

# Curriculum Vitae

David J. Fernández-Bretón

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**Current position:** *Associate Professor*, Instituto Politécnico Nacional.  
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## Employment History

- *Since Fall 2022:* Associate Professor, Instituto Politécnico Nacional.
- *Fall 2021 – Winter 2022:* Assistant Professor, Instituto Politécnico Nacional.
- *Fall 2020 – Winter 2021:* Adjunct Professor, Instituto Politécnico Nacional.
- *Fall 2019 – Summer 2021:* DGAPA Postdoctoral Fellow, Instituto de Matemáticas, Universidad Nacional Autónoma de México.
- *Winter 2019 – Fall 2020:* Adjunct Professor, Instituto Tecnológico y de Estudios Superiores de Monterrey.
- *Winter – Summer 2019:* FORDECyT-funded postdoc, Departamento de Matemáticas, Centro de Investigación y Estudios Avanzados (Cinvestav).
- *Fall 2018:* Postdoctoral Researcher, Kurt Gödel Research Center for Mathematical Logic, University of Vienna.
- *Fall 2015 – Summer 2018:* Post-Doc Assistant Professor, Department of Mathematics, University of Michigan.

## Education

- 2015: PhD in Mathematics and Statistics, York University.
- 2010: Master's Degree in Mathematical Sciences, joint graduate program Universidad Nacional Autónoma de México–Universidad Michoacana de San Nicolás de Hidalgo.
- 2009: *Pasante* (i.e. coursework finished but thesis requirement not yet fulfilled) for a Bachelor's Degree in Philosophy, Universidad Nacional Autónoma de México.
- 2007: *Licenciatura* (i.e. Bachelor's Degree) in Physics and Mathematics, Instituto Politécnico Nacional (Mexico).

## Published or Accepted Research Papers

(† signals that the author was an undergraduate research student)

17. *Hindman's Theorem in the hierarchy of Choice Principles*, Journal of Mathematical Logic **24** no. 1 (2024), 2350002.
16. (with Lorenzo Carlucci). *The adjacent Hindman's theorem for uncountable groups*, Colloquium Mathematicum **173** no. 2 (2023), 273–284.
15. *Using ultrafilters to prove Ramsey-type theorems*, American Mathematical Monthly **129** no. 2 (2022), 116–131.
14. (with Nicholas G. Vlamis, and an appendix also with Mathieu Baillif). *Ends of non-metrizable manifolds: a generalized bagpipe theorem*, Topology and its Applications **310** (2022), 108017.
13. (with Gerardo Acosta). *Equicontinuous mappings on finite trees*, Fundamenta Mathematicae **254** no. 2 (2021), 215–240.
12. (with Joshua Brot† and Mengyang Cao†). *Finiteness classes arising from Ramsey-theoretic statements in set theory without choice*, Annals of Pure and Applied Logic **172** no. 6 (2021), 102961.

11. (with Sung Hyup Lee<sup>†</sup>). *Hindman-like theorems for many colours and finite monochromatic sets*, Proceedings of the American Mathematical Society **148** no. 7 (2020), 3099–3112.
10. *Stable ordered union ultrafilters and  $\text{cov}(\mathcal{M}) < \mathfrak{c}$* , Journal of Symbolic Logic **84** no. 3 (2019), 1176–1193.
9. (with Elizabeth Lauri<sup>†</sup>). *A characterization of the Boolean Prime Ideal theorem in terms of forcing notions*, Fundamenta Mathematicae **245** no. 1 (2019), 25–38.
8. (with Michael Hrušák). *A parametrized diamond principle and union ultrafilters*, Colloquium Mathematicum **153** no. 2 (2018), 261–271.
7. *Hindman’s Theorem is only a countable phenomenon*, Order **35** (2018), 83–91.
6. (with Assaf Rinot). *Strong failures of higher analogs of Hindman’s theorem*, Transactions of the American Mathematical Society **369** no. 12 (2017), 8939–8966.
5. (with Michael Hrušák). *Corrigendum to “Gruff ultrafilters” [Topol. Appl. 210 (2016) 355–365]*, Topology and its Applications **231** (2017), 430–431.
4. (with Michael Hrušák). *Gruff ultrafilters*, Topology and its Applications **210** (2016), 355–365.
3. (with Martino Lupini). *Strongly Productive Ultrafilters on Semigroups*, Semigroup Forum **92** (2016), 242–257.
2. *Strongly summable ultrafilters, union ultrafilters, and the trivial sums property*, Canadian Journal of Mathematics **68** (2016), 44–66.
1. *Every strongly summable ultrafilter on  $\bigoplus \mathbb{Z}_2$  is sparse*, New York Journal of Mathematics **19** (2013), 117–129.

