

# Robert Y. Lewis

## CONTACT INFO

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## EMPLOYMENT

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- 2018 – Present **Vrije Universiteit Amsterdam**, The Netherlands  
Postdoc, Theoretical Computer Science  
Hired through the [Matryoshka](#) ERC Starting Grant
- Summer 2016 **Wolfram Research**, Champaign, IL, USA  
Intern, Mathematica Algorithms R&D
- 2010 – 2012 **St. Agnes Academy**, Houston, TX, USA  
Secondary School Teacher  
10th grade geometry, 11th and 12th grade pre-calculus, 12th grade AP Calculus AB

## EDUCATION

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- 2012 – 2018 **Carnegie Mellon University**, Pittsburgh, PA, USA  
PhD, Pure and Applied Logic, 2018  
MS, Mathematics, 2015  
MS, Logic, Computation, and Methodology, 2014
- Summer 2015 **University of Newcastle**, NSW, Australia  
Visiting student, [CARMA](#) Priority Research Centre
- 2006 – 2010 **Rice University**, Houston, TX, USA  
BA, Mathematics and Philosophy

## PEER REVIEWED PUBLICATIONS

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### Formalizing the ring of Witt vectors

Johan Commelin and Robert Y. Lewis

To appear in Hritcu, C. and Popescu, A., eds., *10th ACM SIGPLAN International Conference on Certified Programs and Proofs* (CPP 2021)

*Distinguished Paper Award*

### Normalizing casts and coercions

Robert Y. Lewis and Paul-Nicolas Madelaine

In Fontaine, Reummer, and Tourret, eds., *Practical Aspects of Automated Reasoning* (PAAR 2020)

### Maintaining a library of formal mathematics

Floris van Doorn, Gabriel Ebner, and Robert Y. Lewis

In Benzmüller and Miller, eds., *13th Conference on Intelligent Computer Mathematics* (CICM 2020)

### **The Lean mathematical library**

The mathlib Community

In Blanchette, J., Hritcu, C., eds., *9th ACM SIGPLAN International Conference on Certified Programs and Proofs* (CPP 2020), pp. 367-381. 2020

This paper describes a collective project with many contributors. I am a maintainer of the project and wrote much of this paper.

### **Formalizing the solution to the cap set problem**

Sander Dahmen, Johannes Hölzl, and Robert Y. Lewis

In Harrison, J., O’Leary, J., and Tolmach, A., eds., *Interactive Theorem Proving* (ITP 2019), pp. 15:1-15:19. 2019

### **A formal proof of Hensel’s lemma over the $p$ -adic integers**

Robert Y. Lewis

In Mahboubi, A., Myreen, M. O., eds., *8th ACM SIGPLAN International Conference on Certified Programs and Proofs* (CPP 2019), pp. 15-26. 2019

### **An extensible ad hoc interface between Lean and Mathematica**

Robert Y. Lewis

In Dubois, C. and Paleo, B. W. eds., *Proof eXchange for Theorem Proving 2017* (EPTCS), pp. 23-38. 2017

### **A heuristic prover for real inequalities** (journal version)

Jeremy Avigad, Robert Y. Lewis, and Cody Roux

*Journal of Automated Reasoning* 56(3), pp. 367-386. 2016

### **A heuristic prover for real inequalities**

Jeremy Avigad, Robert Y. Lewis, and Cody Roux

In Klein, G. and Gamboa, R., eds., *Interactive Theorem Proving* (ITP 2014), pp. 61-76. 2014

### **Energy-minimizing unit vector fields**

Leobardo Rosales, Robert Y. Lewis, et al

*Involve* 3(4), pp. 435-450. 2010

## **BOOKS AND THESES**

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### **Mathematics in Lean** (a tutorial on the Lean theorem prover for mathematicians)

Jeremy Avigad, Kevin Buzzard, Robert Y. Lewis, and Patrick Massot

Under development; available [online](#)

