CV Christian d'Elbée

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Education

Mathematisches Institut der Universität Bonn — Bonn (Germany)
Post-doctoral position (Wissenschaftlicher Mitarbeiter), Advisor: Philipp Hieronymi — July 2022–Now

- Research topics: neostability, expansions of o-minimal structures, positive model-theory, expansions of fields by unary functions.

Fields Institute for Research in Mathematical Sciences — Toronto (Canada)
Post-doctoral position — July 2021–June 2022

- Research topics: neostability, H-structures, G-structures, pairs of field, positive model-theory, expansions of the group of integers, expansion of structure on stably embedded sets.

Hebrew University of Jerusalem, Einstein Institut of Mathematics — Jerusalem
Post-doctoral position, Lady Davis Fellowship, Advisor: Itay Kaplan — October 2019–June 2021

- Research topics: generic expansion of structures (e.g. abelian varieties) ; model-companion ; neostability ; NSOP_1 theory. Commutative algebra ; divided integral domains, treed domains; dp-minimality, finite dp-rank. H-structures and G-structures, expansion of a pregeometric theory by a subgroup spanned by a set of independent points ; preservation of model-theoretic properties.

University Lyon 1, Institut Camille Jordan — Lyon (France)
PhD; Advisors: Thomas Blossier, Zoé Chatzidakis — October 2015–20th June 2019

- Thesis: "Expansions and neostability in model theory". This thesis is concerned with the expansions of some algebraic structures and their fit in Shelah's classification landscape. Keywords : Generic expansions; fields with generic subgroups; NSOP_1 theories; forking; Kim forking; p-adic valuations on integers; finite dp-rank.

University Paris Diderot — Paris (France)
Master's degree in Mathematical Logic and Foundation of Computer Science — 2014–2015

- Thesis: "Model-theory of fields: the independence property" (Advisor: Zoé Chatzidakis)

Agrégation externe de Mathématiques — 2014
A french national degree in mathematics and teaching

University of Bordeaux — Bordeaux (France)
Master's degree in General Mathematics — 2013–2014

- Thesis: "The field of quaternions" (Advisor: Jean François Jaulent)

Manchester University — Manchester (UK)
Master's degree Mathematics and Logic — 2012–2013

- Thesis: "On the complete ordered field" (Advisor: Alex Wilkie)

University of Bordeaux — Bordeaux (France)
Bachelor in Mathematics — 2009–2012

- Thesis: "Ruler and Compass Constructions" (Advisor: Pierre Parent)

Publications

1. E. Alouf and C. d'Elbée, "A new dp-minimal expansion of the integers", *The Journal of Symbolic Logic*, vol. 84, no. 2, pp. 632–663, 2019
   We consider the structure $(\mathbb{Z}, +, 0, |_{p_1}, \ldots, |_{p_n})$, where $x|_p y$ means $v_p(x) \leq v_p(y)$ and v_p is the p-adic valuation. We prove that this structure has quantifier elimination in a natural expansion of the language of abelian groups, and that it has dp-rank n. In addition, we prove that a first order structure with universe $\mathbb{Z}$ which is an expansion of $(\mathbb{Z}, +, 0)$ and a reduct of $(\mathbb{Z}, +, 0, |_p)$ must be interdefinable with one of them. We also give an alternative proof for Conant's analogous result about $(\mathbb{Z}, +, 0, <)$.

2. C. d'Elbée, "Generic expansions by a reduct", *Journal of Mathematical Logic*, vol. 21, no. 03, p. 2 150 016, 2021
   Consider the expansion T_S of a theory T by a predicate for a submodel of a reduct T_0 of T. We present a setup in which this expansion admits a model companion TS. We show that some of the nice features of the theory T transfer to TS. In particular, we study conditions for which this expansion preserves the NSOP_1-ness, the simplicity or the stability of the starting theory T. We give concrete examples of new NSOP_1 not simple theories obtained by this process, among them

   - the expansion of a perfect ω-free field of positive characteristic by generic additive subgroups;
   - the expansion of an algebraically closed field of *any* characteristic by a generic multiplicative subgroup.

