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Topological Data Analysis of Phase Transitions in Soft Active Matter Systems

Friday 14 June 2024 15:30 (1h 40m)

This thesis explores the application of algebraic topological methods, particularly persistent homology, in the analysis of models within statistical, condensed matter, and active matter systems. The primary goal is to classify phase transitions in soft active matter systems characterized by topological defects. Building on preliminary studies using the XY-model as a reference, we propose to use the variance of the Wasserstein distance between persistence diagrams of positively and negatively charged topological defects as a phase transition indicator.

We further hope to extend this approach by:

-Validating the method against other classical models with topological defects or solitons.
-Generalizing the methodology to dimensions higher than two.
-Rigorously proving that this method can reliably indicate phase transitions.

This research seeks to provide a novel topological perspective on phase transitions in complex physical systems.

Field of study

Physics of Complex Systems

Supervisor

Amin Doostmohammadi, Martin Cramer Pedersen

Author: MOLS, Frederik (The Niels Bohr Institute, University of Copenhagen)

Session Classification: Poster session: Enjoy the posters!