### **Logic and Proof** (a textbook using the Lean theorem prover)

Jeremy Avigad, Robert Y. Lewis, and Floris van Doorn

Available freely in [interactive](#) and [static](#) versions

### **Two Tools for Formalizing Mathematical Proofs** (dissertation)

Robert Y. Lewis

Certified Feb 16, 2018

### **Polya: A Heuristic Procedure for Reasoning with Real Inequalities** (MS thesis)

Robert Y. Lewis

Certified Dec 11, 2014

## TEACHING

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|             |   |
|-------------|---|
| Spring 2021 | <b>Logic and Modeling</b> (VU, instructor) (online)                             |
| Fall 2020   | <b>Introduction to Computer Science (theory week)</b> (VU, instructor) (online) |
| Spring 2020 | <b>Logic and Modeling</b> (VU, instructor) (online)                             |
| Spring 2019 | <b>Logic and Modeling</b> (VU, instructor)                                      |
| Spring 2018 | <b>Logic and Modeling</b> (VU, teaching assistant)                              |
| Fall 2016   | <b>Logic and Mathematical Inquiry</b> (CMU, instructor)                         |
| Spring 2015 | <b>Nature of Mathematical Reasoning</b> (CMU, instructor)                       |
| Fall 2014   | <b>Models and Methods of Optimization</b> (CMU, teaching assistant)             |
| Summer 2014 | <b>Nature of Mathematical Reasoning</b> (CMU, instructor)                       |
| Spring 2014 | <b>Undecidability and Incompleteness</b> (CMU, grader and guest lecturer)       |
| Fall 2013   | <b>Formal Logic</b> (CMU, grader and guest lecturer)                            |
| 2010 – 2012 | <b>Geometry, Pre-calculus, AP Calculus AB</b> (St. Agnes Academy, instructor)   |
| 2007 – 2010 | <b>Honors Calculus III/IV, Honors Linear Algebra</b> (Rice, grader)             |

## STUDENTS

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All students at VU Amsterdam.

|             |                                       |
|-------------|---------------------------------------|
| Current     | Aurélien Saue (MS intern)             |
| Current     | Polina Boneva (BS thesis)             |
| 2019        | Kevin Kappelmann (MS intern)          |
| 2019        | Paul-Nicolas Madelaine (MS intern)    |
| 2018 – 2019 | Markos Dermitzakis (BS thesis)        |
| 2018 – 2019 | Phillip Lippe (MS research assistant) |
| 2018 – 2019 | Miko Kuijn (MS thesis)                |
| 2018        | Pablo Le Hénaff (MS intern)           |

## AWARDS, GRANTS, AND HONORS

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|             |   |
|-------------|---|
| 2021        | Distinguished Paper Award, CPP 2021   |
| 2020        | Lorentz Center workshop: Machine Checked Mathematics (~€25k)                                    |
| 2020        | Microsoft Research on Azure grant (\$10k)   |
| 2019 – 2023 | Senior Collaborator, <a href="#">Lean Forward</a> NWO Vidi grant                                |
| 2017        | <a href="#">Laboratory of Symbolic and Educational Computation</a> research fellowship          |
| 2017        | <a href="#">Future Faculty</a> , Eberly Center for Teaching Excellence & Educational Innovation |
| 2015 – 2016 | William S. Dietrich II <a href="#">Presidential PhD Fellowship</a>                              |
| 2014        | Honorable Mention, NSF Graduate Research Fellowship Program                                     |

