Higher Reidemeister Torsion

organized by
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Workshop Summary

Original goals. One of the main original goals of this conference was to discuss the central question of whether the three definitions of higher Reidemeister torsion agree. These are

- The Morse theory approach of Igusa and Klein
- The A-theory approach of Dwyer-Weiss-Williams
- Bismut-Lott analytic higher torsion

However, by the time the conference met, this had already been accomplished by major works of Badzioch, Dorabiala, Klein, Williams and Goette.

The other original goal of the conference was for the three camps to meet to explain to each other their respective techniques, in particular details of the three definitions of higher torsion.

The meeting. At the AIM meeting there were lectures on the first three days explaining the three different approaches to higher torsion by the experts in those fields including two of the organizers and two participants. On the first days, we made a list of questions, easy and difficult which we used later in the week as topics for group meetings. Two particular topics which were discussed thoughout the meeting were the questions *What does it mean for the higher torsion to be zero?* and *How does one show that the different approaches to Hatcher example are equivalent?* On the last three days we broke up into small groups to discuss these educational and research topics. The group discussions were very productive and made unexpected amounts of progress in the two hours that they met. We were all very pleased with these small group meetings.

Lectures. *Day one:* Sebastian Goette gave an overview of higher analytic torsion with a gentle lecture which avoided many technical details. Bruce Williams gave an overview of Dwyer-Weiss-Williams torsion concentrating on the homotopy torsion and the smooth torsion.

In the afternoon, we compiled the first list of questions and Bernard Badzioch, Sebastian Goette and Kiyoshi Igusa gave short accounts of DWW torsion and IK torsion answering the question: *What is the input and output of the higher torsion?* On each subsequent day we had two lectures in the morning and discussions in the afternoon. Small group meetings started on Wednesday.

Day two: Lectures by Bernhard Badzioch on an alternative construction of the Dwyer-Weiss-Williams torsion and by Kiyoshi Igusa on the definition and calculation of Igusa-Klein torsion. In the afternoon, we discussed Hatcher's example.

Day three: Sebastian Goette talked about Bismut-Lott torsion and Stacy Hoehn talked about the fiberwise end obstruction.

Day four: Ulrich Bunke talked about analytic torsion and its relation to differential K-Theory and Kiyoshi Igusa explained his axioms for higher torsion.

Day five: Wolfgang Steimle spoke about new geometric problems related to classical Whitehead torsion. We had discussions in the morning in lieu of a second talk.

On these days, small group discussions addressed the questions of:

- How to generalize the Axioms to the case of nontrivial coefficients
- What is Waldhausen's algebraic K-theory?
- Comparison of different approaches to the Hatcher Example.
- What does it mean if the higher torsion is zero?
- What is a flat superconnection?