3. C. d'Elbée, "Forking, imaginaries and other features of ACFG", *The Journal of Symbolic Logic*, pp. 1–34, 2021
   We study the generic theory of algebraically closed fields of fixed positive characteristic with a predicate for an additive subgroup, called ACFG. This theory is a new example of a NSOP_1 non-simple theory. In this paper we describe more features of ACFG, such as imaginaries. We also study various independence relations in ACFG, such as Kim-independence or forking independence, and describe interactions between them.

4. C. d'Elbée, "Generic expansion of an abelian variety by a subgroup", *Mathematical Logic Quarterly*, vol. 67, no. 4, pp. 402–408, 2021
   Let A be an abelian variety defined over an algebraically closed field of characteristic 0. We prove that the expansion of A by a generic predicate for a divisible subgroup of A with the same torsion exists, provided A has few algebraic endomorphisms, namely $\mathrm{End}(A) = \mathbb{Z}$. The resulting theory is NSOP_1 and not simple. Note that there exist abelian varieties A with $\mathrm{End}(A) = \mathbb{Z}$ of any genus.

5. C. d'Elbée and Y. Halevi, "Dp-minimal integral domains", *Israel Journal of Mathematics*, vol. 246, no. 1, pp. 487–510, 2021
   It is shown that every dp-minimal integral domain R is a local ring and for every non-maximal prime ideal $\mathfrak{p}$ of R, the localization $R_\mathfrak{p}$ is a valuation ring and $\mathfrak{p}R_\mathfrak{p} = \mathfrak{p}$. Furthermore, a dp-minimal integral domain is a valuation ring if and only if its residue field is infinite or its residue field is finite and its maximal ideal is principal.

6. C. d'Elbée, *Cyclic and non-cyclic division algebras of finite dp-rank*, 2021. arXiv: 2106.09767 [math.RA]
   We give examples of cyclic divisions algebras of finite dp-rank, answering a question of Milliet. We also give an example of an IP cyclic division algbra of finite burden and a non-cyclic division algebra of dp-rank 16.

7. C. d'Elbée, I. Kaplan, and L. Neuhauser, *On algebraically closed fields with a distinguished subfield*, 2021. arXiv: 2108.04160 [math.LO]
   Accepted in Israel Journal of Mathematics
   We study the model theory of pairs (K, F) where K is algebraically closed and F is arbitrary with extra structure. We prove that tameness properties of F are preserved in the expansion (K, F). In particular we deduce that a PAC field F is NSOP_1 if and only if its absolute Galois group is NSOP_1 as a profinite group.

8. C. d'Elbée, I. Kaplan, and L. Neuhauser, *Existentially closed models of fields with a distinguished submodule*, 2021. arXiv: 2110.02361 [math.LO]
   Accepted in Journal of Symbolic Logic.
   We study the category of existentially closed models of fields with a distinguished submodule, in the Robinson setting. We prove that this category is NSOP_1 and TP_2 in the positive sense. We also prove some higher amalgamation results satisfied by a "strong" independence relation.

9. G. Conant, C. d'Elbée, Y. Halevi, L. Jimenez, and S. Rideau-Kikuchi, *Enriching a predicate and tame expansions of the integers*, 2022. arXiv: 2203.07226 [math.LO]
Submitted to Journal of Mathematical Logic
We study the expansion of a theory by enriching the induced structure of a stably embedded set. In particular, we prove preservation of combinatorial tameness properties, such as stability, simplicity, $NSOP_1$, NIP, NTP_2. We use those results to answer several open questions on tame expansions of the integers. For example, we construct the first known example of strictly stable expansions of $(\mathbb{Z}, +)$.

10. A. Berenstein, C. d'Elbée, and E. Vassiliev, *Vector spaces with a dense-codense generic submodule*, 2022. arXiv: 2204.10758 [math.LO]
Submitted to Annals of Pure and Applied Logic.
We study generic expansions of a vector space over a field F with a predicate for a submodule over a subring of F satifying some Mordell-Lang condition. This expansion preserves tame model-theoretic properties such as stability, NIP, NTP1, NTP2 and NSOP1.

