

# Carson B. Connard

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## ABOUT

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Born March 30, 2002, in Merriam, KS, USA. Age: 21. United States Citizen.

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## EDUCATION

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### Kansas State University

August 2020 – May 2024

*Bachelor of Science in Mathematics, Minor in Physics, University Honors Program*

*Manhattan, KS*

- Cumulative GPA: 3.954/4.000, Concentration GPA: 4.000/4.000
- Expected Degree Hours: 146, with 42 at 700+ (graduate) level. See page 4 or click for Relevant Course List
- Math Club/IIME (President), Physics Club (Treasurer, '22), Swimming Club (Executive Board)

### Tomball High School

August 2016 – May 2020

*High School Diploma*

*Tomball, TX*

## RESEARCH

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### Cohomology Product Deformation on Symplectic Orbifolds

May 2023 – Present

*Kansas State University*

*Manhattan, KS*

- Project advised by Dr. Lino Amorim studying exotic product structures on the cohomology of dihedral twisted sectors (cf. the Chen-Ruan product for orbifolds) by way of Gromov-Witten invariants. An initial goal was to study Morse-Smale functions and a construction for a Morse complex on orbifolds. This work is the basis for an undergraduate thesis (in preparation).
- Supported by KSU College of Arts and Sciences Undergraduate Research Award.

### Functional Analysis/Spectral Theory of Operators REU

June 2022 – July 2022

*University of Tennessee at Chattanooga*

*Chattanooga, TN*

- REU participant under Dr. Roger Nichols, studying the weak convergence of the spectral shift function between two resolvent-comparable Schrödinger operators, leading to a generalization of suitable boundary conditions.
- Supported by NSF grant #1852288. “Weak convergence of spectral shift functions revisited” to appear in *Pure and Applied Functional Analysis*. Currently available at [arXiv:2211.14970](https://arxiv.org/abs/2211.14970).

### Novel Decompositions and Numerical Methods for Peridynamics

August 2021 – November 2021

*Kansas State University*

*Manhattan, KS*

- Undergraduate research assistant under Drs. Bacim Alali and Nathan Albin, supported by NSF grant #2108588.
- Attended lectures for Methods of Applied Mathematics I (MATH 855) and proved basic results regarding Fourier spectral methods and nonlocal operators, namely a nonlocal Laplacian  $L^{\delta,\beta}$  which was developed by Alali and Albin in previous publications.

## INDEPENDENT STUDIES AND DIRECTED READING PROJECTS

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### Topological $K$ -Theory/Homotopy Theory DRP | *Advised by David Marcus*

January 2024 – Present

- Reading Aguilar et al.'s *Algebraic Topology from a Homotopical Viewpoint*.

### Lie Groups DRP | *Advised by David Marcus*

August 2023 – December 2023

- Reading Kirillov's *Introduction to Lie Groups and Lie Algebras*. Topics include Lie groups and their actions on manifolds, Lie algebras, the representations of Lie groups/algebras.

### Morse Theory DRP | *Advised by Jesse Osnes, Dr. Lino Amorim*

January 2023 – May 2023

- Topics include lemma of Morse, fundamental theorems from Milnor's *Morse Theory*, Morse functions, homotopy equivalence, cellular homology, Reeb sphere theorem, Morse inequalities.

### Homological Algebra DRP | *Advised by David Marcus, Dr. Zongzhu Lin*

September 2022 – December 2022

- Topics include general category theory (categories, functors, presheaves, Yoneda lemma, limits/colimits) and an introduction to homological algebra, including additive and abelian categories.

**Functional Analysis Independent Study** | *Advised by Dr. Lizaveta Ihnatsyeva* September 2020 – May 2022

- Topics include metric spaces, topological vector spaces, measure theory, and Lebesgue integration (2020-2021); Baire Category, Hahn-Banach, F. Riesz, Banach closed graph, and Banach closed range theorems, bounded linear operators, Hilbert and Banach spaces, weak and weak\* topologies, dual spaces (2021-2022).

**Intro to Operator Algebras DRP** | *Advised by Lydia de Wolf* January 2022 – May 2022

- Topics include orthogonality, convexity, self-adjoint/normal/invertible/unitary/(partially) isometric bounded linear operators, direct sums of Hilbert spaces, Banach algebras.

