ADVANCED SEMINAR ON GROUP THEORY
SOSE 2019 SUMMER MONTHS EDITION

RIGIDITY OF BRANCH GROUPS
& PROJECTIVE REPRESENTATION THEORY

COORDINATED BY MORITZ PETSCHICK

For the summer months we change subject and go through two small series of lectures, one of them focussing on rigidity theorems for branch groups, what can be seen as an expansion of aspects of talk 8 in the main programme, while the second series will focus on projective representation theory and its connection to Clifford theory.

Here is a short outline of the planned talks.

Talk 2.1: Branch groups, basal subgroups and rigidity properties.
Cover the definitions of branch groups, basal and vertex subgroups, and the rigidity properties (∗) and (∗∗), give examples. Sources: [2, 1].

Talk 2.2: Rigidity theorem of Grigorchuk and Wilson.
Proof Theorem 1 in [2]. Since time is short, skip over the proof of some lemmata. Focus on: a) Where the rigidity properties (∗) and (∗∗) are used and b) where it may be possible to extend the results to endomorphisms. Sources: [2].

Talk 2.3: Rigidity theorem of Lavreniuk and Nekrashevych I.
Set up the language and notation presented in the paper, and give an overview about what the results stated in chapter 4 and 5 of [5]. Show proofs of some results in chapter 6, coordinate this with the speaker of the next talk. Source: [5].

Talk 2.4: Rigidity theorem of Lavreniuk and Nekrashevych II.
Finish the proof of Theorem 7.5 and the steps to it in [5]. Coordinate chapter 6 with the speaker of the previous talk. Source: [5].

For the second part of the summer programme we will follow Chapter 6 & 11 in Isaacs book [4]. (Hopefully) there will be an exercise hour for anyone who wants to do some exercises.

Talk 3.1: Basics of Clifford Theory.
Cover the contents of chapter 6 of [4] up to and including Theorem 6.15. If time is short, skip some corollaries. Focus on proofing Theorem 6.11. Sources: [4, 3].

Talk 3.2: Projective representations and factor sets.

Cover chapter 11 of [4] up to Theorem 11.7, including its proof (and the word of caution about it, of course!). Sources: [4, 3].

Talk 3.3: Schur multipliers.

Follow chapter 11 further up to and including Corollary 11.18. Sources: [4, 3].

Talk 3.4: Character triples and applications.

Follow chapter 11 even further up to and including Corollary 11.32. Focus on the applications. Sources: [4, 3].

References

[1] L. Bartholdi, R. I. Grigorchuk, Z. Sunik, *Branch groups.* Handbook of algebra, Vol. 3, 989–1112, Handb. Algebr., 3, Elsevier/North-Holland, Amsterdam, 2003.

[2] R. I. Grigorchuk, J. S. Wilson, *A minimality property of certain branch groups*, Groups: topological, combinatorial and arithmetic aspects, 297–305, London Math. Soc. Lecture Note Ser., 311, Cambridge Univ. Press, Cambridge, 2004.

[3] B. Huppert, *Character theory of finite groups.* De Gruyter Expositions in Mathematics, 25. Walter de Gruyter & Co., Berlin, 1998.

[4] I. M. Isaacs, *Character theory of finite groups.* Pure and Applied Mathematics, No. 69. Academic Press [Harcourt Brace Jovanovich, Publishers], New York-London, 1976.

[5] Y. Lavreniuk, V. Nekrashevych, *Rigidity of branch groups acting on rooted trees.* Geom. Dedicata 89, (2002), 159–179.