11. C. d'Elbée, *Generic multiplicative endomorphism of a field*, 2022. arXiv: 2212.02115 [math.LO]
Submitted to Journal of Mathematical Logic.
We study the expansion of an algebraically closed field F by a generic multiplicative endomorphism, whose theory is denoted ACFH. This new theory is NSOP1 and not simple. We study open questions in NSOP1 theories such as existence for forking, which implies full elimination of imaginaries in ACFH. We also show that the kernels of some definable endomorphism in ACFH are examples of pseudofinite-cyclic groups.

Grants and Awards

MSCA Postdoctoral Fellowship February 2023

MSCA Postdoctoral Fellowship for the research project 101107014 — WILDMOD "Model Theory of wild mathematical structure, new perspectives via geometries and positive logic", with a score of 95,8%.

Research in Paris July 2023
with I. Müller, N. Ramsey and D. Siniora
A two-weeks research stay at the Institute Henry Poincaré, for a Research in Paris grant for the proposal "Generic Nilpotent Groups".

Visits

Department of Mathematics, Ohio State University, Columbus. U.S.
Invited by AProf. G. Conant and AProf C. Terry. May 15th, 2022 – May 21st, 2022

Department of mathematics, Universidad de los Andes, Bogotá. Colombia
Visit supported by the French public international collaboration fellowship:
ECOS Nord program 048-2019. April 21st, 2019 – May 19th, 2019

Talks

- **Mathematics seminar, University of Helsinki** February 2023
  (Online talk) Generic multiplicative endomorphism of a field (Invited seminar talk).
- **Oberwolfach Workshop ID 2302** January 2023
  Generic multiplicative endomorphism of a field (Oberwolfach Workshop talk). A video is available via this link or on my website.
- **Séminaire de Logique, Institut Camille Jordan, Lyon** December 2022
  Generic multiplicative endomorphism of a field (Invited seminar talk).

- **Logic seminar, Hebrew University of Jerusalem** November 2022
  Generic multiplicative endomorphism of a field (Invited seminar talk).
- **Logic Oberseminar, Mathematical Institut, Bonn** October 2022
  Generic multiplicative endomorphism of a field (Invited seminar talk).
- **Logic Seminar, Ohio State University** May 2022
  Generic multiplicative endomorphism of a field (Invited seminar talk).
- **Fields Postdoc Colloquium, Fields Institute** November 2021
  Dp-minimal expansions of the group of integers: a survey (Invited seminar talk).
- **Workshop on Trends in Pure and Applied Model Theory, Fields Institute** July 2021
  (Online Talk) Dp-minimal integral domains (Invited conference talk).
- **Logic seminar, Imperial College London** May 2021
  (Online Talk) Dp-minimal integral domains (Invited seminar talk).
- **Logic seminar, Università degli Studi della Campania** May 2021
  (Online Talk) Dp-minimal integral domains (Invited seminar talk).
- **Topological and Differential Expansions of O-minimal Structures, Universidad de los Andes/Universität Konstanz/Università di Pisa** December 2020
  (Online Talk) Generic expansion by a reduct (Invited conference talk).
- **Séminaire Théorie des Modèles Paris-Lyon, Université Paris Diderot/Université de Lyon** December 2020
  (Online Talk) Dp-minimal integral domains (Invited seminar talk).
- **Logic seminar, Hebrew University of Jerusalem** November 2020
  (Online Talk) Dp-minimal integral domains (Invited seminar talk).
- **Notre Dame Logic Seminar, South Bend, Indiana** October 2020
  (Online Talk) Dp-minimal integral domains (Invited seminar talk).
- **British Postgraduate Model Theory Conference, Leeds** January 2020
  Neostability and independence relations (Invited conference talk).
- **Logic seminar** Hebrew University of Jerusalem October 2019
  Generic Abelian Varieties (Invited seminar talk).
- **Seminarios de Lógica, Universidad de los Andes, Bogotá** April 2019
  Expansions of the group of integers (Invited seminar talk).
- **Séminaire des doctorants et doctorantes, Institut Camille Jordan, Université Lyon 1** March 2019
  Model theory and independence relations (Invited seminar talk).
- **Séminaire Théorie des Modèles et Groupes** Institut Mathématique de Jussieu, Université Paris-Diderot December 2018
  Generic additive subgroup of an algebraically closed field of positive characteristic (Invited seminar talk).
- **Neostability theory, BIRS 18w5193, Casa matematica, Oaxaca (Mexico)** October 2018
  Generic additive subgroup of an algebraically closed field of positive characteristic. Generic expansion by a reduct (Invited conference talk).
- **Séminaire des Doctorants et Doctorantes, Institut Camille Jordan, Université Lyon 1** November 2017
  Hilbert 17th problem: a model theoretic proof (Invited seminar talk).
- **Séminaire de Théorie des Modèles Institut Camille Jordan, Université Lyon 1** October 2017
  Generic additive subgroup of an algebraically closed field of positive characteristic (Invited seminar talk).
- **Séminaire Théorie des Modèles et Groupes, Institut Mathematique de Jussieu, Université Paris-Diderot** February 2017
  Minimal expansions of the group of integers (Invited seminar talk).
- **Séminaire Théorie des Modèles, Institut Camille Jordan, Université Lyon 1** February 2017

