

# MAX CARTER

## CURRICULUM VITAE

### CONTACT INFORMATION

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Institut de recherche en mathématique et physique,  
Université catholique de Louvain,  
Louvain-la-Neuve, 1348 Belgique.

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### PERSONAL INFORMATION

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Birth: 19th July 1998 in Australia.

Nationality: Australian.

Langauages:

- English (Native);
- French (Learning, ~A2 level);
- Mandarin (Learning, ~HSK2 level);

### EDUCATION

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- 2023 – **Doctor of Philosophy (Mathematics).**  
Université catholique de Louvain.  
◦ Advisors: Pierre-Emmanuel Caprace, Timothée Marquis.  
◦ Expected completion February 2027.
- 2021 – 2023 **Master of Philosophy (Mathematics).**  
The University of Newcastle.  
◦ Thesis: On the unitary representation theory of contraction.  
◦ Advisor: George Willis. Co-advisors: Colin Reid and Stephan Törnier.
- 2020 **Bachelor of Mathematics (Honours), w/ Honours Class I and the University Medal.**  
The University of Newcastle.  
◦ Thesis: On two properties of totally disconnected locally compact groups.  
◦ Marks: 94% WAM (combined with Bachelor of Mathematics degree), 99% thesis mark.  
◦ Advisor: George Willis.
- 2017 – 2019 **Bachelor of Mathematics, with Distinction.**  
The University of Newcastle.
- 2011 – 2016 High School Certificate.  
Maitland-Grossman High School (in East Maitland, NSW, Australia).

### RESEARCH INTERESTS

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- Structure theory of locally compact groups with a focus on totally disconnected groups.
- Abstract harmonic analysis.
- Unitary representation theory of locally compact groups.
- Banach algebras and operator algebras, particularly algebras associated to locally compact groups.
- Quantum groups.

### AWARDS & HONOURS

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- 12/2021 **Graduate Speaker.**  
I was chosen to give the ‘graduate address’ at my undergraduate graduation ceremony: a speech on behalf of all graduates in my graduating cohort, akin to a ‘valedictory address’.  
◦ College of Engineering, Science and Environment, The University of Newcastle.  
◦ Associated with Bachelor of Mathematics and Bachelor of Mathematics (Honours) degrees.

- 08/2021      **University Medal.**  
 “The award of a University Medal is an honour made only when there is a candidate of sufficient merit. To be considered for this award, a graduate must have a consistent record of exceptional academic achievement at all levels of their degree program, and qualify with the highest level of the degree”.  
 ○ Issued by The University of Newcastle.  
 ○ Associated with Bachelor of Mathematics and Bachelor of Mathematics (Honours) degrees.
- 06/2021      **Faculty of Science Medal.**  
 Awarded by the Faculty of Science at The University of Newcastle to students who achieved outstanding merit throughout the course of their Bachelor and Bachelor Honours degrees.  
 ○ Issued by the Faculty of Science, The University of Newcastle.  
 ○ Associated with Bachelor of Mathematics and Bachelor of Mathematics (Honours) degrees.
- 10/2020      **Mathematics Prize in 3000 Level Mathematics.**  
 “Awarded annually to the student with the best performance, if of sufficient merit, in level 3000 mathematics courses at The University of Newcastle”. The prize was awarded to me for my studies during 2019.  
 ○ Issued by the School of Mathematical and Physical Sciences, The University of Newcastle.  
 ○ Associated with Bachelor of Mathematics degree.
- 04/2019      **Ivan Lincoln Rose Prize in Applied Mathematics.**  
 “Awarded annually to the student with the best performance, if of sufficient merit, in level 3000 applied mathematics courses at The University of Newcastle”. The prize was awarded to me for my studies during 2018.  
 ○ Issued by the School of Mathematical and Physical Sciences, The University of Newcastle.  
 ○ Associated with Bachelor of Mathematics degree.
- 2017 – 2020      Placed on the Faculty of Science Commendation List every year between 2017 and 2020 inclusive.  
 ○ Issued by The University of Newcastle.  
 ○ Associated with Bachelor of Mathematics and Bachelor of Mathematics (Honours) degrees.
- 2018 – 2020      A part of the Bachelor of Mathematics Merit Pathway.  
 ○ The University of Newcastle.  
 ○ Associated with Bachelor of Mathematics degree.
- 11/2016      Award for Outstanding Achievements in Physics and Mathematics.  
 ○ Issued by Maitland-Grossman High School.  
 ○ Associated with High School Certificate.
- 11/2016      Award for High Achievements in HSC Mathematics.  
 ○ Issued by Maitland-Grossman High School.  
 ○ Associated with High School Certificate.

