Research Interests

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I am a second year PhD student at the university of Geneva under the supervision of Michelle Bucher and I am interested in the connection between the topology and the geometry of manifolds. On Riemannian manifolds, typically of nonpositive curvature, invariants from topology such as for example characteristic numbers are often proportional to geometric invariants such as the volume. An example are the so called Milnor-Wood inequalities which relate the Euler class of flat bundles to the Euler characteristic of the base manifold.

I study in particular cohomology classes of complex hyperbolic manifolds. For this I use techniques from bounded cohomology. Let M be a manifold and let $\beta \in H^q(M;\mathbb{R})$ be a cohomology class. The Gromov norm $\|\beta\|_\infty$ is by definition the infimum of the sup-norms of all cocycles representing β:

$$\|\beta\|_\infty = \inf\{\|b\|_\infty \mid [b] = \beta\} \in \mathbb{R}_{\geq 0} \cup \{+\infty\}$$

This is a way of assigning a numerical invariant to a cohomological invariant. It has for instance been computed for the Kähler class. However, the value of this norm is only known for a few cohomology classes. I would like to determine its value for certain cohomology classes of complex hyperbolic manifolds, especially in top dimension. This could lead to new Milnor-Wood type inequalities and computations of the simplicial volume of complex hyperbolic manifolds.

Furthermore, I am interested in the natural comparison map that exists between continuous bounded cohomology and usual continuous cohomology. For the group of isometries of 3-dimensional real hyperbolic space, injectivity of this comparison map in degree 3 follows from a result of Bloch. I have generalized this proof to show that the comparison map is injective in degree 3 for real hyperbolic space $\mathbb{H}^n$ of any dimension. In fact, for this I prove that the continuous cohomology of $\mathrm{Isom}^+(\mathbb{H}^n)$ up to degree 3 can be calculated using the complex of measurable maps on the boundary of hyperbolic space. I am now trying to extend this last result to all degrees and also to other semisimple Lie groups.