Leibniz Universität Hannover

SEMINAR ANNOUNCEMENT

Prof. Dr. Caroline Lassueur

Summer Semester 2025

Wed. 12:15-13:45, room G117

Seminar Cohomology of Finite Groups
SoSe 2025

Short description:
The aim of this seminar is to introduce the so-called *cohomology groups* associated to a finite group. In particular, we will study the connections between the short exact sequences of groups of the form $1 \longrightarrow A \longrightarrow E \longrightarrow G \longrightarrow 1$ with abelian kernel and the cohomology of the group G (with coefficients in A). Such methods are particularly interesting because they provide us with a powerful tool to classify finite groups of a given order up to isomorphism. The topic has many other applications in modern mathematics, for example in number theory or algebraic geometry. Historically, it lies at the interplay between group theory, module theory and algebraic topology.

$$\begin{array}{ccccccccc} 1 & \longrightarrow & Z & \longrightarrow & E & \xrightarrow{\pi} & G & \longrightarrow & 1 \\ & & \downarrow{\scriptstyle \lambda|_Z} & & \downarrow{\scriptstyle \lambda} & & \downarrow{\scriptstyle \theta} & & \\ 1 & \longrightarrow & K^\times \cdot \mathrm{Id}_V & \longrightarrow & \mathrm{GL}(V) & \xrightarrow{\pi_V} & \mathrm{PGL}(V) & \longrightarrow & 1 \end{array}$$

Module: Seminar, BA Mathematik and MA Mathematik

Registration and questions: via e-mail, lassueur@math.uni-hannover.de

Time/Room: a priori Wednesdays, 12:15-13:45, room 1101-G117

Introduction + topic distribution: on Wednesday, 9th of April 2025

Pre-requisites: Linear Algebra I/II and Algebra I (part on group theory).
Knowledge in module theory/representation theory can be helpful, but is not mandatory.

Language: English/German (to be decided at the beginning of the seminar)

References:

[Bro94] K. S. Brown. *Cohomology of groups*. Vol. 87. Graduate Texts in Mathematics. Springer-Verlag, New York, 1994.

[CR90] C. W. Curtis and I. Reiner. *Methods of representation theory. Vol. I*. Wiley Classics Library. John Wiley & Sons, Inc., New York, 1990.

[Las21] C. Lassueur. *Cohomology of groups*. Lecture Notes SS21. TU Kaiserslautern, 2021.

[Rot95] J. J. Rotman. *An introduction to the theory of groups*. Fourth. Vol. 148. Graduate Texts in Mathematics. Springer-Verlag, New York, 1995.

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Preliminary Programme

We 1. Intro	09.04.25	Caroline Lassueur	**Introduction + talk distribution**
We 2. Talk I	16.04.25	Daniel Lamert	**Modules** ([Las21, Chapter 2])
We 3. Talk II	23.04.25	Johannes Raitz von Frentz	**Chain complexes and projective resolutions** ([Las21, §10 and §11])
We 4. —	30.04.25	no seminar	—
We 5. Talk III	07.05.25	Isabel Wolfgramm Jones	**Ext and Tor** ([Las21, §12])
We 6. ——	14.05.25	No Seminar	**Talks are shifted by one week!**
We 7. Talk IV	21.05.25	Caroline Lassueur	**(Co)homology of groups** ([Las21, §14-§16])
We 8. —	28.05.25	no seminar	—
We 9. Talk V	04.06.25	Devadathan Aikkaraparambil Suresh	**Easy cohomology** ([Las21, §17-§20])
Excursion week	11.06.25	no seminar	—
We 10. Talk VI	18.06.25	Hannah Deuring	**Group extensions and cohomology, I** ([Las21, §22-§23])
We 11. Talk VIII	25.06.25	Caroline Lassueur	**Group extensions and cohomology, II** ([Las21, §24, §26-§28])
We 12. Talk IX	09.07.25	Justus Wiegand	**Theorems of Schur, Zassenhaus and Burnside** ([Las21, §30-§32])
We 13. Talk X	16.07.25	Caroline Lassueur	**The Schur multiplier** ([Las21, §34-§36])