



Departmental PhD Thesis Exam

Wednesday, June 4, 2025 10:00 a.m.
via Zoom/Room BA6183



PhD Candidate : Evan Sundbo

Supervisor : Michael Groechenig

Thesis title : Broken Toric Varieties and Hypertoric Hitchin Systems

Abstract

In the first part of this thesis we study the cohomology of broken toric varieties via the derived push-forward of the constant sheaf to a complex of polytopes, thus proving a Deligne-type decomposition theorem, degeneration of the associated Leray-Serre spectral sequence, and showing that the Leray filtration on their cohomology is equal to the weight filtration (up to re-indexing). We discuss certain maps between broken toric varieties and how they descend to maps of cohomology groups. Furthermore, we give a description of the Betti numbers of some broken toric varieties whose associated complex of polytopes is the n -skeleton of a higher dimensional polytope, encompassing some important examples.

In the second part we investigate hypertoric Hitchin systems, whose cohomology is governed by a subvariety which is broken toric. After reviewing their construction, we give a new proof of a deletion-contraction relationship on these varieties (first proven by Dansco-McBreen-Shende) and refine it to a statement about the cohomology of certain sheaves on the polytope complex. Using these facts and the general results in the first chapter, we develop tools for calculating the cohomology of some families of hypertoric Hitchin systems inductively, given knowledge of a base case. In particular, this yields explicit formulae for the Betti numbers of hypertoric Hitchin systems associated to graphs with first Betti number 2.