

REPRESENTATION THEORY

WS 2022/23

A. ORGANISATION

- LECTURES:
 - Mo. 10:00 - 11:30 / Room 48-538 (+ live stream)
 - Th. 8:15 - 9:45 / Room 48-538 (+ live stream)

- EXERCISES:
 - Th. 12:00 - 13:30 / Room 48-538
 - Assistant: MARIE ROTH (48-417)
 - Registration: in the URM system by **Fr. 28th of Oct, noon.**

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- 2-week rhythm : tutorial/solution session/tutorial/solution session / ...
- Übungsschein : let us know this week if you to obtain one.
- Exercises : 6 Exercises per slot of two weeks

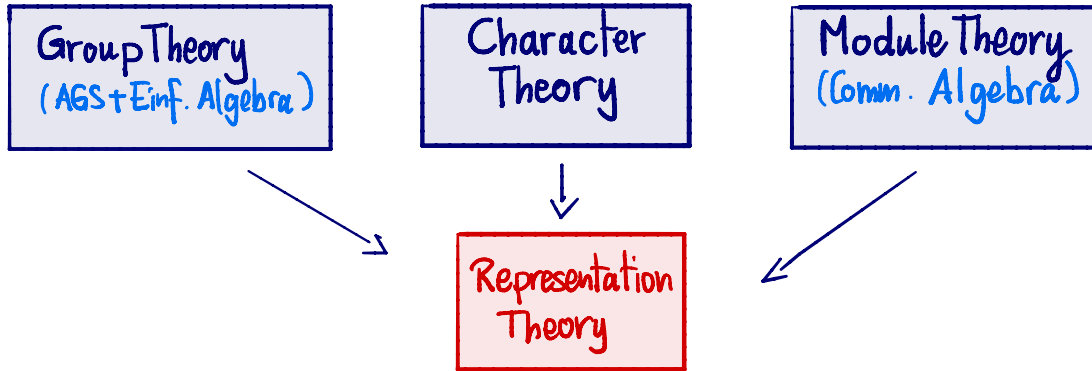
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B. BEFORE AND AFTER

Representation
Theory

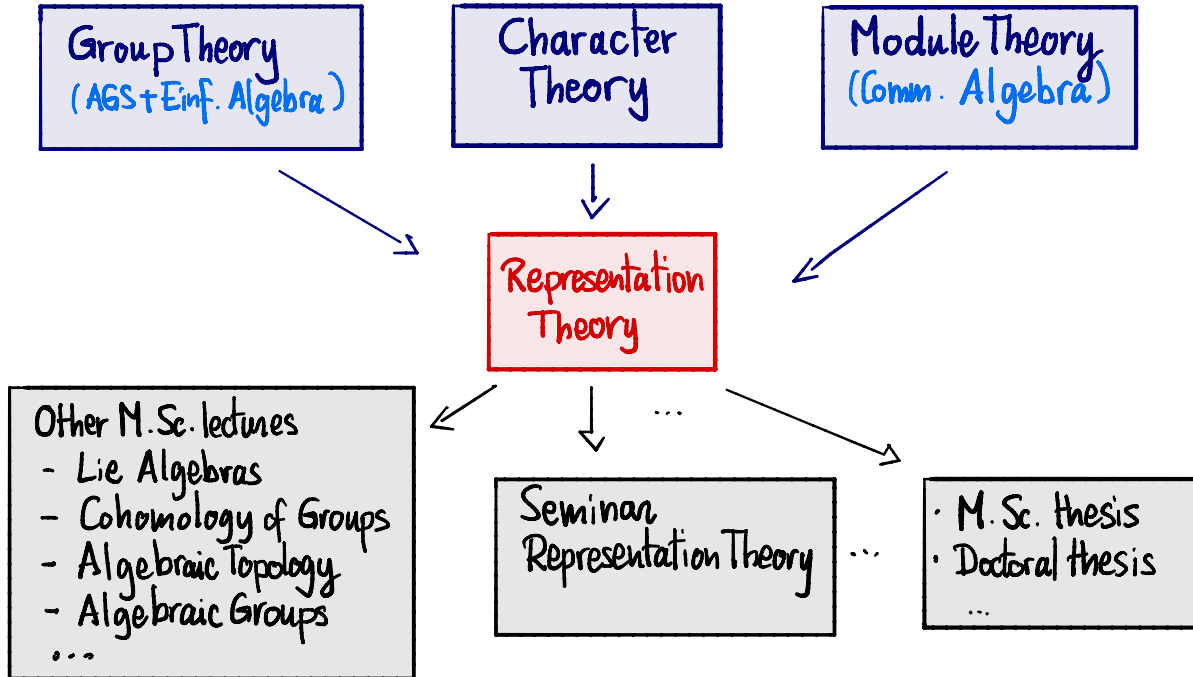
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B. BEFORE AND AFTER



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C. BACKGROUND MODULE THEORY

The following elementary notions of module theory are assumed as known:

- Modules/submodules/homomorphisms/quotient modules
- Free modules / projective modules
- Direct sums / direct products
- Exact sequences / short exact sequences
- Tensor products
- Algebras

→ See Appendix 1 + Revision Sheet 0 (tutorial today 12:00 - 13:30)

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D. AIMS OF THE LECTURE

1. Study representations of finite groups over fields K of positive characteristic

$$\rho: G \rightarrow GL(V) \quad \text{with} \begin{cases} \dim_K V < \infty \\ \text{char } K =: p \mid |G| \end{cases} \quad \begin{matrix} \triangle \\ \textcircled{1}, \textcircled{2} \end{matrix}$$

\Updownarrow equiv. to

2. in particular through module theory over the group algebra KG

KG -module structure on V

Problems to overcome:

① Maschke's theorem not true \rightsquigarrow not every representation is semisimple!

② Character theory has major deficiencies! E.g. $\chi_\rho(1_G)$ only gives $\deg(\rho)$ modulo p .
 \rightsquigarrow Have to replace characters by "better" functions! \rightsquigarrow the "Brauer characters"