbe connections in geometric prequantization Coauthored with D. Fiorenza, and U. Schreiber **Reviews in Mathematical Physics** vol. 28 (2016) 1650012-1–1650012-72 arXiv link 73 pages
- 11. Kontsevich's graph complex, GRT, and the deformation complex of the sheaf of polyvector fields Coauthored with V. Dolgushev and T. Willwacher

Annals of Mathematics vol. 182 (2015) 855–943 arXiv link 89 pages

- What do homotopy algebras form? Coauthored with V. Dolgushev and A. Hoffnung Advances in Mathematics vol. 274 (2015) 562–605 arXiv link 44 pages
- 13. A version of the Goldman-Millson Theorem for filtered  $L_{\infty}$ -algebras Coauthored with V. Dolgushev Journal of Algebra vol. 430 (2015) 260–302 arXiv link 43 pages
- 14.  $L_{\infty}$ -algebras of local observables from higher prequantum bundles Coauthored with D. Fiorenza and U. Schreiber Homology, Homotopy and Applications vol. 16 (2014) 107–142 arXiv link 36 pages
- 2-plectic geometry, Courant algebroids, and categorified prequantization Journal of Symplectic Geometry vol. 11 (2013) 53–91 arXiv link 39 pages
- A higher Chern-Weil derivation of AKSZ sigma-models Coauthored with D. Fiorenza and U. Schreiber International Journal of Geometric Methods in Modern Physics vol. 10 (2013) 1250078-1–1250078-36 arXiv link 37 pages
- 17. Notes on algebraic operads, graph complexes, and Willwacher's construction Coauthored with V. Dolgushev

Contemporary Mathematics vol. 583 (2012) 25–146 arXiv link 122 pages

- 18.  $L_{\infty}$ -algebras from multisymplectic geometry Letters in Mathematical Physics vol. 100 (2012) 29–50 arXiv link 22 pages
- Categorified symplectic geometry and the string Lie 2-algebra Coauthored with J. Baez
   Homology, Homotopy and Applications vol. 12 (2010) 221–236 arXiv link 16 pages
- Categorified symplectic geometry and the classical string Coauthored with J. Baez and A. Hoffnung Communications in Mathematical Physics vol. 293 (2010) 701–725 arXiv link 25 pages
- A geometric formulation of quantum stress fields Coauthored with A. Rappe
   Physical Review B vol. 65 (2002) 224117-1–224117-8
- 22. Unique quantum stress fields Coauthored with A. Rappe AIP Conference Proceedings vol. 582(1) (2001) 91–96
- Geometric theory of stress fields for quantum systems at finite temperature Coauthored with A. Rappe In Computer Simulation Studies in Condensed-Matter Physics XIV Springer Proceedings in Phys., 89, D.P. Landau et al (Eds.) Springer-Verlag New York, 2001

#### INVITED CONFERENCE, COLLOQUIUM, AND SEMINAR TALKS

- "Formal deformation problems and the unicity of homotopy transfer" Melbourne Topology Seminar University of Melbourne, Melbourne, Australia October 2023
- 2. "Toward a  $\mathrm{KRV}_2$  action in the derived category" Workshop on Algebra, Topology, and the Grothendieck-Teichmüller Group SwissMAP Research Station in Les Diablerets, Switzerland August 2022
- 3. "Abstract homotopical methods for concrete geometric models in Lie theory" Workshop on Poisson Geometry, Lie Groupoids and Differentiable Stacks Banff International Research Station for Mathematical Discovery, Canada June 2022

4. "Parenthesized chord diagrams, graph complexes, and Chern characters"

Cascade Topology Conference Boise State University November 2021

5. "Homotopy theory for Kan simplicial manifolds"

Peripatetic Seminar Department of Mathematics, University of Calgary April 2021

6. "Which homotopy algebras come from transfer?"