## Invited Talks

**Single-session talk:** *Counting infinity: Combinatorics of infinite graphs (Contando el infinito: Combinatoria de grafos infinitos)*

Coloquio “Bienvenidos a la Matemática” Universidad Mayor de San Andrés Lunes 25 de julio de 2022

**Seminar talk:** *The combinatorics of the infinite*, African Mathematics Seminar (May 2022).

**Seminar talk:** *Equicontinuity of dynamical systems on trees (Equicontinuidad de sistemas dinámicos sobre árboles)*, Topology Seminar, UAM-Iztapalapa (January 2022).

**Seminar talk:** *Independence proofs: what are they (good for)? (Pruebas de independencia: ¿Qué son y para qué sirven?)*, Mathematics Seminar, ESFM-IPN (November 2021).

**Keynote lecture:** *From integral calculus to the mysteries of infinity (Del cálculo integral a los misterios del infinito)*, via Zoom but officially at Universidad Nacional Federico Villarreal, Peru (October 2021).

**Seminar talk:** *Ramsey Theory on Infinite Additive Structures (Teoría de Ramsey en Estructuras Aditivas Infinitas)*, Combinatorics, Control and Optimization Seminar, Universidad Autónoma Metropolitana – Azcapotzalco (September 2021).

**Plenary:** *Hindman’s theorem as a weak version of the Axiom of Choice*, Boise Extravaganza in Set Theory 2021, virtual conference (formally at Boise State University, June 2021).

**Parallel session talk:** *Ends of non-metrizable manifolds: a generalized bagpipe theorem*, Spring Topology and Dynamics Conference 2021, virtual conference (formally at Murray State University, May 2021).

**Parallel session talk:** *Uncountable restrictions/extensions of Hindman’s theorem (Restricciones y extensiones no numerables del teorema de Hindman)*, Mexican Mathematical Society Virtual Conference 2020 (October 2020).

**Parallel session talk:** *Finiteness classes inspired by Ramsey theory in choiceless set theory*, special session on “Forcing and Ramsey theory” of the 2020 North American Annual Meeting of the Association for Symbolic Logic, UC Irvine (March 2020) (this event had to be turned into a virtual one just a few weeks before it started).

**Colloquium talk:** *Additive combinatorics and Ramsey theory from a set-theoretic viewpoint (Combinatoria aditiva y teoría de Ramsey desde la perspectiva de la teoría de conjuntos)*, Department Colloquium of the Instituto de Matemáticas, Universidad Nacional Autónoma de México (February 2020).

**Colloquium talk:** *Additive combinatorics and Ramsey-type theorems in infinite structures (Combinatoria aditiva y teoremas de tipo Ramsey en estructuras infinitas)*, Colloquium of the Joint Graduate Program in Mathematical Sciences UNAM–UMSNH, Universidad Nacional Autónoma de México Campus Morelia (November 2019).

**Seminar talk:** *Ramsey-type theorems in additive combinatorics (Teoremas de tipo Ramsey en combinatoria aditiva)*, “Seminario Súmate”, Faculty of Science, Universidad Nacional Autónoma de México (August 2019).

**Plenary talk:** *Una generalización del teorema de la gaita (A generalization of the bagpipe theorem)*, X Jornadas de Topología, Universidad Juárez Autónoma de Durango, Mexico (May 2019).

**Seminar talk:** *Algebraic Ramsey-theoretic results with small monochromatic sets*, Bar-Ilan University Set Theory Seminar (November 2018).

**Plenary talk:** *Variations on a theme: Hindman’s theorem*, BLAST 2018 conference, University of Denver (August 2018).

**Seminar talk:** *Partition theorems on uncountable abelian groups*, Toronto Set Theory Seminar, Fields Institute, Canada (April 2018).