## PUBLICATIONS

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### In preparation

6. (with M. Ferov) *Edge colourings of infinite graphs and their relations with groups and formal languages*, journal article.
5. (with Pierre-Emmanuel Caprace) *Representations of torsion locally compact contraction groups*, journal article.

### Preprints

4. *On the unitary representation theory of locally compact contraction*, arXiv:2311.03041.

## Published journal articles

3. (with G. Willis) *Homomorphic images of locally compact groups acting on trees and buildings*, Monatshefte für Mathematik, **200**,(2023), 507-522, <https://doi.org/10.1007/s00605-022-01690-5>.
2. (with G. Willis) *Decomposition theorems for automorphism groups of trees*, Bulletin of the Australian Mathematical Society, **103**(1), (2021), 104-112, <https://doi.org/10.1017/S0004972720000465>.
1. (with S. Tournier and G. Willis) *On free products of graphs*, Australasian Journal of Combinatorics, **78**(1), (2020), 154-176, [https://ajc.maths.uq.edu.au/pdf/78/ajc\\_v78\\_p154.pdf](https://ajc.maths.uq.edu.au/pdf/78/ajc_v78_p154.pdf).

## Other articles

- iii. *On the unitary representation theory of contraction*, Master's thesis, The University of Newcastle. To appear soon.
- ii. *On two properties of totally disconnected locally compact groups*, Honours thesis, The University of Newcastle, (2020). Available at: <https://max-carter-math.github.io/publications.html>.
- i. Report on *Free products of graphs* for AMSI Vacation Research Scholarship (2019). Available at: <https://vrs.amsi.org.au/student-profile-max-carter/>.

## TALKS

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**Bold number = invited talk**, regular number = contributed talk or other.

### 2023

19. *On the unitary representation theory of locally compact contraction groups*.  
UCLouvain group theory seminar, Louvain-la-Neuve, Belgium, 27/11/23.
18. *Group  $C^*$ -algebras and Hilbert Modules*.  
RTNCG reading seminar (online), 10/07/23
17. *An introduction to quantum groups: the harmonic analysis perspective*.  
Internal seminar, The University of Newcastle, 13/01/23.

### 2022

16. *The type I problem for tree automorphism groups*.  
66th Annual Meeting of the AustMS, UNSW, Sydney, Australia, 07/12/22.
15. *On the unitary representation theory of amenable automorphism groups of trees*.  
Internal seminar, The University of Newcastle, 25/11/22.
14. *Amenability*.  
Internal seminar, UNSW, online, 21/10/22.
13. *An introduction to geometric group theory*.  
Internal seminar, UNSW, online, 16/09/22.
12. *Unitary representations of scale and contraction groups via the Mackey little group method*.  
UCLouvain group theory seminar, Louvain-la-Neuve, Belgium, 21/06/22.
11. *Unitary representations and the type I property of groups acting on trees*.  
Symmetry in Newcastle colloquium, The University of Newcastle, 01/04/22.
10. *Unitary representations and group algebras of scale groups*.  
Confirmation seminar, The University of Newcastle, 17/03/22.

