Research Statement

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I am in the first year of my PhD working under the supervision of Sy D. Friedman. Beginning with my master thesis, which was concerned with work of Joel Hamkins about extensions which do not create new large cardinals, I became interested in Hamkins' research about set-theoretic geology (for an introduction see [1]). Here, the structural relations between the universe V and its inner models are investigated by looking at the universe as a (set) forcing extension of some ground model. A fundamental result is a theorem by Laver which states that every model of set theory is a definable class in all of its set forcing extensions, using parameters from this model (see [2]). Jonas Reitz [3] used this theorem to introduce two new axioms: the Ground Axiom, stating that V is not the nontrivial set forcing extension of any inner model, and the Bedrock Axiom, stating that there is an inner model W, such that V is a set forcing extension of W and W is a model of the Ground Axiom. Consequently, a transitive class W is defined to be a ground of V if $W \models ZFC$ and $V = W[G]$ is a forcing extension of W by set forcing $G \subseteq P \in W$. If in addition there is no deeper ground inside the ground W, then W is called a bedrock of V. There are several open questions in this field, for example: Is the bedrock of a model unique, when it exists? Are the grounds downward directed? There might be the possibility to approach these questions by using the following result of Bukovsky from 1973 (see [4]), which was recently rediscovered by Sy Friedman: The ground models of V are exactly the inner models M with the property that M globally covers V, which means that for some V-regular κ, if $f : \alpha \to M$ belongs to V, then there is $g : \alpha \to M$ in M such that $f(i) \in g(i)$ and $g(i)$ has V-cardinality $< \kappa$ for all $i < \alpha$. As the above results and questions are restricted to set forcing, one goal of my doctoral thesis will be to extend them to class forcing.

References

[1] J. Hamkins *Some second order set theory*, in R. Ramanujam and S. Sarukkai, editors, ICLA 2009, volume 5378 of LNAI, 36–50. Springer-Verlag, Amsterdam, 2009.

[2] R. Laver *Certain very large cardinals are not created in small forcing extensions*, Annals of Pure and Applied Logic 149 (2007), 1–6.

[3] J. Reitz *The ground axiom*, Journal of Symbolic Logic 72 (2007), no.4, 1299–1317.

[4] L. Bukovsky *Characterization of generic extensions of models of set theory*, Fund. Math. 83 (1973), 35–46.