**Single-session talk:** *Ramsey theory of uncountable abelian groups*, Ultrafilters, Ramsey Theory and Dynamics workshop, Université Lyon 1, France (November 2017).

**Semi-plenary talk:** *Algebraic Ramsey-theoretic statements with an uncountable flavour*, Second Pan Pacific International Conference in Topology and Applications, Busan, South Korea (November 2017).

**Parallel session talk:** *Strong negations of Hindman’s theorem for uncountable FS-sets*, AMS Fall Western Sectional Meeting, University of Denver (October 2016).

**Seminar talk:** *Some results on strongly summable ultrafilters*, University of Illinois at Urbana-Champaign Logic Seminar (February 2016).

**Seminar talk:** *A gentle introduction to infinitary Ramsey theory (Una introducción amable a la teoría infinita de Ramsey)*, Cinvestav (Mexico) Mathematics Department Student Seminar Summer Talks (July 2015).

**3 day (1 hr. per day) minicourse:** *Interaction between Ultrafilters and Ramsey-type Theorems (La Interacción entre los Ultrafiltros y los Teoremas de Tipo Ramsey)*, 3rd. Mexican School on Logic and Sets (Tercera Escuela de Lógica y Conjuntos) (November 2014).

**Parallel session talk:** *Strongly Summable Ultrafilters in Forcing Extensions*, 29 Summer Conference on Topology and its Applications, College of Staten Island–City University of New York (July 2014).

**Parallel session talk:** *Some results concerning Strongly Summable Ultrafilters on abelian groups*, 48 Spring Topology and Dynamics Conference, University of Richmond (March 2014).

**Seminar talk:** *Forcing and the Continuum Hypothesis (Forzamiento y la Hipótesis del Continuo)*, Cinvestav (Mexico) Mathematics Department Student Seminar (March 2014).

## Other Professional Experiences & Skills

1. I have been a referee for the following journals:

- *Transactions of the American Mathematical Society* (twice),
- *Bulletin of the London Mathematical Society*,
- *Proceedings of the American Mathematical Society*,
- *Journal of Symbolic Logic*,
- *Annals of Pure and Applied Logic*,
- *Topology and its Applications* (twice),
- *Acta Mathematica Hungarica*,
- *Discrete Mathematics*,
- *Commentationes Mathematicae Universitatis Carolinae*,
- *Topology Proceedings* (twice),
- *Results in Mathematics*,
- *Algebra and Discrete Mathematics*.

I have also been an evaluator for:

- Proposals for conferences requesting funding from the *Consejo Nacional de Ciencia y Tecnología* (Conacyt), which is the main funding agency in Mexico.
- Undergraduate theses participating for the *Sotero Prieto prize* to the best undergraduate thesis in mathematics, awarded by the Mexican Mathematical Society.
- Grant proposals for the SEP-CONACYT-ANUIES-ECOS Mexico–France agreement for scientific and technologic research.

2. I have been a committee member for the following theses:

- *Combinatorial Properties of Filters and Ideals*, by Jonathan Cancino Manríquez (PhD. thesis, defended December 2021); Universidad Nacional Autónoma de México.
- *Un acercamiento al invariante cardinal  $\mathfrak{h}$* , by René Leonardo Ahumada Lemus (undergraduate thesis, defended September 2021); Universidad Nacional Autónoma de México.
- *Aplicaciones de Lógica Matemática en Geometría Algebraica Real: Los Problemas X y XVII de Hilbert*, by Luis Edmundo Gatica Norato (undergraduate thesis, defended September 2020); Instituto Tecnológico Autónomo de México.
- *Propiedades Combinatorias de los Ideales y el orden de Katětov*, by José de Jesús Pelayo Gómez (PhD. thesis, defended September 2018), Universidad Nacional Autónoma de México.
- *Combinatoria Infinita y Teoremas Tipo Ramsey*, by Jareth Zuleyca Torres Reyes (undergraduate thesis, defended December 2015), Universidad Nacional Autónoma de México.