3rd International Conference on Operad Theory and Related Topics Jilin University, China September 2020

7. "From graph complexes to Chern classes"

ESI Program on Higher Structures and Field Theory Erwin Schrödinger Institute, University of Vienna, Austria **August 2020** (rescheduled due to COVID-19 pandemic)

8. "Lie's 3rd Theorem for  $L_{\infty}$ -algebras"

Deformation Theory Seminar Department of Mathematics, University of Pennsylvania **April 2020** (postponed due to COVID-19 pandemic)

- 9. "Explicit models of homotopy theories for  $L_{\infty}$ -algebras and applications" Algebraic Topology Seminar Institute of Mathematics Czech Academy of Sciences, Czech Republic July 2019
- "Homotopy theory for Kan simplicial manifolds" Geometry and Topology Seminar Department of Mathematics, University of California, Irvine April 2019
- 11. "Homotopical applications of convolution" International Conference on Operad Theory and Related Topics Anhui University, Hefei, China November 2018
- "Homotopy transfer as a deformation problem" Department Colloquium Department of Mathematical Sciences, Montana State University March 2018
- "Formal deformation problems and the unicity of homotopy transfer" Recent Developments in Noncommutative Algebra and Related Areas University of Washington, Seattle, WA March 2018

- "The unicity of homotopy transfer: A deformation theoretic proof" Special Session on Cohomology, Deformations, and Quantum Groups AMS Fall Eastern Sectional Meeting, SUNY Buffalo
   September 2017
- 15. "A homotopy theory for Lie *n*-groupoids with applications to integration and differentiation" Conference on Poisson Geometry and Stacks Fields Institute, Toronto, Canada August 2017
- "Towards an adjunction between the homotopy theories of dg manifolds and Lie ∞-groupoids" BIRS-CMO Workshop: Field Theories and Higher Structures in Mathematics and Physics Casa Matemática Oaxaca, Mexico
   June 2017
- 17. "Homotopical properties of the simplicial Maurer-Cartan functor"

Deformation Theory Seminar Department of Mathematics, University of Pennsylvania March 2017

18. "From Hamiltonian mechanics to homotopical Lie theory"

Department Seminar Department of Mathematics, University of California, Riverside December 2016

- 19. "Integrating quasi-isomorphisms between  $L_{\infty}$ -algebras" Special Session on Topology and Physics AMS 2016 Fall Central Sectional Meeting, Minneapolis, MN October 2016
- "What do homotopy algebras form?"
  Program on Higher Structures in Geometry and Physics MATRIX Research Institute, University of Melbourne, Australia June 2016
- 21. "From Hamiltonian mechanics to homotopical Lie theory"

Department Colloquium Department of Mathematics & Statistics, University of Nevada, Reno April 2016

- 22. "Equivariant cohomology and homotopy moment maps"
  ESI Program on Higher Structures in String Theory and Quantum Field Theory Erwin Schrödinger Institute, University of Vienna, Austria
   December 2015
- 23. "What do homotopy algebras form?"

Special Session on Cohomology of Algebras and Deformation Theory AMS 2015 Fall Central Sectional Meeting, Chicago, IL October 2015 24. "Equivariant cohomology, homotopy moment maps, and gauged sigma models"

Lie Group and Moduli Space Seminar University of Geneva, Switzerland April 2015

25. "From Hamiltonian mechanics to homotopical Lie theory"

Department Colloquium Department of Mathematics, University of Louisiana at Lafayette March 2015

26. "From Hamiltonian mechanics to homotopical Lie theory"

Symposium on Mathematical Physics University of Zürich, Switzerland November 2014

- 27. "What do homotopy algebras form?"
  Workshop on String Geometry and Loop Spaces University of Greifswald, Germany
   July 2014
- 28. "Symmetries of closed differential forms and Lie algebras up to homotopy"

Special Session on Symplectic and Contact Structures on Manifolds with Special Holonomy Joint Mathematics Meetings, Baltimore, MD January 2014

- 29. "What do homotopy algebras form?" Conference on Higher Lie Theory University of Luxembourg, Luxembourg December 2013
- "Geometric prequantization and homotopy Lie theory"
  Special Session on Higher Structures in Algebra, Geometry and Physics AMS 2013 Fall Eastern Sectional Meeting, Philadelphia, PA
   October 2013
- 31. " $L_{\infty}$ -algebras and geometric prequantization" Algebraic Analysis and Geometry Workshop University of Padua, Italy September 2013
- 32. "Lie algebras up to homotopy and the geometry of closed differential forms" Department Colloquium Department of Mathematics & Statistics, University of Nevada, Reno August 2013
- 33. "Geometric prequantization and homotopy Lie theory" Special Session on Mathematical Physics, Operad Theory, Algebraic Topology and Higher Categories Mathematical Congress of the Americas, Guanajuato, Mexico August 2013

