

## RESEARCH STATEMENT

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I conduct research broadly in the area of mathematical logic, with a focus on set theory and with particular attention to the mathematics and philosophy of the infinite.

A principal concern has been the interaction of forcing and large cardinals, two central concepts in set theory. The general theme is the question: How are large cardinals affected by forcing? I have investigated the indestructibility phenomenon of large cardinals, introducing the lottery preparation in order to do so, as well as the lifting property, occurring when all the large cardinal embeddings of an extension are lifts of embeddings definable in the ground model.

I have introduced several new forcing axioms, which are expressed by a fundamental interaction of forcing and truth, rather than by a combinatorial property involving dense sets. The Maximality Principle, for example, asserts that any statement that is forceable in such a way that it remains true in all further forcing extensions is already true. Considerations of parameters make the axiom range in strength from ZFC up through the large cardinal hierarchy.

In related work, I have introduced the modal logic of forcing, where a statement of set theory is possible if it holds in some forcing extension and necessary if it holds in all forcing extensions. Together with Löwe, I proved that the ZFC-provably valid modal principles of forcing are exactly the assertions of the modal theory S4.2.

Together with Reitz and Fuchs, I have introduced the topic of set-theoretic geology, focused on how the set-theoretic universe relates to its various ground models and those of its forcing extensions. The mantle, for example, is the intersection of all grounds, and it turns out that every model of ZFC is the mantle of another model of ZFC.

I have worked in group theory and its interaction with set theory in the automorphism tower problem and in computability theory, particularly the infinitary theory of infinite time Turing machines, which I introduced with Kidder and Lewis. Engaging with the emerging subject known as the philosophy of set theory, I have introduced and defended a multiverse perspective.