3. I have the following experiences supervising undergraduate students on research projects:

- REU (Research Experience for Undergraduates) program at the Department of Mathematics, University of Michigan: on each of the summers of 2016, 2017 and 2018 I supervised undergraduate students (one on each of 2016, 2017, and two in 2018, for a total of four students) on various research projects, each of which resulted in a research paper submitted for publication to a mathematical journal.
- In the summer of 2014 I helped Matthias Neufang and Juris Steprāns supervise four students at the Fields Institute Undergraduate Summer Research Program, working on the project titled *Metric Arens irregularity*.

4. I have organized, for two years in a row, the virtual conference *Interacciones en la Frontera*, which took place June 3–5, 2020 via BlueJeans; and then again May 17–19, 2021, via Zoom.

5. From September 2015 to June 2018 I was the organizer of the **Michigan Logic Seminar** at the Department of Mathematics, University of Michigan; and from September 2019 to March 2020 I organized the **Mexico City Logic Seminar** at the Instituto de Matemáticas, UNAM.

6. I have spoken three times (title of the talks: *Surreal Numbers*, *Ramsey Theory*, and *What does “infinitely many” mean?*) at the Michigan Math Club, a series of weekly talks aimed at advanced undergraduate students.
7. I am a Member of the following professional associations:
  - *Association for Symbolic Logic* (since 2013),
  - *Canadian Mathematical Society* (since 2013),
  - *American Mathematical Society* (since 2014).
8. I can fluently speak, read and write in the following languages:
  - Spanish (native speaker),
  - English (reasonably fluent),
  - French (reasonably fluent).
9. I do service (volunteer) work as “editor” (which means that I have some administration/moderation privileges) for *El Irracional* (<http://www.irracional.org>), a website for mathematical questions in Spanish which is quite similar to MathOverflow or MathStackExchange.

### Selected Conferences Attended

- June 17-19, 2021: Boise Extravaganza in Set Theory 2021, virtual conference (formally held at Boise State University).
- May 12-15, 2021: Spring Topology and Dynamics Conference 2021, virtual conference (formally held at Murray State University).
- August 4-9, 2019: Workshop on Set theory of the Reals, Casa Matemática Oaxaca – BIRS.
- September 10-14, 2018: Set theory today: A conference in honour of Georg Cantor, Kurt Gödel Research Center, Vienna, Austria.
- August 6-10, 2018: BLAST 2018, University of Denver.
- November 20-24, 2017: Ultrafilters, Ramsey Theory and Dynamics workshop, Université Lyon 1, France.
- November 13-17, 2017: Second Pan Pacific International Conference in Topology and Applications, Busan, South Korea.
- September 11-16, 2016: Workshop on Set Theory and its Applications in Topology, Casa Matemática Oaxaca – BIRS.
- March 13-15, 2014: 48th. Spring Topology and Dynamics Conference, University of Richmond.
- May 8-11, 2013: Association for Symbolic Logic North American Annual Meeting, University of Waterloo.
- July-December, 2012: Thematic Program on Forcing and its Applications, Fields Institute.
- December 10-12, 2011: 2011 Canadian Mathematical Society Winter Meeting, Toronto.
- March 21-25, 2011: Fourth Young Researchers in Set Theory Workshop, Königswinter near Bonn, Germany.

### Teaching-Related Experience

- At **Instituto Politécnico Nacional** (since Fall 2020):
  - Lógica Matemática (Mathematical Logic); Winter and Fall 2023.