## SERVICE

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- 2021 Organizer, Machine Checked Mathematics (Lorentz Center workshop)
- 2021 Organizer, [Lean Together 2021](#) workshop
- 2020 Proposal assessor, [NWO Open Domain Science – XS](#) scheme
- 2020 [Certified Programs and Proofs 2021](#) Conference Program Committee
- 2020 Organizer, [Formal Methods in Mathematics / Lean Together 2020](#) workshop
- 2019 – Maintainer, Lean [mathlib](#) library
- 2019 Organizer, [Lean Together 2019](#) workshop
- 2018 Organizer, ICMS session on [Formal and Informal Mathematical Corpora](#)
- 2018 [Artificial Intelligence and Symbolic Computation](#) Conference Program Committee
- 2015, 2016 CMU Philosophy Dept. Graduate Admissions Committee
- 2015 CMU Philosophy Dept. 30th Anniversary Conference Planning Committee
- 2014 – 2018 Founding member, CMU chapter of [Minorities and Philosophy](#)
- 2013 – 2017 Organizer, CMU Philosophy Dept. Graduate Research Sharing Forum
- 2011 – 2012 Coach and sponsor, St. Agnes Academy Engineering/Robotics Team
- 2008 – 2010 Coordinator and tutor, SRC Society of Academic Fellows, Rice University

## SELECTED PRESENTATIONS

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### Metaprogramming and tactic writing and Dealing with numbers

- [Lean for the Curious Mathematician](#), virtual. 07/2020.

### Simplifying casts and coercions

- [PAAR 2020: Practical Aspects of Automated Reasoning](#), virtual. 06/2020.

### The Lean mathematical library

- [CPP 2020: Certified Programs and Proofs](#), New Orleans, LA, USA. 01/2020.

### Formalizing the solution to the cap set problem

- [ITP 2019: Interactive Theorem Proving](#), Portland, OR, USA. 09/2019.
- [Vietnam-USA Joint Mathematical Meeting](#), Quy Nhon, Vietnam. 06/2019.
- [CARMA Workshop on Computer-Aided Proof](#), Newcastle, NSW, Australia. 06/2019. (Invited speaker.)

### A formal proof of Hensel's lemma over the $p$ -adic integers

- [CPP 2019: Certified Programs and Proofs](#), Cascais, Portugal. 01/2019.
- [Lean Together 2019](#), Amsterdam, The Netherlands. 01/2019.

### A heuristic method for formally verifying real inequalities

- [Matryoshka 2018](#), Amsterdam, The Netherlands. 06/2018.
- [Hales60](#), Pittsburgh, PA, USA. 06/2018. (Invited speaker.)

### Toward AI for Lean, via metaprogramming

- [AITP 2018: Artificial Intelligence in Theorem Proving](#), Aussois, France. 03/2018.

### The Lean theorem prover, for mathematicians

- Western University Mathematics Dept. Foundations Seminar, London, ON, Canada. 12/2017.

### An extensible ad hoc interface between Lean and Mathematica

- [ICMS 2018: International Congress on Mathematical Software](#), South Bend, IN, USA. 07/2018.
- [PxTP 2017: Proof eXchange for Theorem Proving](#), Brasília, Brazil. 09/2017.
- [Wolfram Technology Conference](#), Champaign, IL, USA. 10/2016.

#### **Automation and computation in the Lean theorem prover**

- [HaTT: Hammers for Type Theory](#), IJCAR, Coimbra, Portugal. 07/2016.
- [AITP 2016: Artificial Intelligence in Theorem Proving](#), Obergurgl, Austria. 04/2016.
- TU München Logic and Verification Seminar, Munich, Germany. 03/2016.

#### **Algebra and analysis in the Lean theorem prover**

- [MAP 2016: Effective Analysis](#), Marseille, France. 01/2016.

#### **Dependent types and the algebraic hierarchy**

- [Workshop on Mathematics and Computation](#), Newcastle, NSW, Australia. 06/2015.

#### **A heuristic prover for real inequalities**

- [ITP 2014: Interactive Theorem Proving](#), Vienna, Austria. 07/2014.
- [6th Podlasie Conference on Mathematics](#), Bialystok, Poland. 07/2014.
- CMU Graduate Research Sharing Forum, Pittsburgh, PA. 12/2013.

#### **Energy-minimizing vector fields of unit length**

- Rice University VIGRE Summer Seminar, Houston, TX. 07/2009.