34. "Higher symplectic geometry"

XXI International Fall Workshop on Geometry and Physics Universidad de Burgos, Spain August 2012

- 35. "Towards higher geometric quantization" Higher Structures in China III Jilin University, China August 2012
- 36. "Towards higher geometric quantization"

Higher Differential Geometry Seminar Max Planck Institute for Mathematics, Bonn, Germany May 2012

37. "Towards higher geometric quantization"

Mathematical Physics Seminar Department of Mathematics, University of Hamburg, Germany March 2012

38. "Lie algebras up to homotopy and generalized geometry"

Algebra and Geometry Seminar Department of Mathematics, Sapienza Università di Roma, Italy **February 2012** 

- 39. "Higher geometric quantization" Higher Structures in Mathematics and Physics 2011 University of Göttingen, Germany November 2011
- 40. "Higher symplectic geometry and geometric quantization" Quarterly Seminar on Topology and Geometry Utrecht University, Netherlands
   October 2011
- 41. " $L_{\infty}$ -algebras from higher symplectic geometry" Special Session on Physically Inspired Higher Homotopy Algebra AMS 2011 Spring Eastern Sectional Meeting, Worcester, MA April 2011
- 42. " $L_{\infty}$ -algebras from higher symplectic geometry" Deformation Theory Seminar Department of Mathematics, University of Pennsylvania **November 2010**
- 43. "Mini-course on categorified symplectic geometry"
  ESI Program on Higher Structures in Mathematics and Physics Erwin Schrödinger Institute, University of Vienna, Austria October 2010

44. " $L_{\infty}$ -algebras from multisymplectic geometry"

Differential Geometry Seminar Department of Mathematics, University of California, Riverside May 2010

45. "An invitation to higher symplectic geometry"

Seminaire Mathématique Unité de Recherche en Mathématiques, University of Luxembourg, Luxembourg January 2010

46. "Lie 2-algebras, 2-plectic geometry, and strings"

String Theory Seminar Department of Mathematics, University of California, Davis May 2009

47. "Lie 2-algebras from 2-plectic geometry"

Courant Institute Workshop: Higher Structures in Topology and Geometry II University of Göttingen, Germany **February 2009** 

# **MEETINGS (INVITATION ONLY)**

- 2023 Homotopical Algebra and Higher Structures Mathematical Research Institute of Oberwolfach (Oberwolfach, Germany) August 2024
- 2022 Higher Categories and Categorification, Part Two Universidad Nacional Autónoma de México (Cuernavaca, Mexico) June 2022
- 2022 Differentiable Stacks, Poisson Geometry and Related Geometric Structures SwissMAP Research Station (Les Diablerets, Switzerland) February 2022
- 2021 Homotopical Algebra and Higher Structures Mathematical Research Institute of Oberwolfach (Oberwolfach, Germany) September 2021
- 2010 Deformation Methods in Mathematics and Physics Mathematical Research Institute of Oberwolfach (Oberwolfach, Germany) October 2010

## **RESEARCH ADVISING AND THESES DIRECTED**

#### **Postdoctoral Researchers**

2016–2019 Dr. He Wang, University of Nevada, Reno Current position: Assistant Professor of Practice Department of Mathematics Northeastern University

## Ph.D. Students

2022 -	Sonja Farr, University of Nevada, Reno
	Thesis topic: Grothendieck-Teichmüller group in derived algebraic geometry
2019 - 2023	Dr. Alex Milham, University of Nevada, Reno
	Thesis title: "On the Goldman-Millson theorem for $A_\infty$ -algebras in arbitrary characteristic"
	Current position: Instructor
	Department of Mathematics
	Truckee Meadows Community College

2017 – 2019 Richard Foote, University of Nevada, Reno Current position: pursuing career in data science

## **Masters Students**

2019 – 2021 Jenna Moore, University of Nevada, Reno Thesis title: "Galois descent, cohomology, and conjugacy" Current position: Ph.D. student Department of Mathematics University of Utah