- Temas Selectos de Análisis Real y Funcional (Topics in Real and Functional Analysis), graduate-level class, Fall 2023.
- Temas Selectos de Álgebra (Topics in Algebra), graduate-level class, Fall 2022.
- Análisis Real (Real Analysis), graduate-level class; Winter 2022 and Winter 2023.
- Teoría de Conjuntos (Set Theory); Winter 2022.
- Teoría de Gráficas (Graph Theory); Fall 2021 and Fall 2022.
- Análisis Matemático II (Mathematical Analysis II, measure theory); Fall 2021.
- Análisis Matemático I (Mathematical Analysis I, metric spaces); Winter 2021.
- Álgebra Lineal (Linear Algebra); Winter 2023.
- Teoría de la Medida en Finanzas (Measure Theory and Finance); Fall 2023.
- Introducción al Cálculo (Introduction to (proofs-based) Calculus); Fall 2020.
- Matemáticas Discretas (Discrete Mathematics); two sections in each of Fall 2020 and Winter 2021.
- At **Universidad Nacional Autónoma de México** (Winter 2020):
  - Curso Avanzado de Álgebra: Introducción a las Pruebas de Consistencia e Independencia (Introduction to Consistency and Independence Proofs, graduate-level course).
- At **Instituto Tecnológico y de Estudios Superiores de Monterrey** (January 2019–December 2020):
  - MA 2001 – Ecuaciones Diferenciales (Differential Equations); Summer 2019.
  - MA 1017 – Matemáticas 2 (Calculus 2); Winter 2019.
  - MA 1019 – Álgebra Lineal (Linear Algebra); Winter and Fall 2019, Winter and Fall 2020.
- At the **University of Michigan** (September 2015–July 2018):
  - MATH 682 – Set Theory (PhD-level course); Fall 2017.
  - MATH 582 – Introduction to Set Theory; Winters of 2016, 2017 and 2018.
  - MATH 217 – Linear Algebra; one section in each of Winter and Fall 2016, Winter and Fall 2017, Winter and Spring 2018.
  - MATH 481 – Introduction to Mathematical Logic; Fall 2016.
  - MATH 115 – Calculus I; two sections in Fall 2015.
- At **York University’s Glendon Campus** (September–December 2014):
  - MATH 1670 – Fundamentals of Mathematics (precalculus).
- At **York University** as Teaching Assistant (September 2010–August 2014):
  - MATH 1200 (Problems, Conjectures and Proofs): Fall-Winter 2011-2012 and 2013-2014.
  - MATH 1019 (Discrete Mathematics for Computer Science): Winter 2013.
  - MATH 1190 (Introduction to Sets and Logic): Fall 2010, Fall 2011, Summer 2013 and Fall 2013.
  - MathLab Tutor: Winter 2011, Summer 2011, Fall 2011, Winter 2012, Summer 2012, Winter 2013, Summer 2013 and Fall 2013.
  - MATH 1090 (Introduction to Logic for Computer Science): Summer 2011, Winter 2012, Summer 2012, Winter 2013, Winter 2014 and Summer 2014.
  - MATH 1310 (Integral Calculus with Applications): Fall 2010 and Winter 2014.
  - MATH 1300 (Differential Calculus with Applications): Fall 2010 and Winter 2011.
  - MATH 2022 (Linear Algebra II): Winter 2011.
  - MATH 1025 (Applied Linear Algebra): Summer 2014,

– MATH 1510 (Fundamentals of Mathematics): Fall-Winter 2011-2012.

- I have volunteered to help facilitate sessions at the *Wayne County Math Teachers Circle* (helping grade-school teachers identify opportunities for engaging students in problem-solving activities).
- I was an invited panelist for the discussion *The impact of class size on instructors*, University of Michigan Seminar on Teaching Mathematics, October 24, 2016.
- I have participated in the *Wolverine Express* program, speaking at a high-school classroom about the implications and ramifications of attending University, as part of the outreach efforts by the University of Michigan in low-income areas.
- I completed the Teaching Assistant Certificate of Teaching (TACT), offered by the Teaching Commons at York University, certified and endorsed by the Staff and Educational Development Association (SEDA).
- I have participated in teaching-focused events, such as the Teaching in Focus conferences in 2013 y 2014, and the STAY (Supporting Teaching At York) symposia, also in 2013 y 2014.
- December 16-18, 2009: Minicourse (6 hrs.) *On the undecidability of certain Algebra problem*; Benemérita Universidad Autónoma de Puebla; Puebla, Mexico.
- 2007: Trainer Assistant for the 21st. Mexico City Mathematics Olympiad.

## Other Publications

- Reviews for *Mathematical Reviews* (MathSciNet):

**MR4030955** Tachtsis, E.; *Loś's theorem and the axiom of choice*. *MLQ Math. Log. Q.* **65** (2019), no. 3, 280–292.

**MR3941152** Mermelstein, O.; *Calculating the closed ordinal Ramsey number  $R^{cl}(\omega \cdot 2, 3)$* . *Israel J. Math.* **230** (2019), no. 1, 387–407.