### 2021

*Graduate address.*

9. College of Eng., Sci. and Envi. graduation ceremony, The University of Newcastle, 13/12/21.

*Representation theory of locally compact groups: spherical and induced representations.*

8. Local seminar, The University of Newcastle, 16/09/21.

*Cartan-like decompositions of totally disconnected locally compact groups.*

7. Australian Algebra Conference (AAC04) (online), 18/01/21.

*Cartan-like decompositions of totally disconnected locally compact groups.*

6. Postgraduate Group Theory Conference 2020 (online), 15/01/21.

## 2020

*Two properties of totally disconnected locally compact groups.*

5. Honours thesis seminar, The University of Newcastle, 26/11/20.

*Two properties of totally disconnected locally compact groups.*

4. Local seminar, The University of Newcastle, 24/07/20.

## 2019

*Decomposition theorems for automorphism groups of trees.*

3. Local seminar, The University of Newcastle, 07/11/19.

*Free products of graphs.*

2. AMSI Connect Conference, University of Melbourne, 08/02/19.

## 2018

*Free products of graphs.*

1. Local seminar, The University of Newcastle, 15/12/18.

## RESEARCH VISITS

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06/2022	Research visit in the group theory research group at the Université catholique de Louvain. Worked on a paper with Lancelot Semal (20/06/2022 – 30/06/2022).
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## EVENT ORGANISATION

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02/09/2022	Chaired session at the World of Group Craft II conference See the following website for more details on the conference: <a href="https://sites.google.com/view/world-of-groupcraft-2">https://sites.google.com/view/world-of-groupcraft-2</a>
12/2021 –	<b>Founder and co-organiser of the Australian Postgraduate Algebra Colloquium.</b> See the APAC website for more details on the colloquium: <a href="https://www.apacmath.org">https://www.apacmath.org</a> .
08/2021 – 01/2022	Co-host of the $(GT)^2$ Graduate Symposium. See the $(GT)^2$ website for more details on the symposium: <a href="https://www.maths.usyd.edu.au/u/GTSquared/">https://www.maths.usyd.edu.au/u/GTSquared/</a> .

## SCHOLARSHIPS & GRANTS

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07/2022	Accommodation funding to attend “Operator algebras, dynamics and groups” conference. 4200 DKK, funded by the University of Copenhagen mathematics department.
01/2021 – 01/2023	<b>Australian government Research Training Program (RTP) scholarship.</b> \$60951 AUD, awarded by the Australian Government and The University of Newcastle.

12/2020 – 02/2021	Undergraduate summer research scholarship. \$3000 AUD, awarded by The University of Newcastle.
12/2019 – 02/2020	Faculty of Science summer research scholarship. \$3000 AUD, awarded by The University of Newcastle.
01/2020	AMSI summer school travel and accommodation grant. ~ \$2000 AUD, funded by the Australian Mathematical Sciences Institute.
11/2018 – 02/2019	AMSI vacation research scholarship. \$3000 AUD, awarded by the Australian Mathematical Sciences Institute.

## TEACHING EXPERIENCE

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2021 –	<b>Student mentoring</b> I provide mentoring to advanced undergraduate and postgraduate mathematics students studying in various areas of pure mathematics.
2018 –	<b>Private mathematics tutoring</b> I provide private mathematics tutoring for university level mathematics students from first year undergraduate through to postgraduate level. The job involves preparing and giving lessons to students and assisting them with their studies outside of class time. I speak to students both face-to-face and online.
2019 – 2022	<b>Casual Academic at The University of Newcastle</b> I have run workshops and tutorials for a variety of mathematics courses at The University of Newcastle. The role includes marking assessments and invigilating in class exams. Listed below are the courses I have taught. <ul style="list-style-type: none"> <li>○ MATH1001 - Preparatory Studies in Mathematics. Semesters: Sem 1 2019, Sem 2 2019, Sem 2 2020, Sem 1 2021.</li> <li>○ MATH1002 - Foundational Studies in Mathematics. Semesters: Sem 2 2019, Sem 1 2021.</li> <li>○ MATH1120 - Mathematics for Engineering, Science &amp; Technology 2. Semesters: Sem 2 2020, Sum 2 2021, Sum 2 2022.</li> <li>○ MATH1510 - Discrete Mathematics. Semesters: Sem 2 2021</li> <li>○ MATH2310 - Calculus of Science and Engineering. Semesters: Sem 2 2020, Sem 1 2021, Sem 2 2021.</li> <li>○ MATH2330 - Real Analysis. Semesters: Sem 1 2020.</li> <li>○ MATH2340 - Linearity and Continuity. Semesters: Sem 1 2020.</li> <li>○ MATH3205 - Fourier Analysis. Semesters: Sem 1 2021 (marking and one-on-one consultations only).</li> <li>○ MATH4101 - Topological Groups. Semesters: Sem 2 2021 (marking only).</li> </ul>

## PROFESSIONAL AFFILIATIONS & SOCIETIES

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2022 –	Member of CARMA (Computer-Assisted Research Mathematics and its Applications).
2021 –	Member of the Australian and New Zealand Association of Mathematical Physics.
2019 –	Member of the Australian Mathematical Society.