**Proof Writing DRP** | *Advised by Lydia de Wolf* August 2020 – December 2020

- Topics include methods of proof for statements regarding metric spaces, distance functions, and other basic results in real analysis.

## WORKSHOPS

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**Dartmouth Scholar's Program** October 12, 2023 – October 15, 2023

*Dartmouth College*

*Hanover, NH*

- Professional development workshop held in conjunction with other STEM disciplines. Feedback was given on graduate school application packages, mock interviews, and poster presentations.
- Presented a poster "Morse-Smale Functions on Global Quotient Orbifolds."

**Northwestern Dynamics Summer School** June 19, 2023 – June 23, 2023

*Northwestern University*

*Evanston, IL*

- Workshop covering novel topics in dynamics. Lecturers include Keith Burns, Osama Khalil, Homin Lee, Kurt Vinhage (Northwestern), Alena Erchenko (Stony Brook), Raz Slutsky (Weizmann Institute of Science).
- Topics include: lattices in higher rank semisimple Lie groups, Margulis' arithmeticity and superrigidity theorems, homogeneous dynamics, Ratner's theorems, unipotent flows on quotients of Lie groups by lattices, invariant random subgroups, Kakutani equivalence of flows, flexibility principles in dynamics. [Click here for workshop information.](#)

**CMND Undergraduate Workshop – Rationality & Hyperbolicity** June 12, 2023 – June 17, 2023

*University of Notre Dame*

*Notre Dame, IN*

- Undergraduate workshop covering "projective planes and beyond" (Juan Migloire, Notre Dame) and conics, differential geometry, and elliptic curves (Brian Lehmann, Boston College). [Click here for workshop information.](#)
- Topics include: conics, Gauss' circle problem, elliptic curves, Mordell's theorem, compactification, Harnack's theorem, Falting's theorem, projective planes, Hilbert functions, Lefschetz properties, Bézout's theorem, "geproci" sets.

**CMND Undergraduate Workshop – Number Theory** May 29, 2022 – June 4, 2022

*University of Notre Dame*

*Notre Dame, IN*

- Undergraduate workshop covering algebraic curves (Claudiu Raicu), elliptic curves (Evan O'Dorney), and modular forms (Andrei Jorza). [Click here for lecture notes, problem sets, and other information.](#)
- Topics include: varieties, Hilbert function, local rings, divisors and linear equivalence, Riemann-Roch theorem, Mordell-Weil theorem, Mazur's theorem,  $L$ -functions,  $\theta$  series, Riemann surfaces, modularity theorem.

## CONFERENCES AND TALKS

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**MAA Kansas Section 2024** March 22-23, 2024