2018 – 2019 Aydin Ozbek, University of Nevada, Reno Thesis title: "The homotopy theory of commutative dg algebras and representability theorems for Lie algebra cohomology" Current position: Ph.D. student Department of Mathematics University of Oregon

#### **Undergraduate Honors Students**

2019 – 2020 Daniel Mallory, University of Nevada, Reno

Thesis title: "Grothendieck's *dessins d'enfants* and Belyi's classification of algebraic curves over  $\overline{\mathbb{Q}}$ "

Current position: Ph.D. student Department of Mathematics Northwestern University

2019 – 2020 Eliza Grifall, University of Nevada, Reno Thesis title: "Frobenius algebras and 2D topological quantum field theories" **TEACHING** (at University of Nevada, Reno)

Spring 2023	Math 440/640: Topology
Spring 2023	Math 742: Algebraic Topology II
Fall 2022	Math 733: Commutative Algebra
Fall 2022	Math 793: Graduate Independent Study (Model Categories)
Fall 2022	Math 773: Topics in Algebra (Operads)
Fall 2022	Math 441/641: Introduction to Algebraic Topology
Spring 2022	Math 182: Calculus II
Fall 2021	Math 780: Lie Algebras and Representation Theory
Fall 2021	Math 331: Groups, Rings, and Fields
Spring 2021	Math 780: Homotopy Theory
Spring 2021	Math 440/640: Topology
Fall 2020	Math 780: Algebraic Geometry
Fall 2020	Math 441/641: Introduction to Algebraic Topology
Fall 2019	Math 331: Groups, Rings and Fields
Fall 2019	Math 330: Linear Algebra (2 sections)
Fall 2019	Math 793: Graduate Independent Study (Deformation Theory)
Summer 2019	Math 499: Undergraduate Independent Study (Topological Quantum Field Theory)
Spring 2019	Math 499: Undergraduate Independent Study (Frobenius Algebras)
Spring 2019	Math 793: Graduate Independent Study (Lie Groups and Van Est's Theorem)
Fall 2018	Math 780: Topics in Galois Theory
Fall 2018	Math 499: Undergraduate Independent Study (Field and Galois Theory)
Fall 2018	Math 182: Calculus II
Spring 2018	Math 732: Graduate Abstract Algebra II
Spring 2018	Math 793: Graduate Independent Study (Abstract Homotopy Theory)
Spring 2018	Math 499: Undergraduate Independent Study (Module Theory)
Fall 2017	Math 731: Graduate Abstract Algebra I
Fall 2017	Math 331: Groups, Rings and Fields
Spring 2017	Math 301: Introduction to Proofs
Spring 2017	Math 499: Undergraduate Independent Study (Advanced Linear Algebra)

Fall 2016 Math 330: Linear Algebra

#### **PROFESSIONAL SERVICE**

#### Grant proposal review

202X National Science Foundation, Division of Mathematical Sciences

#### Referee (peer review) for the following research journals

Advances in Mathematics Differential Geometry and its Applications Journal of Algebra Journal of Geometry Journal of Noncommutative Geometry Journal of Symplectic Geometry Mathematical Physics, Analysis and Geometry Theory and Applications of Categories Mathematische Annalen International Mathematics Research Notices Bulletin of the London Mathematical Society

#### **Conference organization**

- 2021 Co-organizer "Special Session on Connections between Homotopical Algebra and Geometry", AMS 2021 Spring Western Sectional meeting. 1–2 May, 2021
- 2014 Co-organizer "Higher Structures in Philadelphia", Temple University, 11–13 August 2014
- 2012 Co-organizer "Higher Structures in Topology and Geometry VI", University of Göttingen,
  9–11 July 2012

### Miscellaneous

2011 - 2019 Thirty-six reviews written for Mathematical Reviews (MathSciNet ID: 888087)

**UNIVERSITY SERVICE** (selected; while at University of Nevada, Reno)

- 2022 2023 Department Annual Evaluation and Merit Committee
- 2022 Department research mentor for junior tenure-track faculty
- 2019 Algebraic and Geometric Topology Seminar organizer
- 2017 Department Colloquium Committee Chair
- 2019 2020 Mathematics TT Search Committee Member
- 2018 2021 Mathematics Graduate Program Committee
- 2016 2017 Graduate Student Recruiting Committee Member
- 2016 2017 External Department Chair Search Committee Member