

Oberseminar

Block Theory

SS 2019

Termin: **Mo. 15:30 – 17:00 (Raum 48-438)**

Beginn: 29.04.19

29.04.19	Gunter Malle	I. Intro. to block theory via algebras and modules
06.05.19	Emil Rotilio	II. Intro. to block theory via character theory I
13.05.19	Anantha Prasad Subbaraya	III. Intro. to block theory via character theory II
20.05.19	Giovanni de Franceschi	IV. Clifford theory of blocks
27.05.19	Alessandro Paolini	VII. Blocks of finite groups of Lie type
03.06.19	Ruwen Hollenbach	VI. Fong reductions and blocks of p-solvable groups
17.06.19	Bernhard Böhmler	X. Blocks with cyclic defect I
24.06.19	Michael Livesey	VIII. TBC
01.07.19	Niamh Farrell	IX. Nilpotent blocks
08.07.19	Shigeo Koshitani	V. Equivalences of blocks and block invariants
15.07.19	Caroline Lassueur	XI. Blocks with cyclic defect II

LITERATUR

- [Alp86] J. L. Alperin, *Local representation theory*, Cambridge Studies in Advanced Mathematics, vol. 11, Cambridge University Press, Cambridge, 1986, Modular representations as an introduction to the local representation theory of finite groups. MR 860771 (87i:20002)
- [Bro94] Michel Broué, *Equivalences of blocks of group algebras*, Finite-dimensional algebras and related topics (Ottawa, ON, 1992), NATO Adv. Sci. Inst. Ser. C Math. Phys. Sci., vol. 424, Kluwer Acad. Publ., Dordrecht, 1994, pp. 1–26. MR 1308978
- [CE93] Marc Cabanes and Michel Enguehard, *Unipotent blocks of finite reductive groups of a given type*, Math. Z. **213** (1993), no. 3, 479–490. MR 1227495 (94h:20048)
- [CE99] ———, *On blocks of finite reductive groups and twisted induction*, Adv. Math. **145** (1999), no. 2, 189–229. MR 1704575
- [Isa76] I. Martin Isaacs, *Character theory of finite groups*, Academic Press [Harcourt Brace Jovanovich, Publishers], New York-London, 1976, Pure and Applied Mathematics, No. 69. MR 0460423
- [KM15] Radha Kessar and Gunter Malle, *Lusztig induction and ℓ -blocks of finite reductive groups*, Pacific J. Math. **279** (2015), no. 1-2, 269–298. MR 3437779
- [Lin18] Markus Linckelmann, *The block theory of finite group algebras. Vol. II*, London Mathematical Society Student Texts, vol. 92, Cambridge University Press, Cambridge, 2018. MR 3821517
- [LP10] Klaus Lux and Herbert Pahlings, *Representations of groups*, Cambridge Studies in Advanced Mathematics, vol. 124, Cambridge University Press, Cambridge, 2010, A computational approach. MR 2680716
- [Nav98] G. Navarro, *Characters and blocks of finite groups*, London Mathematical Society Lecture Note Series, vol. 250, Cambridge University Press, Cambridge, 1998. MR 1632299
- [NT89] Hiroshi Nagao and Yukio Tsushima, *Representations of finite groups*, Academic Press, Inc., Boston, MA, 1989. MR 998775 (90h:20008)
- [Web16] Peter Webb, *A course in finite group representation theory*, Cambridge Studies in Advanced Mathematics, vol. 161, Cambridge University Press, Cambridge, 2016. MR 3617363

Interessierte Hörer sowie weitere Vortragende sind herzlich willkommen!

TALK DESCRIPTIONS (TENTATIVE)

Talk length: 90 minutes

29.04.19 – TALK I. Introduction to block theory via algebras and modules

The aim of this talk is to introduce block theory from the point of view of modules and algebras including: a recap of the essential results needed from representation theory, central primitive idempotents, blocks, defect groups, Brauer's main theorems, the Green correspondence etc. Sources: [Alp86], [Web16], [LP10], [NT89]

06.05.19 – TALK II. Introduction to block theory via character theory I

The aim of this talk is to introduce blocks from a character theoretic point of view. This includes an introduction to Brauer characters and decomposition numbers. In doing this we will also fix some notation from [Nav98], so that later talks can be presented using this notation if it is more suitable than the notation from Talk I. Source: [Nav98]

Chapter 1: all assumed

Chapter 2: (include/omit things depending on what was included in Talk I)

- Definitions: Brauer character, trivial Brauer character, decomposition numbers/matrices, projective indecomposable character
- Properties of Brauer characters - Lemma 2.2, Theorem 2.3, Corollary 2.9, Theorem 2.12, Corollary 2.16
- Properties of decomposition matrices - Corollary 2.11
- Properties of projective indecomposable characters - Corollary 2.17

Chapter 3: Up to Definition 3.1 (p -block)

13.05.19 – TALK III. Introduction to block theory via character theory II

A continuation of Talk II - we will show that the character theoretic characterization of a block is the same as the module theoretic definition from Talk I, and discuss some properties of blocks relating to their defect groups. Source: [Nav98]

Chapter 3:

- Recall the character theoretic definition of a block (Definition 3.1)
- Theorem 3.3: relate decomposition numbers to new definition of a block
- Define Linked, Brauer graph (Definition 3.4)
- Theorem 3.9: characterizations of the ordinary characters in a p -block via connected components of Brauer graphs
- Lemma 3.13: relate character theoretic approach to algebra/module theoretic approach
- Define defect of a block (Definition 3.15)
- If time permits: Properties relating to defect (Corollary 3.17, Theorem 3.18)

20.05.19 – TALK IV. Clifford theory of blocks

This should cover the basics about Clifford theory of blocks including (possibly) a quick recap of Clifford theory for characters, and covering the Fong-Reynolds reduction. Source: [NT89, Chapter 5, Sections 5-8], [Nav98, Chapter 9]. (For Clifford theory of characters see [Isa76, Chapter 6])

27.05.19– TALK V. Blocks of finite groups of Lie type

This survey talk will present the theory of blocks of finite groups of Lie type, including the parametrization of blocks by e -Jordan cuspidal pairs. Sources: [CE93], [CE99], [KM15] etc

03.06.19 – TALK VI. Fong reductions and blocks of p -solvable groups

This talk will present the case of blocks of p -solvable groups – what is known and why this situation works so nicely. The Fong reductions will be introduced and their importance for p -solvable groups explained. Source: [Nav98, Chapter 10]

17.06.19 – TALK VII. Blocks with cyclic defect I

In this talk we will revisit the properties of blocks with cyclic defect which we saw in the Oberseminar last semester in more detail. Source: [Alp86, Chapter V].

24.06.19 – TALK VIII. TBA

TBA

01.07.19 – TALK IX. Nilpotent Blocks

In this survey talk we will define nilpotent blocks and present the main results known about these blocks. Source: [Lin18]

08.07.19 – TALK X. Equivalences of blocks and block invariants

This talk is a survey of the equivalences that can exist between blocks, and the block invariants which are preserved by each equivalence. Source: [Bro94]

15.07.19 – TALK XI. Blocks with cyclic defect II

In this talk we will look at the indecomposable modules of blocks with cyclic defect.