*Washburn University*

*Topeka, KS*

**Joint Mathematics Meetings 2024** January 3-6, 2024

*American Mathematical Society*

*San Francisco, CA*

**Kansas Mathematics Graduate Student Conference (Fall 2023)** December 2-3, 2023

*Kansas State University, University of Kansas*

*Lawrence, KS*

**Kansas Honors Connections Conference** November 18, 2023

*Emporia State University*

*Emporia, KS*

**Topology Seminar** November 13, 2023

*Kansas State University*

*Manhattan, KS*

**19<sup>th</sup> Prairie Analysis Seminar** November 3-4, 2023

*Kansas State University, University of Kansas*

*Manhattan, KS*

<b>Physics Undergraduate Colloquium</b> <i>Kansas State University</i>	October 30, 2023 <i>Manhattan, KS</i>
<b>Dartmouth Scholar's Program Poster Presentation Session</b> <i>Dartmouth College</i>	October 13, 2023 <i>Hanover, NH</i>
<b>MAA Kansas Section 2023</b> <i>Bethany College</i>	April 14-15, 2023 <i>Lindsborg, KS</i>
<b>Kansas Mathematics Graduate Student Conference (Spring 2023)</b> <i>Kansas State University, University of Kansas</i>	April 8, 2023 <i>Manhattan, KS</i>
<b>Function Theory Study Seminar</b> <i>Kansas State University</i>	Weekly, Spring 2023 <i>Manhattan, KS</i>
<b>Analysis Seminar</b> <i>Kansas State University</i>	Weekly, Spring 2023 <i>Manhattan, KS</i>
<b>Joint Mathematics Meetings 2023</b> <i>American Mathematical Society</i>	January 4-7, 2023 <i>Boston, MA</i>
<b>Junior M-Seminar (Mirror Symmetry/Tropical Geometry)</b> <i>Kansas State University</i>	Weekly, Fall 2022 <i>Manhattan, KS</i>
<b>MAA MathFest 2022</b> <i>Mathematical Association of America</i>	August 3-6, 2022 <i>Philadelphia, PA</i>
<b>UTC Fall Research Conference</b> <i>University of Tennessee at Chattanooga</i>	August 25-26, 2022 <i>Virtual</i>
<b>MAA Kansas Section 2022</b> <i>Benedictine College</i>	April 8-9, 2022 <i>Atchison, KS</i>

## AWARDS, PRIZES, AND SOCIETIES

<b>College of Arts and Sciences Undergraduate Research Award:</b> \$1,000 research grant	Summer 2023
<b>Thomas L. &amp; Elouise J. Miller Scholarship:</b> Awarded to outstanding mathematics students at KSU	April 2023
<b>Fung's Achievement Award:</b> Top 2023 Putnam Exam scorer at KSU	April 2023
<b>James and Gail Baxter Scholarship:</b> Awarded to outstanding mathematics students at KSU	May 2022
<b>I-Center Undergraduate Scholar (×2):</b> One of 8 recognized undergraduate researchers	May 2022, April 2023
<b>Mathematics Undergraduate Scholar:</b> Awarded to advanced mathematics students at KSU	May 2022
<b>Kansas Collegiate Mathematics Competition (×2):</b> Placed 2nd, monetary prize	April 2022, April 2023
<b>ΠME Member:</b> Unsolicited nomination to Pi Mu Epsilon Mathematics Honor Society	April 2022
<b>S. Thomas Parker Mathematics Competition:</b> Placed 1st, monetary prize	April 2022
<b>Wayne and Ellen Evans Mathematics Scholarship</b>	August 2020
<b>Semester Scholastic Honors:</b> Awarded to students with $\geq 3.75$ semester GPA	Six Semesters

## WORK EXPERIENCE

<b>Kansas State University Mathematics Department</b>   <i>Manhattan, KS</i>	August 2020 – Present
<ul style="list-style-type: none"> <li>• Spring 2024 – Advanced Grader: Intro to Algebraic Systems, Intro to Linear Algebra, Advanced Calculus II.</li> <li>• Fall 2023 – Advanced Grader: Intro to Algebraic Systems, Advanced Calculus I.</li> <li>• Spring 2023 – Advanced Grader: Advanced Calculus II.</li> <li>• Spring 2022 – Advanced Grader: Foundations of Analysis.</li> <li>• Spring and Fall 2021 – Grader: Calculus II, Calculus III.</li> <li>• Spring 2021 – Undergraduate Helproom Teaching Assistant <ul style="list-style-type: none"> <li>- Aided students on an individual basis in lower-division mathematics courses. Position terminated due to departmental budget cuts.</li> </ul> </li> <li>• Fall 2020 – Grader: Calculus I, Calculus II.</li> </ul>	
<b>Kansas State University Rock Climbing Wall</b>   <i>Manhattan, KS</i>	January 2024 – Present
<ul style="list-style-type: none"> <li>• Supervisor at the Kansas State University Recreation Center's climbing wall.</li> </ul>	
<b>Global Shop Solutions ERP Software</b>   <i>The Woodlands, TX</i>	June 2019 – August 2020
<ul style="list-style-type: none"> <li>• Full-time intern in the FAST Response Team during summer/winter breaks and pandemic, part-time otherwise.</li> <li>• Primary tasks include technical support of the Global Shop software and the PSQL/Zen DBMS, implementation of custom software requests.</li> </ul>	

