

Final report 01/10/2020 – 31/03/2021

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In the work done during the second semester of the research grant “*Mathematical Logic: models, sets, computability, applications in combinatorics, transseries and exponential fields*”, we continued focusing on the structure theory of sets and groups definable in various important model-theoretic settings.

In (1), we completed the previously started work with Berarducci-Mamino (1). This project combined Eleftheriou’s expertise [EPR], together with that of Berarducci-Mamino [BerMa], to obtain a new, orthogonal decomposition of definable groups in arbitrary o-minimal structures.

The previously submitted paper (2) received its first, positive report, requesting minor revisions. Those were addressed and a revised version has been submitted. In this paper, we extend the influential Pillay’s Conjecture for definable groups from the o-minimal setting to the weakly o-minimal non-valuational setting.

Since November 2020, Eleftheriou and A. Berenstein (Bogotá) have run an online seminar on Topological and Differential Expansions of O-minimal Structures, meeting consistently once every two weeks, with an average participation of about 25 international attendees per session.

#### Papers submitted/revise:

- (1) A. Berarducci, P. Eleftheriou, M. Mamino, Orthogonal decomposition of definable groups (Submitted to the *Journal of the Institute of Mathematics of Jussieu* in January 2021).

Orthogonality in model theory captures the idea of absence of non-trivial interactions between definable sets. We introduce a somewhat opposite notion of cohesiveness, capturing the idea of interaction among all parts of a given definable set. A cohesive set is indecomposable, in the sense that if it is internal to the product of two orthogonal sets, then it is internal to one of the two. We prove that a definable group in an o-minimal structure is a product of cohesive orthogonal subsets. If the group has dimension one, or it is definably simple and non-abelian, then it is itself cohesive. Finally, we show that a group definable in the disjoint union of finitely many o-minimal structures is a quotient, by a discrete normal subgroup, of a direct product of locally definable groups in the single structures.

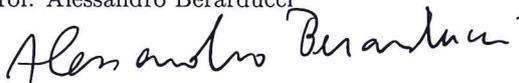
- (2) P. Eleftheriou, Pillay’s conjecture for groups definable in weakly o-minimal non-valuational structures, arXiv: 2001.08209. (Submitted to *Bulletin of the London Mathematical Society* in May 2020, requested minor revisions. Resubmitted in January 2021).

Let  $G$  be a group definable in a weakly o-minimal non-valuational structure  $\mathcal{M}$ . Then  $G/G^{00}$ , equipped with the logic topology, is a compact Lie group, and if  $G$  has finitely satisfiable generics, then  $\dim(G/G^{00}) = \dim(G)$ . Our main technical result is that  $G$  is a dense subgroup of a group definable in the canonical o-minimal extension of  $\mathcal{M}$ .

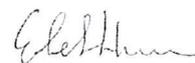
#### REFERENCES

- [BerMa] A. Berarducci, M. Mamino *Groups definable in two orthogonal sorts*, Israel Journal of Mathematics, 208 (2015), 413–441.  
 [EPR] P. Eleftheriou, Y. Peterzil, J. Ramakrishnan, *Intrepretable groups are definable*, Journal of Mathematical Logic, Vol. 14, No. 1 (2014), 47 pages.

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6/4/2021