**MR3835077** Tachtsis, E.; *On the set-theoretic strength of Ellis' theorem and the existence of free idempotent ultrafilters on  $\omega$* . *J. Symb. Log.* **83** (2018), no. 2, 551–571.

**MR3700856** Brendle, J.; *Q. Sets and computations* (Lect. Notes Ser. Inst. Math. Sci. Natl. Univ. Singap., **33**), NJ, 2018, pp. 1–10.

**MR3633221** Viale, M.; *Forcing the truth of a weak form of Schanuel's conjecture*. *Confluentes Math.* **8** (2016), no. 2, 59–83.

**MR3552290** Juhász, I.; Soukup, L.; and Szentmiklóssy, Z.; *Pinning down versus density*. *Israel J. Math.* **215** (2016), no. 2, 583–605.

**MR3459883** Herrlich, H.; Howard, P.; and Tachtsis, E.; *On a certain notion of finite and a finiteness class in set theory without choice*. *Bull. Pol. Acad. Sci. Math.* **63** no. 2 (2015), 89–112.

**MR3433520** Gavryushkin, A.; Khoussainov, B.; and Stephan, F.; *Reducibilities among equivalence relations induced by recursively enumerable structures*. *Theoret. Comput. Sci.* **612** (2016), 137–152.

**MR3377354** Spinas, O. and Wyszowski, M.; *Silver Antichains*. *J. Symb. Log.* **80** (2015), 503–519.

- Reviews for Zentralblatt:

**Zbl 07303626** Hindman, N. and Pleasant, K.; *Central sets theorem for arbitrary adequate partial semigroups*. *Topol. Proc.* **58** (2021), 183–206.

**Zbl 07150826** Chentsov, A. G.; *Bitopological spaces of ultrafilters and maximal linked systems*. (English. Russian original) *Proc. Steklov Inst. Math.* **305**, Suppl. 1, S24–S39 (2019); translation from *Tr. Inst. Mat. Mekh.* (Ekaterinburg) **24**, No. 1, 257–272 (2018).

**Zbl 06908765** Xu, X.; Liang, M.; and Luo, H.; *Ramsey theory. Unsolved problems and results*. De Gruyter (ISBN 978-3-11-057651-1/hbk; 978-3-11-057670-2/ebook). xii, 178 pp. Berlin, 2018.

**Zbl 06735264** Guerrero Sánchez, D; Tkachuk, V. V.; *If  $C_p(X)$  is strongly dominated by a second countable space, then  $X$  is countable*. J. Math. Anal. Appl. **454** no. 2 (2017), 533–541.

**Zbl 06506061** Shelah, S.; Spinas, O.; *Mad spectra*. J. Symb. Log. **80** (2015), 901–916.

**Zbl 06517543** Dow, A.; *Generalized side-conditions and Moore-Mrówka*. Topology Appl. **197** (2016), 75–101.

**Zbl 1328.03052** Usuba, T.; *Characters of countably tight spaces and inaccessible cardinals*. Topology Appl. **161** (2014), 95–106.

- *Un problema de álgebra que resultó indecidible*, in Juan Angoa et. al. (eds.), *Topología y Sistemas Dinámicos IV*, Benemérita Universidad Autónoma de Puebla, 2011; p. 91–112.

## Awards

**Beca Posdoctoral en el Extranjero (Postdoctoral Fellowship Overseas)** from Consejo Nacional de Ciencia y Tecnología (Conacyt-Mexico), for \$ 25000 USD per academic year, academic years 2015-2016 and 2016-2017.

**Nomination** of my PhD thesis by the Department of Mathematics and Statistics, York University, as the best among those defended in 2014 at the Department so it could compete for various University-wide awards.

**Beca de Doctorado en el Extranjero (Scholarship for a Ph. D. overseas)** Consejo Nacional de Ciencia y Tecnología (Conacyt-Mexico), for a total amount (stipend plus tuition fees and medical insurance) of \$ 21750 USD per annum, 2010-2014.

**Tuition Fee Scholarship** for \$ 1600 CAD three times per annum, 2010-2014 (declined due to its incompatibility with the Conacyt scholarship).

**York Graduate Scholarship** for \$ 3,000 CAD, 2010.