## OUTREACH AND SERVICE

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<b>Assoc. for Pure &amp; Applied Mathematics Undergraduate Liaison</b> <i>Kansas State University Mathematics Department</i>	December 2023 – Present <i>Manhattan, KS</i>
<b>Mathematics Undergraduate Ambassador</b> <i>Kansas State University Mathematics Department</i>	October 2022 – Present <i>Manhattan, KS</i>
<b>Panelist for 1st-Year Mathematics Seminar (×2)</b> <i>Kansas State University Mathematics Department</i>	September 12, 2022, October 16, 2023 <i>Manhattan, KS</i>
<b>Incoming Student Preview Volunteer</b> <i>Kansas State University Mathematics Department</i>	August 19, 2022 <i>Manhattan, KS</i>
<b>Integration and Differentiation Bee Coordinator (×2)</b> <i>Kansas State University, Manhattan High School</i>	March 2022, 2023 <i>Manhattan, KS</i>

## SKILLS

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**Languages:** English, reading and writing proficiency in Spanish

**Programming Languages:** Python, SQL

**Software:** L<sup>A</sup>T<sub>E</sub>X, Office 360, .NET Framework, Git

## RELEVANT COURSE LIST

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### Mathematics Courses

*Click course number for course description.*

- Calculus III (MATH 222). Text: Prof. Ivan Blank's notes. Grade: A
- Elementary Differential Equations (MATH 340). Text: Lebl. Grade: A
- Putnam Seminar (MATH 499B). Grade: A
- Introduction to Proofs (MATH 499E). Text: Hammack. Grade: A
- Foundations of Analysis (MATH 520). Text: Bilodeau. Grade: A
- Introduction to Modern Algebra (MATH 512). Text: Artin. Grade: A
  - Completed report on Möbius transformations and  $\text{PGL}_2(\mathbb{C})$  with a peer for Honors credit.
- Introduction to Linear Algebra (MATH 515). Text: Friedberg et al. Grade: A
- History of Mathematics (MATH 570). Text: Prof. Andrew Bennett's notes. Grade: A
- Sightseeing in Mathematics (MATH 599C). Grade: A
  - Seminar covering introductory homological algebra, category theory, and representation theory as a means of introducing open research areas in mathematics to undergraduates.
- Advanced Calculus II (MATH 634). Text: Fitzpatrick. Grade: A
- Abstract Algebra I [Groups, Rings] (MATH 730 \*). Text: Dummit & Foote. Grade: A
- Introduction to Topology/Geometry I [Point-Set, Algebraic] (MATH 770 \*). Text: Munkres. Grade: A
- Real Analysis (MATH 821 ◇). Text: Folland, Rudin. Grade: A
- Complex Functions (MATH 723 \*). Text: Ahlfors. Grade: A
- Abstract Algebra II [Modules, Fields, Representations] (MATH 731 \*). Text: Dummit & Foote. Grade: A
- Introduction to Topology/Geometry II [Manifolds] (MATH 771 \*). Text: Tu. Grade: A
- Elementary Differential Geometry (MATH 772 \*). Text: do Carmo. Grade: A
- Geometric Function and Measure Theory I (MATH 823 ◇). Text: Bishop & Peres. Grade: A
- Classical and Modern Fourier Analysis I (MATH 827 ◇). Text: Duoandikoetxea. Grade: A
- Differential Topology (MATH 881 ◇). Text: Wall. Grade: A
- Topics in Analysis – Operator Algebras (MATH 992 ◇). Text: Prof. Gabriel Nagy's notes. Grade: A

### Current Enrollments

- Complex Analysis I (MATH 825 ◇). Text: Gamelin, §2, 3. Spring 2024
- Differential Geometry (MATH 882 ◇). Text: Gallot et al. Spring 2024
- Riemann Surfaces (MATH 890 ◇). Text: Forster. Spring 2024

### Other Relevant Courses

- Introduction to Computer Programming (CIS 111). Grade: A
- Engineering Physics I (PHYS 213). Grade: A

- Engineering Physics II (PHYS 214).
- Physics III, Relativity, and Quantum Physics (PHYS 325).
- Mechanics (PHYS 522). Text: Taylor.
- Introductory Probability and Statistics I (STAT 510).

Grade: B

Grade: A

Grade: A

Grade: A

\* Graduate course

◇ Graduate course contracted as MATH 799 on transcript