Minimal expansions of the group of integers (Invited seminar talk).

- **British PostGraduate Model Theory Conference, Leeds** January 2017
  Minimal expansions of the group of integers (Invited conference talk).
- **Colloquium Inter'Action, Université Lyon 1** May 2016
  Ax's proof of a theorem of Grothendieck (Invited seminar talk)
- **Journée des doctorants et doctorantes, Université Lyon 1** April 2016
  Algebra and model theory (Invited seminar talk).

Conferences Attended

- Oberwolfach Workshop ID 2302
  Oberwolfach, Germany, 08/01/23–14/01/2023
- Model Theory and applications 2022
  Cetraro, Italy, 06/20/22–06/25/2022
- Interactions Between O-minimal, Complex Analytic and Nonarchimedean Methods
  Fields Institute, Toronto, 06/06/2022–06/10/2022
- From Geometric Stability Theory to Tame Geometry, In honor of Ehud Hrushovski's 60th birthday
  Fields Institute, Toronto, 12/13/2021–12/17/2021
- Workshop on Trends in Pure and Applied MT
  Fields Institute, Toronto, 07/26/21–07/30/2021
- British Postgraduate Model Theory Conference
  Leeds, 01/08/2020–01/10/2020
- From permutation groups to model theory
  ICMS, Edinburgh, 09/17/2018–09/21/2018
- Workshop Model Theory of Valued Fields
  IHP Paris, 03/05/2018 –03/09/2018
- Model Theory, Combinatorics and Valued Fields
  CIRM Marseille, 01/08/2018 –01/12/2018
- Model Theory in Wroclaw
  Wroclaw (Poland), 06/30/2017 –07/02/2017
- British Postgraduate Model Theory Conference
  Leeds (UK), 01/25/2017 –01/27/2017
- BN - pair
  Istanbul (Turkey), 10/19/2016 –10/23/2016
- Model theory Month,
  Muenster, 04/18/2016 –05/20/2016
- Neostability, BIRS 23w5145
  Banff International Research Station (Canada), 19/02/2023 –24/02/2023.
- Model Theory Conference, Newelski 60th Birthday
  Bedlewo, Poland, 16/12/22–22/12/2022
- Practical and Structural Model Theory
  Leeds, 07/25/22–07/30/2022
- Introductory Workshop on Tame Geometry, Transseries and Applications to Analysis and Geometry
  Fields Institute, Toronto, 01/10/2022–01/14/2022
- Workshop on Model Theory and Combinatorics
  Fields Institute, Toronto, 11/29/2021–12/3/2021
- Problems Allied to MT and Universal Algebra (Online)
  Erlagol (Russia), 05/23/21–29/05/2021
- Neostability, BIRS 18w5193
  Casa matematica Oaxaca (Mexico), 10/14/2018 –10/19/2018.
- Model Theory and Applications
  IHP Paris, 03/26/2018 –03/30/2018
- Workshop Model Theory and Combinatorics
  IHP Paris, 01/29/2018 –02/02/2018
- Model Theory
  Bedlewo (Poland), 07/03/2017 –07/07/2017
- Automorphism Groups, Differential Galois Theory
  Barcelone, 06/26/2017 –06/27/2017
- Conférence Théorie des Modèles et Applications
  Mons (Belgium), 01/16/2017 –01/19/2017
- Colloque en l'honneur de Françoise Delon
  IMJ, Paris, 06/02/2016 –06/03/2016

Research Activities and Outreach

GeSAMT: Bonn-Münster-Düsseldorf bi-yearly seminar January 28th, 2023
Mathematisches Institut, Bonn
Co-organiser with Prof. Hieronymi.

