

# Braids and Configuration Spaces

ORGANIZER: Mario Salvetti (*University of Pisa, IT*)

**Thursday, July 5, 16:15–18:15, Conference Hall**

TALKS:

Fred Cohen (*University of Rochester, UK*), **Braid groups at the interface of low dimensional topology and homotopy theory**

Filippo Callegaro (*Scuola Normale Superiore, IT*), **The Cohomology of the braid group  $B_3$  and of  $SL_2(\mathbb{Z})$  with coefficients in geometric representations**

Toshitake Kohno (*University of Tokyo, JP*), **Homological representations of braid groups and  $KZ$  connections**

Mario Salvetti (*University of Pisa, IT*), **Topological problems on braid groups and generalizations**

# Braid groups at the interface of low dimensional topology and homotopy theory

Fred Cohen

*University of Rochester, UK*

This talk is a catalogue of how and why properties of the braid groups are at the interface of low dimensional topology, homotopy theory as well as other subjects. The following topics and their interconnections will be addressed.

- (a) Definitions and elementary properties of braid groups, and configuration spaces.
- (b) Homology and the cohomology of configuration spaces and their loop spaces. A Lie algebra of T. Kohno, and Ptolemaic epicycles are central to all of this.
- (c) Homotopy groups of finite complexes and the structure of pure braids.
- (d) Spaces of links and spaces of knots.
- (e) Connections to cohomology and modular forms.
- (f) Problems and conjectures.

# The Cohomology of the braid group $B_3$ and of $SL_2(\mathbb{Z})$ with coefficients in geometric representations

Filippo Callegaro  
*Scuola Normale Superiore, IT*

We describe the integral cohomology of the braid group  $B_3$  and  $SL_2(\mathbb{Z})$  with local coefficients in a classical geometric representation given by symmetric powers of the natural symplectic representation. These groups have a description in terms of the so called "divided polynomial algebra". The results show a strong relation between torsion part of the computed cohomology and fibrations related to loop spaces of spheres.

# Homological representations of braid groups and $KZ$ connections

Toshitake Kohno  
*University of Tokyo, JP*

We give a relation between the homological representations of the braid groups studied by Lawrence, Krammer and Bigelow and the monodromy of the  $KZ$  equation with values in the space of null vectors in the tensor product of Verma modules of  $\mathfrak{sl}(2, \mathbb{C})$  when the parameters are generic. We discuss some applications of the quantum symmetries in homological representations of the braid groups.

# Topological problems on braid groups and generalizations

Mario Salvetti

*University of Pisa, IT*

We address some topological problems in the theory of braid groups and their generalizations (Artin groups) which are related to computations of the twisted-cohomology of some associated configuration spaces.