RESEARCH STATEMENT

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My research centers around large cardinal axioms, class forcing, and combinatorial properties that hold in L. In my doctoral thesis (working with Sy Friedman), I give a class forcing which endows the extension universe with a definable well-order, while preserving proper classes of "local" large cardinals. By this I mean large cardinals axioms that are witnessed by boundedly many elementary embeddings. I obtain the well-order by coding information into whether the principle $\diamondsuit^*_\kappa$ (a strengthening of $\diamondsuit_\kappa$) holds for various successor cardinals κ.

In my thesis I also show that one may force gap-1 morasses to exist at every uncountable regular cardinal while preserving all n-superstrong ($1 \leq n \leq \omega$), hyperstrong, and 1-extendible cardinals. Morasses are combinatorial structures found in L in which every element of some cardinal κ^+ is built up in a very structured way through the branches of a tree of size κ. Alongside that result, I give a forcing that yields universal morasses on regular cardinals κ — these are a kind of morass on κ that carry with them an encoding of $\mathcal{P}(\kappa)$. One may preserve a given n-superstrong, hyperstrong or 1-extendible cardinal while carrying out this latter forcing.

I also have a strong interest in the application of set theory to algebraic topology. Specifically, it was recently shown by Casacuberta, Scevenels and Smith that assuming Vopěnka's Principle (a large cardinal axiom above supercompact but below huge), one can settle (in the affirmative) the long standing question of whether all generalised cohomology theories have localisation functors. However, I do not have any results in this area as yet.