## VOLUNTEER EXPERIENCE

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- 2023 – Reviewer for zbMATH  
Profile: <https://zbmath.org/authors/carter.max>.
- 2021 – 2022 The University of Newcastle peer mentor program.
- 14/01/2021 National Youth Science Forum.  
Assisted running a workshop for high school students covering aspects of symmetry and group theory.
- 2019 – 2020 The University of Newcastle Maths Club.  
Co-founded the UoN Maths Club and assisted organising and running various events.

## CONFERENCE ATTENDANCE

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### 2023

- Colloque pour honorer la mémoire de Jacques Tits.
  - Collège de France, Paris, France, 11/12/23–13/12/23.
- Actions of totally disconnected locally compact groups on discrete structure: local to global workshop.
  - WWU Münster, Münster, Germany, 09/10/23–13/10/23.
- Actions of totally disconnected locally compact groups on discrete structure: geometry workshop.
  - WWU Münster, Münster, Germany, 04/09/23–08/09/23.
- Young Mathematicians in  $C^*$ -algebras.
  - KU Leuven, Leuven, Belgium, 07/08/23–11/08/23.
- Summer School on Higher-Dimensional Expanders.
  - Ghent University, Ghent, Belgium, 22/05/23–26/05/23.

### 2022

- 66th Annual Meeting of the AustMS
  - UNSW, Sydney, Australia, 06/12/22–09/10/22.
- Computation Aspects of TDLG Groups
  - The University of Newcastle, Newcastle, Australia, 24/10/22–28/10/22.
- Mathematical Thinking Workshop.
  - The University of Newcastle, Newcastle, Australia, 26/09/22–28/09/22.
- Operator algebras, dynamics and groups.
  - ICM satellite conference, University of Copenhagen, Denmark, 01/07/22–04/07/22.
- Operator Algebras and their Applications.
  - Online, hosted by IPM, Iran, 05/02/22–09/02/22.

### 2021

- 65th Annual Meeting of the Australian Mathematical Society.
  - The University of Newcastle, Australia, 7/12/21–10/12/21.
- Groups and Geometries.
  - Online, hosted by MATRIX, Creswick, Australia, 29/11/21–03/12/21.
- Australia Algebra Conference (AAC05).
  - Online, hosted by the University of Western Australia, Australia, 17/11/21–19/11/21.
- Totally Disconnected Locally Compact Groups via Group Actions.
  - Online, hosted by Banff Research Station, Banff, Canada, 15/08/21–20/08/21.

Young Mathematicians in  $C^*$ -algebras (YMC\*A 2021).

- Online, hosted in Münster, Germany, 02/08/21–13/08/21.

Operator Algebras and their Applications.

- Online, hosted by IPM, Iran, 16/02/21–19/02/21.

Australia Algebra Conference (AAC04).

- Online, hosted by the University of Melbourne, Australia, 18/01/21–19/01/21.

Postgraduate Group Theory Conference 2020.

- Online, hosted by the University of Southampton, UK, 11/01/21–15/01/21.

## 2020

Locally Compact Groups Acting on Discrete Structures (WinSum School).

- Online, hosted by the Bernoulli Centre, EPFL, Lausanne, Switzerland, 15/12/20–18/12/20.

64th Annual Meeting of the Australian Mathematical Society.

- Online, hosted by the University of New England, Armidale, Australia, 07/12/20–11/12/20.

AMSI Summer School 2020.

- La Trobe University, Melbourne, Australia, 06/01/20–31/01/20.

## 2019

AMSI Connect Conference.

- University of Melbourne, Australia, 06/02/19–08/02/19.

## LAST UPDATED

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13th March 2024 in Louvain-la-Neuve, Belgium.