Research Statement

Vincenzo Dimonte

In 1971, a result by K. Kunen threatened to shatter the fragile top of the soaring skyscraper of large cardinal hypotheses. Following a remark in W. Reinhardt's thesis, Kunen proved that there are no non–trivial elementary embeddings $j : V \prec V$. This was unprecedented in the history of large cardinal hypotheses, the first (and, in fact, the last) inconsistency result. After this dramatic discovery, many tried to check how deep the cracks of inconsistency pervaded the large cardinals structure. While these efforts of finding another inconsistency were fruitless, a map of new hypotheses that cover the remaining possibilities arose, and the confidence in these axioms now is quite strong.

Among these hypotheses, the more fruitful are probably I3, i.e., the existence of an elementary embedding from V_λ to itself, because of the interesting properties of the algebra of such embeddings, and I0, i.e., the existence of an elementary embedding j from $L(V_{\lambda+1})$ to itself, for some $\lambda > crt(j)$, because of its particular features shared with $AD^{L(\mathbb{R})}$; but there are many levels between I3 and I0, and above. In my past research, I focused my attention on the hypotheses stronger than I0: the idea is that between $L(V_{\lambda+1})$ and $L(V_{\lambda+2})$ there are a lot of intermediate steps, namely $L(N)$ with $V_{\lambda+1} \subset N \subset V_{\lambda+2}$, and in recent research Woodin defined a canonical sequence of such N's, called E^0_α. In my work I dealt with the properties of the elementary embeddings from $L(E^0_\alpha)$ to itself, expecially *properness*, that is a fragment of the Axiom of Replacement for the elementary embedding. In my articles I've proved that in fact if the canonical sequence is long enough then there exists an α such that every elementary embedding from $L(E^0_\alpha)$ into itself is not proper. It is also possible to find an $L(E^0_\beta)$ that contains both proper and non-proper elementary embeddings, so properness is not a property directly implied by the model.

In the present I am analyzing the behaviour of the continuum function under such large cardinals. For example, it is true that they are consistent with GCH, but the failure of GCH is much more problematic. This is mainly due to the paradigm shift of these new hypotheses: while before all the large cardinals were regular, in these cases we have to deal with singular cardinals, a known tricky subject.