

**Seminar in Summer Semester 2022:
Sofic Groups**

When working with increasingly abstract or complex objects, a useful approach is to ground one's study in objects that are better understood. In the case of groups, some of our best models are finite. Roughly speaking, sofic groups are the groups that can be approximated by finite groups (the name comes from the Hebrew word for finite). Sofic groups have been the subject of intensive research in recent years with connections to dynamical systems, geometric group theory, graph theory, operator algebras, and quantum information theory. Several well-known conjectures for groups are known to hold for sofic groups. However, the full scope of these groups is unknown. In fact a major outstanding question is whether there exists *any* group that is not sofic.

In this seminar, we will study sofic groups and related classes of groups, such as residually finite, amenable, hyperlinear and surjunctive groups. The last of these classes comes from the theory of cellular automata. We will also examine soficity and hyperlinearity from analytic, geometric, and model theoretic perspectives. Finally, we will introduce (open) problems concerning these classes of groups.

Suggested Topics

1. Background from group theory.
2. Residually finite groups.
3. Amenable groups.
4. Hamming metric and sofic groups.
5. Sofic groups via ultrafilters.
6. Surjunctivity.
7. Hyperlinear groups.
8. Model theoretic characterization of sofic groups.
9. Kaplansky's direct finiteness conjecture.
10. Solving equations over groups.

The seminar takes place **Wednesdays, 14:00-16:00** in SR 5 (Einsteinstraße 62, 5th floor).

The preliminary meeting takes place in hybrid format on **Friday, February 4 at 14:00 sharp (s.t.)** in SR 4 (Einsteinstraße 62, 4th floor) and on Zoom via meeting 62464637457 (no password).

The primary language for the seminar is English, but Bachelors students may present in German.

The seminar is aimed at students from the 5th semester and above and would naturally lead towards a Bachelor's thesis. It is also appropriate for Masters students and can be used to fulfil an Specialisation Supplement and Research Skills Module (Ma-E) (Ergänzungsmodul (E-Modul)) or a Specialisation Module (Ma-S2, Ma-S3 or Ma-S5) (Spezialisierungsmodul (S-Modul)).

A draft of the write up should be submitted at least two weeks before the presentation, at which point a meeting with either Dr. Courtney or Dr. Gardam should be arranged to discuss the presentation and clarify any details from the material as needed. The final write up should be submitted within a week of the presentation.