Oberseminar July 2022 – Now
Mathematisches Institut, Bonn
Co-organiser with Prof. Hieronymi
Weekly seminar.

Fields Model Theory Seminar July 2021 – June 2022
Fields Institute, Toronto
Co-organiser with Esther Elbaz and Alexi Block-Gorman
Weekly seminar during the Thematic Program
on Trends in Pure and Applied Model Theory,
and the Thematic Program on
Tame Geometry, Transseries and Applications
to Analysis and Geometry

Journée des Jeunes Chercheur-e-s Nov. 28th, 2016
ICJ Lyon
Co-organiser, with Ariane Carrance.
A one-day conference for young researchers in Lyon.

MathαLyon Oct. 11th, 2018 – Oct. 12th, 2018
ICJ Lyon
Outreach activities for "Fête de la science", with school students.

Peer Reviewing
I am referee for the *Annals of Pure and Applied Logic* and *Journal of Symbolic Logic*.

Student Supervision

Mathematisches Institut University of Bonn
Post-doctoral position October 2022–Now

- PhD thesis co-advisor
  With Philipp Hieronymi, supervision of the PhD thesis of Leon Chini. Keywords of the thesis: Model theory of expansions of a real-closed field by generic multiplicative map. Distal expansions of the natural numbers with a successor function.

Hebrew University Jerusalem
Post-doctoral position October 2019–October 2021

- Bachelor's thesis co-advisor
  With Itay Kaplan, supervision of the bachelor's thesis of Leor Neuhauser. Keywords of the thesis: Positive logic and generic expansions of fields with subgroups. NSOP_1 in the positive logic sense. NSOP_1 expansions of theories of fields.

Teaching

Mathematisches Institut — University of Bonn
Teaching Assistant — October 2022–Now

- (Winter term) Adv Math Logic II: Tame Geometry
  Exercise Sessions for an MSc course.
- (Summer term) Adv. Topics in Math. Logic - Neostability and Independence relations
  Lecturer for an MSc course.

University Lyon 1 — Lyon (France)
Teaching Assistant (ATER) — October 2018–June 2019

- Notions in Mathematics
  24hrs. 1st year Mathematics and Computer Science
- Mathematical Physics
  38hrs. 1st year Physics and Engineering
- Weekly mathematic oral exam : Diagonalization and Applications
  36hrs. 2nd year Mathematics and Computer Science

University Lyon 1 — Lyon (France)
Ph.D. — October 2015–June 2018

- Basics of Mathematics
  39 hrs. 1st year Physics and Computer Sciences
- Algebra, Diagonalization and Applications
  28hrs. 2nd year Mathematics and Computer Science
- Algebra and Geometry
  14hrs. 3rd year General Mathematics
- Algebra and Geometry
  45hrs. 2nd year Mathematics and Computer Science
- Weekly Oral Examination: Calculus
  34.5hrs. 2nd year Mathematics and Computer Science
- Weekly Oral Examination General Mathematics
  6hrs. 1st year Mathematics and Computer Science
- Weekly Oral Examination Algebra, Diagonalization and Application
  9.5hrs. 2nd year Mathematics and Computer Science
- Weekly Oral Examination Calculus and Measure Theory
  8hrs. 3rd year General Mathematics

Computer Science Abilities

- **Mathematical Calculus :** sage-math, matlab, scilab, maple.
- **General :** python, C, html.
- **Computer music :** LogicPro.

Languages

- **French :** Native speaker.
- **English :** Fluent.
- **Spanish :** Fluent.
- **Basque :** Read and spoken.
- **Arabic :** Beginner.