

# ANNALES DE LA FACULTÉ DES SCIENCES DE TOULOUSE Mathématiques

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*Preface*

Tome XXIII, n° 2 (2014), p. i-ii.

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## Preface

This volume is a collection of surveys and original contributions by participants in a workshop which took place at University of Pau on June 11-15, 2012. This workshop was part of “Arrangements in Pyrénées, School on Arrangements of Hyperplanes and Related Topics” which gathered almost 100 graduate students, recent PhD graduates and experts in this field. It was organized by the Algebra and Geometry team at the University of Pau, with D. Faenzi, V. Florens and J. Valles as members of the organizing committee. The workshop included several minicourses, research talks and poster presentations.

Works in this volume represent the highlights of the meeting and were submitted by invitation. In particular material of all five minicourses given during the workshop appear in the papers below. As for the workshop itself, the unifying theme here was recent developments in the topology of the complements to arrangements of affine hyperplanes in complex vector space and their relations with geometry and combinatorics.

The papers by E. Artal Bartolo, L. Paris and A. Suciu consider different aspects of the topology of complements. E. Artal Bartolo describes the method of braid monodromy for finding presentations of the fundamental groups of the complements and properties of the invariant of the fundamental group called the “characteristic variety”. The latter is a generalization of the classical Alexander polynomial, playing prominent role in knot theory as well as in the study of the topology of complements to plane algebraic curves. Characteristic varieties, introduced at the beginning of the 90s by this editor, have rich connections with geometry, combinatorics, cohomology of local systems etc... The paper by L. Paris focuses on the following long-standing problem: when complements to arrangements of hyperplanes corresponding to classical root systems are Eilenberg-MacLane spaces? The paper of A. Suciu describes the topology of boundary manifolds of arrangements, the topology of Milnor fibers of arrangements and the boundaries of these Milnor fibers. The characteristic varieties and cohomology of local systems play a key role in this theory as well. All these papers not only are comprehensive surveys but do contain numerous results appearing for the first time.

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The work of M. Yoshinaga provides an introduction to the theory of free arrangements and to its connection with vector bundles. Ample examples are given including establishing freeness of extended Catalan and Shi arrangements.

The work of G. Denham describes compactifications of the complements to arrangements, in particular bringing ideas from tropical geometry

F. Callegaro surveys spectral sequence calculations of the cohomology of Artin groups with constant as well as twisted coefficients. The paper by S. Manfredini and S. Settepanella considers homotopy groups of configuration spaces associated with Grassmannians. Finally the work of C. Dunn, M. Miller, M. Wakefield and S. Zwicknagl settles several cases of an important open problem connecting topology of the complement and combinatorics by proving non existence of some 4-nets in complex projective plane.

These papers should be useful to novices at this area as well as to active researchers studying the topology and geometry of the complements to complex arrangements.

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