Shezad Mohamed

Information

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Research

The model theory and geometry of fields with operators.

Education

University of Manchester
PhD in Mathematics, September 2020–March 2024
Supervisor: Omar León Sánchez

University of Oxford
MMath in Mathematics, 2016–2020
Thesis: *Aspects of Stone duality for Boolean algebras.*
Supervisor: Hilary Priestley

Preprints

The uniform companion for fields with free operators in characteristic zero.
Submitted for publication. 28 pages
arxiv.org/abs/2311.01856

Generalising the uniform companion for large fields with a single derivation, we construct a theory $\mathrm{UC}_{\mathcal{D}}$ of fields of characteristic 0 with free operators—operators determined by a homomorphism from the field to its tensor product with $\mathcal{D}$, a finite-dimensional $\mathbb{Q}$-algebra—which is the model companion of any theory of a field with free operators whose associated difference field is difference large and model complete. Under the assumption that $\mathcal{D}$ is a local ring, we show that simplicity is transferred from the theory of the underlying field to the theory of the field with operators, and we use this to study the model theory of bounded, PAC fields with free operators.

Published Papers

The Weil descent functor in the category of algebras with free operators.
Journal of Algebra, 640:216–252, 2024

We prove that there exists a version of Weil descent, or Weil restriction, in the category of $\mathcal{D}$-algebras. The objects of this category are k-algebras R equipped with a homomorphism $e\colon R \to R \otimes_k \mathcal{D}$ for some fixed field k and finite-dimensional k-algebra $\mathcal{D}$. We do this under a mild assumption on the so-called associated endomorphisms. In particular, this yields the existence of the Weil descent functor in the category of difference algebras, which, to our knowledge, does not appear elsewhere.

Unpublished Notes

Commuting operators as an instance of iterative generalised Hasse–Schmidt rings.

We show that fields with free operators (in the sense of Moosa and Scanlon's "Model theory of fields with free operators in characteristic zero") whose operators pairwise commute can be seen as an instance of iterative $\underline{\mathcal{D}}$-rings (in the sense of the same authors' "Generalised Hasse–Schmidt varieties and their jet spaces").

Talks

The uniform companion for theories of difference large fields with free operators.
LYMoTS, University of Leeds, January 2024

Very slim differential fields.
Final Geomod Conference, University of Freiburg, November 2023

The uniform companion for large fields with free operators.
London Logic Seminar, Imperial College London, November 2023

The uniform companion for large fields with free operators.
One-day workshop in Model Theory and Algebra, University of Manchester, January 2023

The Weil descent functor in the category of algebras with free operators.
Algebra Seminar, University of Manchester, October 2022

The Weil descent functor in the category of $\mathcal{D}$-algebras.
Joint LYMoTS/SEEMOD meeting, University of Manchester, May 2022

Teaching

Algebraic Structures 1, 2020
Teaching assistant. ~25 students.

Programming with Python, 2021
Teaching and programming assistant. ~50 students.

Algebraic Structures 1, 2021
Teaching assistant. ~25 students.

Contingencies 1, 2022
Teaching and programming assistant. ~25 students.

Probability 1, 2022
Teaching assistant. ~15 students.

Introduction to Mathematica, 2023
Teaching and programming assistant. ~50 students.

0B1: Calculus and Algebra, 2023
Led problem sessions. ~25 students.

Activities

British Postgraduate Model Theory Conference
Co-organiser
Funding from the Manchester Institute for Mathematical Sciences and the London Mathematical Society. ~50 attendees.
Online, University of Manchester, January 2022

Pure Postgrad Seminar
Co-organiser
Weekly seminar. ~20 attendees.
University of Manchester, 2021–2022